The effect of Physical Education teachers' autonomy support on college students' basic psychological needs and physical exercise

El efecto del apoyo a la autonomía de los profesores de Educación Física en las necesidades psicológicas básicas y el ejercicio físico de los estudiantes universitarios

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Abstract

Background: This study applied self-determination theory to investigate the mediating effect of basic psychological needs between exercise autonomy support and exercise behavior, to construct a path model for promoting college students' participation in physical exercise, and to provide a theoretical basis for intervention of college students' physical exercise behavior.
Method: A questionnaire survey was conducted using convenience sampling. The Autonomy Support Scale, Basic Psychological Needs Scale, and Physical Activity Rating Scale-3 (PARS-3) questionnaires were used. Participants were 1,155 college students (age 19.38 ± 0.979; 524 males, 631 females). Statistical methods of regression analysis and structural equation modeling were used to analyze the data.
Results: Exercise autonomy supports significant predictor of physical exercise behavior (β= 0.235, R^2= 0.06, P<0.01). Basic psychological needs for exercise had a full mediation effect between exercise autonomy support and exercise behavior (β=0.304, R^2=0.11, P<0.01), and the indirect effect was 4.085.
Conclusion: The satisfaction of basic psychological needs is an important mediator of the role of autonomy support in the process of college students' exercise behavior. College students perceive that the higher the level of teachers' autonomy support, the more conducive to the satisfaction of the basic psychological needs of individuals, thus prompting them to actively participate in physical exercise and form an autonomous and regular physical exercise lifestyle.

Keywords

Self-determination theory; autonomy support; basic psychological needs; exercise behavior.

Resumen

Antecedentes: Este estudio aplicó la teoría de la autodeterminación para investigar el efecto mediador de las necesidades psicológicas básicas entre el apoyo a la autonomía en el ejercicio y el comportamiento de actividad física, con el objetivo de construir un modelo de ruta para promover la participación de estudiantes universitarios en el ejercicio físico y proporcionar una base teórica para intervenciones en su comportamiento de ejercicio.
Metodología: Se realizó una encuesta por muestreo de conveniencia utilizando los cuestionarios Escala de Apoyo a la Autonomía, Escala de Necesidades Psicológicas Básicas y *Physical Activity Rating Scale-3 (PARS-3)*. Los participantes fueron 1,155 estudiantes universitarios (edad 19.38 ± 0.979; 524 hombres, 631 mujeres). Se emplearon análisis de regresión y modelos de ecuaciones estructurales para analizar los datos.
Resultados: El apoyo a la autonomía en el ejercicio predijo significativamente el comportamiento de ejercicio físico (β= 0.235, R^2= 0.06, p<0.01). Las necesidades psicológicas básicas tuvieron un efecto de mediación completa entre el apoyo a la autonomía y el comportamiento de ejercicio (β=0.304, R^2=0.11, p<0.01), con un efecto indirecto de 4.085.
Conclusión: La satisfacción de las necesidades psicológicas básicas es un mediador clave en la influencia del apoyo a la autonomía sobre el comportamiento de ejercicio en estudiantes universitarios. Cuanto mayor es el nivel de apoyo a la autonomía percibido de los docentes, más se favorece la satisfacción de estas necesidades, incentivando así la participación activa en el ejercicio físico y la adopción de un estilo de vida autónomo y regular en esta práctica.

Palabras clave

Teoría de la autodeterminación; apoyo a la autonomía; necesidades psicológicas básicas; comportamiento de ejercicio.

