

ORIGINAL ARTICLE



The Influence of Sport Environment on Exercise Behavior of Overweight and Obese Children and Adolescents: The Mediating Role of Sport Commitment

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ABSTRACT

Background. With the increased prevalence of overweight and obesity among adolescents, exploring the impact of the exercise environment and sport commitment is critical in understanding their physical activity behaviors. **Objectives.** This study aims to investigate the correlates of exercise behavior among overweight and obese children and adolescents, focusing on the impact of the sport environment and the mediating role of sport commitment. **Methods.** Three hundred sixty-eight junior high school students from Zhaotong City, Yunnan Province, China, participated in the study. They completed the Sport Environment, Exercise Behavior, and Sport Commitment Scales. The group consisted of 189 males and 179 females, with a mean age of (13.59±1.09) years and a mean body mass index of (24.30±2.18). Statistical analysis was performed using SPSS 26.0 and AMOS 23.0. **Results.** The results indicate significant correlations between the sport environment, sport commitment, and exercise behavior of overweight and obese children and adolescents. The sport environment has a direct positive effect on sport commitment ($\beta=0.40$) and exercise behavior ($\beta=0.34$), while sport commitment also has a direct positive effect on exercise behavior ($\beta=0.47$). Sport commitment also mediates the relationship between the sport environment and exercise behavior among overweight and obese children and adolescents. **Conclusion.** The findings Exercise behavior among overweight and obese children and adolescents is influenced not only by the sport environment but also by the mediating role of sport commitment. Therefore, creating a supportive sport environment and promoting sport commitment are practical approaches to improving exercise behavior and PA levels among overweight and obese children and adolescents.

KEYWORDS: *Sport Environment, Exercise Behavior, Sport Commitment, Overweight and Obesity, Children and Adolescents, Mediating Role.*

INTRODUCTION

Regular physical activity (PA) is essential for preventing and reducing obesity among children and adolescents (1). The World Health Organization recommends at least 60 minutes of moderate to vigorous PA daily for adolescents (2). yet a 2016 study found that 81% of students aged 11-17 worldwide were physically inactive (3). In China, the 2020 Report on Nutrition and Chronic Disease Status highlighted that 10% of children

under six and nearly 20% of adolescents aged 6-17 are overweight or obese (4). These statistics underscore the significant public health challenge obesity poses in China (5).

Addressing obesity requires lifestyle changes, including healthy eating and increased PA (6). Exercise behaviors are influenced by individual beliefs and the social environment, which includes family, schools, and community infrastructure (7).

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External support enhances commitment to exercise, and the built environment, such as the accessibility of exercise venues, impacts PA participation and weight outcomes (8). In China, inadequate sports infrastructure and uneven development of sports programs in various settings pose challenges (9). Despite growing research on exercise behavior (10), there is a lack of integrated studies in China that combine the sports environment, sports commitment, and exercise behavior among overweight and obese children and adolescents. Therefore, this study aims to address two main questions: 1) the direct effects of sport commitment and sport environment on exercise behavior, and 2) the potential mediating role of sport commitment between sport environment and exercise behavior.

MATERIALS AND METHODS

Participants. This study utilized a cross-sectional survey design, drawing samples from the physical fitness testing databases of four schools in Zhaotong, China. Initially, target sampling was employed to identify samples that met the criteria for overweight and obesity among children and adolescents. Subsequently, survey participants were randomly chosen from this group of students to ensure the sample's representativeness of the population. The criteria for target sampling were established based on the Body Mass Index (BMI) calculated using weight (kg) / height (m)², as outlined in the Screening for overweight and obesity among school-age children and adolescents (2018 Edition). A total of 380 individuals were included in the final sample. A total of 380 questionnaires were distributed, of which 376 were collected. After screening for critical content information and regular responses, 368 valid questionnaires were obtained, resulting in a validity rate of 96.84%. The participants included 189 males and 179 females, with a mean age of (13.59±1.09) years and a mean body mass index of (24.30±2.18).