Introduction

Although the health benefits of scientifically regular physical exercise are generally recognized (Guo & Mao, 2017; Bull et al., 2020; Van Doren et al., 2021), according to the most recent data from the World Health Organization (WHO, 2020): globally, 80% of adolescents are still have experienced varying degrees of slippage in their physical health (Piercy et al., 2018; Chaput et al., 2020; Guthold et al., 2020). Studies have shown that the physical fitness of Chinese college students has shown a declining trend in recent years, with less than 30% regularly participating in physical exercise, and college students who lack physical exercise have a 1.25 times higher risk of developing obesity diseases than those who are actively involved in physical exercise (Yang et al., 2020; Fang, 2020; Wang, 2019). College students' sedentary and inactive lifestyles have not changed, and the frequency and intensity of participating in physical exercise are gradually decreasing. It can be seen that the lack of physical exercise is the main reason for the decline in their physical fitness and the increase in obesity rate. Some studies have shown that physical education (PE) teachers are very helpful in promoting students' physical exercise and motivation (Leyton-Román et al., 2020; Tian & Shen, 2023; Van Doren et al., 2021). Therefore, how to stimulate college students' motivation to exercise, explore methods and measures to improve exercise behavior, and cultivate positive and regular exercise habits are important issues of interest to exercise psychology researchers.

Self-determination theory(SDT) proposed by Deci and Ryan elucidates the mechanisms of action by which the environment influences individual behavior, and the theory provides a plethora of explanations for understanding patterns of exercise behavior and exercise participation, as well as the process by which its internal, interpersonal factors promote autonomous motivation to exercise (Deci & Ryan, 2000). Among them, Basic Psychological Needs Theory (BPNT) is an important sub-theory of Self-Determination Theory, which suggests that the three basic psychological needs of autonomy, competence, and relationships are central to connecting the external environment with individual motivation and behavior (Deci & Vansteenkiste, 2004), and that the satisfaction of the three basic psychological needs is positively effected through the interaction of socio-environmental factors that promote behavior (Xiang, 2014; Zhu & Yin, 2017), and conversely, when the external environment fails to satisfy or partially satisfy an individual's basic psychological needs, negative behavioral engagement is exhibited (Maldonado, et al., 2019; Su, 2008). In summary, it can be seen that the social environment has a dual effect that can facilitate or hinder individuals' basic psychological needs, which in turn can positively or negatively affect individuals' motivation and behavior (Deci & Ryan, 2000). Therefore, it is important to explore which social environments can satisfy students' basic psychological needs and thus motivate exercise behavior.

Autonomy support is an important external environmental factor emphasized by self-determination theory, and exercise autonomy support refers to an individual's perception that significant others (e.g., peers, teachers) are supportive of his or her exercise, understand his or her feelings, and encourage and give him or her the opportunity to make autonomous choices (Deci & Ryan, 2008). Teacher autonomy support involves providing students with more opportunities for free choice and self-determination, encouraging independent thinking, and reducing coercive and controlling behaviors in order to satisfy students' positive affective experiences and need for autonomy, and students who perceive support from their teachers will have higher levels of perceived competence and interest in exercise (Mageau & Vallerand, 2003; Reeve, 2009). Research has shown that individuals can significantly increase their levels of motivation, pleasure, and commitment to physical exercise when they perceive more autonomy support from significant others (Zhu et al., 2023). Autonomy support from PE teachers is more likely to be found in the classroom or in physical education teaching, such as the creation of an autonomy-supportive environment for students in the physical education classroom, which can increase adherence to exercise and exercise intentions (Sun & Ji, 2010; Ntoumanis, 2005; Cheon et al.) When students perceive autonomy support from their physical education teachers, students believe that the PE teachers support their autonomous motivations, understand them, and provide opportunities for autonomous choices that encourage independent problem-solving.

Hosseini et al. (2022) investigated 400 high school students' perceived autonomy supportive teaching, basic psychological needs, motivation to learn, and physical activity participation in physical education classes using a scale. The results indicated that autonomy supportive teaching provided by PE teachers