Instrument. The Sport Environment Scale (SES) (11) assesses perceptions of sport environments in the home, community, and school. This scale consists of three subscales with a total of 11 questions: school sport environment (e.g., availability of sufficient time for after-school physical activity), family sport environment (e.g., how often parents participate in physical activities with the individual), and community sport environment (e.g., regular provision of skills

training for children and adolescents in the community). Participants rated their responses on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Scores were assigned in descending order from 1 to 5. Previous research has demonstrated adequate factorial validity and reliability for this measure (11). In this study, results from confirmatory factor analysis included $X^2=166.982$, $df=51$, $X^2/df=3.274$, $RMSEA=0.079$, $GFI=0.936$, $AGFI=0.902$, $NFI=0.941$ and $CFI=0.958$. The Cronbach α value was 0.918 for all items of SES.

The Exercise Behavior Scale (EBS) (12) evaluated exercise behavior in overweight and obese children and adolescents. This scale delves into four key aspects of exercise behavior among this demographic: exercise value perception, exercise behavioral initiative, exercise emotional experience, and exercise environment adaptability. The exercise value perception component comprises three questions aimed at gauging the awareness of the benefits of physical exercise among children and adolescents, such as improvements in physical fitness. The exercise behavioral initiative section consists of three questions designed to assess the level of active participation in physical exercise over the past week. The emotional experience aspect of exercise involves a single question to determine whether children and adolescents derive happiness from physical exercise. Lastly, exercise environment adaptability includes two questions to evaluate the susceptibility of children and adolescents to environmental influences during physical exercise, such as their ability to concentrate. Responses were indicated on a 5-point Likert scale anchored by 1 ("strongly disagree") to 5 ("strongly agree"), with scores assigned in descending order from 1 to 5. Evidence of excellent psychometric properties of the EBS has been extensively reported (12). In this study, results from confirmatory factor analysis included $X^2=65.491$, $df=24$, $X^2/df=2.729$, $RMSEA=0.069$, $GFI=0.972$, $AGFI=0.933$, $NFI=0.957$ and $CFI=0.972$. The Cronbach α value was 0.845 for all items of EBS.

The Exercise Commitment Scale (ECS) was utilized to evaluate sports commitment among overweight and obese children and adolescents (13). This scale comprises five dimensions: exercise enjoyment, personal involvements, social constraints, involvement opportunities, and involvement alternative, with each dimension consisting of 3 items totaling 15 items. Responses

were indicated on a 5-point Likert scale anchored by 1 ("completely disagree") to 5 ("completely agree"). Scores were assigned in descending order from 1 to 5. Evidence of excellent psychometric properties of the ECS has been extensively reported (13). In this study, results from confirmatory factor analysis included $X^2=213.476$, $df=80$, $X^2/df=2.668$, $RMSEA=0.067$, $GFI=0.957$, $AGFI=0.902$, $NFI=0.933$ and $CFI=0.957$. The Cronbach α value was 0.908 for all items of ECS.

Data Analysis. The data obtained from the valid questionnaires were analyzed using SPSS 26.0 software. Correlation analysis and linear regression analysis were conducted to explore the direct effects of the sport environment and sport commitment on exercise behavior. The conceptual construct model was validated, and the structural validity of the scales was tested using Amos 23.0 software. The Bootstrap method is currently considered the most suitable approach for testing mediating effects (14). This method involves repeated sampling from the original sample and assessing the significance of mediating effect coefficients through 95% confidence intervals

(CI). This study applied the Bootstrap method to examine whether sport commitment mediates the relationship between the sport environment and exercise behavior.

RESULTS

Regression analysis. The Linear regression analysis examined the relationship between sport environment and sports commitment. The regression model is shown in Table 1, which shows that sports commitment = $-2.536 + 0.303$ in a sports environment. The R-square value of the model was 0.110, indicating that sport environment accounts for 11.0% of the variance in sports commitment. The F-test results ($F=45.463$, $p=0.000 < 0.05$) confirmed that the model is statistically significant, suggesting that the sports environment impacts sports commitment. Further analysis revealed that the sports environment's regression coefficient was 0.303 ($t=6.743$, $p=0.000 < 0.01$), indicating a significant positive relationship between sport environment and sport commitment.

Table 1. Multiple regression analysis model 1

Independent Variable	B	SE	Beta	t	p	Unstandardized Coefficients		R	R ²	R ² _{adj}
						95%CI				
						Lower	Upper			
(constant)	2.536	0.165		15.345	0	2.211	2.861	0.332a	0.11	0.108
Sport environment	0.303	0.045	0.332	6.743	0	0.215	0.391			

Dependent Variable (a): Sport Commitment

Linear regression analysis was performed to examine the relationship between sport environment, sports commitment, and exercise behavior in Table 2. The model formula was: exercise behavior = $1.470 + 0.266$ sport environment + 0.338 sports commitment, with an R-squared value of 0.265, indicating that sport environment and sports commitment could explain 26.5% of the variation in exercise behavior. The F-test of the model showed statistical significance ($F=65.660$, $p=0.000 < 0.05$), suggesting that at least one of the sport environment or sports commitment variables impacts exercise behavior. Additionally, the test for multicollinearity found that all Variance Inflation Factors (VIF) were below 5, indicating no issues of covariance. The Durbin-Watson (D-W) statistic around 2 suggested no autocorrelation in the model. The regression coefficients for sports environment

(0.266 , $t=6.131$, $p=0.000 < 0.01$) and sports commitment (0.338 , $t=7.093$, $p=0.000 < 0.01$) were both statistically significant, indicating positive influences on exercise behavior. Both sports environment and commitment significantly influence exercise behavior, with a more substantial explanatory power when considered together.

Mediation effects test based on Bootstrap methodology. The study conducted a mediation effect test on the conceptual framing model following the procedure introduced by Wen Zhonglin et al. (15). Hayes recommended a minimum of 5,000 replicate samples for the Bootstrap mediation effect test (16). If the results show that the Bootstrap test CI does not include 0, it indicates an established indirect effect. This study performed the mediated effect test by estimating the Bootstrap 95% CI through 5,000 sample samplings. The results, shown in Table 3,

indicate that the indirect effect of the sports environment on exercise behavior, mediated by sports commitment, was significant with a point estimate of 0.132, a standard deviation of 0.023, and a Z value 5.74. The direct effect of the sports environment on exercise behavior had a point estimate of 0.171, a standard deviation of 0.046,

and a Z value of 3.72. The total effect of the sports environment on exercise behavior was 0.303, with a standard deviation of 0.045 and a Z value of 6.73. Since the Bootstrap 95% CI for these effects does not include 0, we can conclude that the direct and total effects of the sports environment on exercise behavior are significant.

Table 2. Multiple regression analysis model 2

Independent Variable	B	SE	Beta	t	p	Unstandardized Coefficients		R	R ²	R ² _{adj}
						95%CI				
						Lower	Upper			
(constant)	1.47	0.193		7.604	0	1.09	1.85	0.514 ^a	0.256	0.261
Sport environment	0.266	0.043	0.292	6.131	0	0.181	0.352			
Sport commitment	0.338	0.048	0.388	7.093		0.245	0.432			

Dependent Variable (a): Exercise behavior

Table 3. Result of mediation effect test

	Variable	Point Estimate	Coefficient Multiplication		Bootstrapping			
			SE	Z	Bias-corrected Bootstrap 95%CI		Bias-corrected Nonparametric Percentile Bootstrap 95%CI	
					lower	Upper	Lower	Upper
Direct Effect	Sport Environment→Exercise Behavior	0.171	0.046	3.72	0.08	0.261	0.181	0.3519
Indirect Effect	Sport Environment→Exercise Commitment→Exercise Behavior	0.132	0.023	5.74	0.089	0.181	0.0639	0.1488
Total Effect	Sport Environment→Exercise Behavior	0.303	0.045	6.73	0.215	0.391	0.283	0.4547

Relationship model of sports environment, sport commitment, and exercise behavior. According to Milka, model fit indexes generally include a chi-square (X^2) test value of $P>0.05$, X^2/df 0.9, and RMSEA <0.05 as the reference standard (17). The results of the model fit analysis for the mediating effects of sport environment, sport commitment, and exercise behavior are presented in Table 4, meeting all

required criteria. This suggests a high model fit and validity. Additionally, it illustrates significant path coefficients, with sport environment directly influencing exercise behavior ($\beta=0.34$, $P<0.05$). Both sport environment \rightarrow sport commitment ($\beta=0.40$, $P<0.05$) and sport commitment \rightarrow exercise behavior ($\beta=0.45$, $P<0.05$) show significant mediating effects in Figure 1.

Table 4. Fitting parameters of structural equation model of sport environment, sport commitment, and exercise behavior

	X ²	df	X ² /df	P	GFI	AGFI	CFI	NFI	IFI	RMSEA
Model	73.036	51	1.432	0.023	0.968	0.952	0.982	0.944	0.983	0.034

DISCUSSION

This study examines the relationship between the sport environment, sport commitment, and exercise behavior by constructing a measurement model. The model posits that the sport environment and commitment directly

impact exercise behavior, with sport commitment as a mediating variable in the influence of the sport environment on exercise behavior. The findings of the study validate the assumptions of the model. Obesity during adolescence, a crucial stage in an individual's

development, can result in negative self-image, reduced self-esteem, and heightened feelings of shame, potentially raising the likelihood of mental health issues. Furthermore, childhood obesity can have long-term health implications,

including increased risks of cancer, diabetes, hypertension, and cardiovascular disease. Hence, prioritizing physical activity for overweight and obese children is imperative (18).

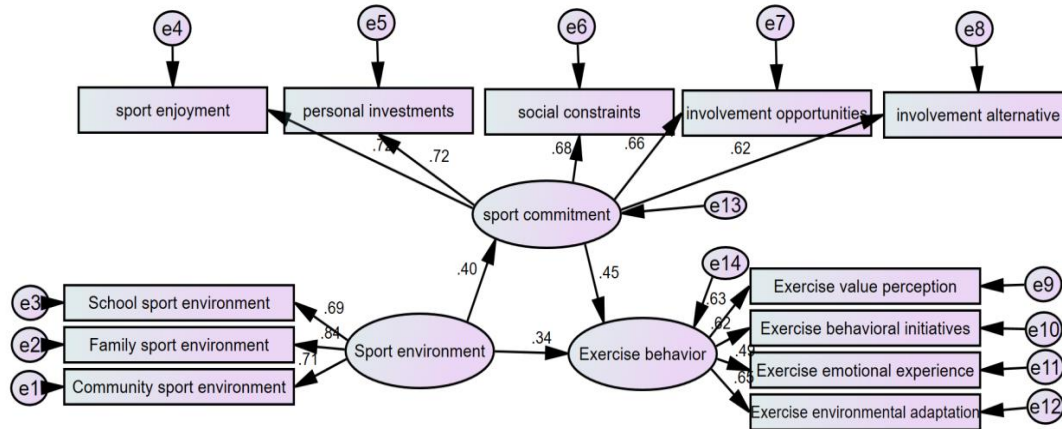


Figure 1. Path model of sport environment and sport commitment affecting exercise behavior.

1) The Influence of Sport Environment and Sport Commitment on Exercise Behavior in Overweight and Obese Children and Adolescents.

The study findings suggest that the sport environment plays a crucial role in influencing the exercise behavior of overweight and obese children and adolescents. These results align with existing research in this area. Carre DP et al. discovered that their living environment significantly influences an individual's attitude and participation in physical activity. Improvements in the sports environment where children and adolescents reside lead to increased engagement in exercise (19). The perception of the physical environment directly impacts the continuity of exercise behaviors among children and adolescents (20). It can be segmented into family, school, and community by categorizing the primary activity locations of children and adolescents in daily life and the sports environment type (21). Currently, utilizing the physical environment as a starting point to address the issue of inadequate physical activity among children and adolescents is a critical focus in current research on the physical health of this population (22). It is an effective intervention to encourage the active involvement of children and adolescents in physical exercise (23).

The study findings suggest that commitment is crucial in maintaining consistent exercise behavior. This commitment is rooted in an individual's self-awareness and selectivity, driving them to act when they desire or need to engage in physical activity (24). According to exercise psychology, commitment is a process that triggers a shift in behavioral patterns through cognitive processing and reconstruction, resulting in a deliberate behavior that reflects a strong behavioral attitude (25). The degree of exercise commitment directly correlates with an individual's level of engagement during physical activity and impacts their adherence to the behavior (26). Those who engage in voluntary physical activity are more likely to sustain their exercise behavior over time than those who are passively encouraged to participate (27). Therefore, individuals with higher levels of exercise commitment tend to have more positive attitudes toward physical activity, increasing the likelihood of consistent exercise behavior. To promote better exercise habits among overweight and obese children and adolescents, it is essential to help them develop a proper understanding of physical activity and find enjoyment in exercise early on in their participation. This can lead to a higher level of

exercise commitment and improve the stability of their exercise behavior.

2) The mediating role of sport commitment.

The results show that exercise commitment plays an intermediary role between sport environment and exercise behavior of overweight and obese children and adolescents. This finding is consistent with the results of other studies, such as He Linghui's research, which revealed a positive correlation between high exercise commitment and exercise behavior among children and adolescents, leading to increased exercise volume. Additionally, exercise commitment was a predictive factor for physical activity in this demographic (28). In a separate study, He Junchun conducted a cross-sectional survey involving 450 high school students to investigate the influence of family sports behavior on students' physical exercise habits, focusing on exercise commitment. The findings indicated that exercise commitment mediates the relationship between family sports behavior and exercise habits among high school students (29).

Overweight and obese children and adolescents often face problems with body image and self-esteem, which makes them lack the confidence to participate in sports activities (30) actively. However, when they make a clear commitment and firm determination to participate in sports, sport commitment can help them overcome internal and external obstacles, enhance self-efficacy and motivation, and thus encourage them to participate in exercise behavior more actively. A sports environment can improve the level of exercise commitment of overweight and obese children and adolescents (31) and further encourage them to participate in exercise behavior more actively. Therefore, in constructing sports environments in schools and communities, it is necessary to ensure the satisfaction of exercise facilities for overweight and obese children and adolescents, provide them with rich sports activities, and arrange sports activities reasonably. At the same time, the particularity of overweight and obese children and adolescents should be considered in the organization form of sports activities. At the family level, parents should correct their sports attitude, actively participate in physical exercise and set an example, encourage overweight and obese children and adolescents to participate in physical exercise through positive words and actions and guide them to form good sports awareness to improve their sports

commitment level. It is suggested that the linkage mode of school, family, and community sports environment should be formed to improve the exercise behavior of overweight and obese children and adolescents and improve their physical health. Through practical cooperation and joint efforts, they can create a good sports environment and enhance their sports commitment, thus promoting their active participation in physical exercise.

Our study provides valuable insights, but the cross-sectional design limits causal inference. Longitudinal studies are needed to establish more effective causality between built sports environments and physical activity behaviors contributing to overweight and obesity in children and adolescents. Additionally, the study sample was limited to specific environments, potentially restricting the generalizability of findings. Future research should incorporate more diverse samples across different regions and populations to enhance the applicability of results. To address these issues, future studies could employ mixed methods integrating quantitative and qualitative data to comprehensively understand the impact of built environments on sedentary behavior. Simultaneously, testing architectural interventions in various settings is essential to evaluate their effectiveness across different contexts.

CONCLUSION

This study examined the relationship between the physical environment and exercise behavior of 368 overweight and obese children and adolescents in Zhaotong City, China. The results showed a significant positive correlation between the physical environment, sport commitment, and exercise behavior. A conducive sport environment was found to enhance the sport commitment of overweight and obese children and adolescents, thereby influencing their exercise behavior. The findings suggest that sport commitment is a mediating variable between the sports environment and exercise behavior, highlighting its importance in promoting PA among this population.

APPLICABLE REMARKS

- A supportive sporting environment should be established for overweight and obese children and adolescents, with the provision of suitable facilities and resources to promote their engagement in physical activity.

- Design customized exercise programs that address the characteristics and needs of overweight and obese children and adolescents to increase their commitment to sport and promote sustained exercise behavior.
- Develop comprehensive interventions to promote physical activity levels in overweight and obese children and adolescents, considering the relationship between the physical environment, commitment to sport, and exercise behaviors.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Han Mingxue, Hairul A. Hashim, Adam A. Malik. Acquisition of data: Han Mingxue. Analysis and interpretation of data: Han Mingxue, Hairul A. Hashim. Drafting the manuscript: Han Mingxue, Hairul A. Hashim. Critical revision of the manuscript for important intellectual content: Han Mingxue, Hairul A. Hashim, Adam A. Malik. Statistical analysis: Han Mingxue, Hairul A. Hashim. Administrative,

technical, and material support: Han Mingxue. Study supervision: Hairul A. Hashim.

CONFLICT OF INTEREST

There is no conflict of interest to declare.

FINANCIAL DISCLOSURE

There is no financial interest associated with this study.

FUNDING/SUPPORT

This study was not funded.

ETHICAL CONSIDERATION

(a) informed consent was obtained from each patient included in the study, and (b) the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the Human Research Ethics Committee USM (HREC) (JEPeM Code: USM/JEPeM/KK/23010097).

ROLE OF THE SPONSOR

There is no funding organization or sponsor for this study.

ARTIFICIAL INTELLIGENCE (AI) USE

As non-native speakers, we use AI to check papers for English spelling and grammatical errors.

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