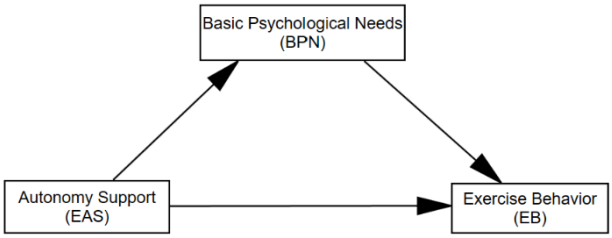
can positively influence students' learning outcomes in physical education.Abdoshahi et al. (2022) investigated perceptions of autonomy supportive teaching, internal motivation, and willingness to participate in physical activity among 384 Iranian elementary school students and found that the higher the level of students' perceptions of autonomy supportive teaching, the higher their internal motivation in physical education classes, and the more their after-school The higher the students' perception of autonomy support for teaching, the higher their internal motivation in physical education, and the higher their willingness to participate in physical activity after class. Su (2008), in validating a model of college students' motivation to avoid extracurricular sports behaviors, found that college students' perceptions of low autonomy support from their PE teachers affected their perceptions of competence and autonomy in sports, which led to low intentions to participate in physical education and to the formation of avoidance of sports behaviors. In summary, the sense of autonomy support of PE teachers is an important environmental factor that affects individual participation in physical exercise, and the positive interaction between teachers and students can play a positive role in influencing students' exercise behavior and exercise effects. Therefore, teacher behavior plays an indispensable role in influencing college students' exercise behavior.

Deci and Ryan indicated that individuals' behavior occurs as a result of satisfying their intrinsic psychological needs, which are the key factors that stimulate intrinsic motivation in individuals, and that the three basic psychological needs of autonomy, competence, and relatedness are indispensable (Deci & Ryan, 2000). It has been confirmed that basic psychological needs can have an impact on physical exercise behavior (Gholidahaneh et al., 2020; Gråstén et al., 2021; Tang, 2019; Zhang & Li, 2017). Song (2016) demonstrated that whether or not the basic psychological needs of college students when they engage in physical exercise are satisfied is very important and is the key to students' participation in physical exercise. Self-determination theory states that individuals perceive that external autonomy support can serve as a mediator through the satisfaction of basic psychological needs, which in turn affects the corresponding behavioral outcomes (Zhu & Yin, 2017). It has also been shown that the provision of an autonomy support environment by PE teachers promotes the satisfaction of individuals' basic psychological needs, which in turn enhances individuals' subjective vigor and sports participation (Xiang & Ding, 2014; Aibar et al., 2021; Chen, 2018; Carriedo et al. 2020).

Cronin et al. (2020) showed that teacher autonomy support satisfies students' basic psychological needs, which leads to greater engagement in physical skills and better performance of the resulting learning outcomes. Ulstad et al. (2018) showed that students' perceived teacher autonomy support positively predicted students' need satisfaction in a study based on the SDT model, which in turn positively predicted students' autonomy motivation and sport participation.Tang et al. (2021) showed that autonomy support has a positive predictive effect on basic psychological needs in overweight and obese college students. Which in turn positively predicted students' autonomous motivation and sports participation. Tang et al.'s (2021) study noted that autonomy support for overweight and obese college students positively predicted basic psychological needs, and autonomy support influenced physical exercise adherence through the mediating variable of basic psychological needs. Research in the field of exercise has also demonstrated that the degree of autonomy support in social support has a non-negligible role in the fulfillment of students' basic needs (Lu & Hui, 2020). In summary, the three basic psychological needs are positively related to physical exercise behavior and positively predict physical exercise behavior. It provides support for the research hypothesis that teacher autonomy support facilitates the path of students' basic psychological needs and exercise behavior.

Previous studies have provided important empirical support for the localization argument of SDT in China, but the applicability of the theory in China's college student population has yet to be further verified. Therefore, based on the theory of basic psychological needs, this study explores the role mechanism of teacher autonomy support in influencing college students' physical exercise behavior. In summary, this study proposes the following hypothesis, H1: Teachers' autonomy support significantly and positively predicts college students' physical exercise behavior; H2: Basic psychological needs mediate the prediction of college students' physical exercise behavior by teachers' autonomy support. The research hypothesis model is shown in Figure 1.

Figure 1. Research Hypothesis Model



Method

Participants

The participants were 1253 junior undergraduate students from six types of universities in China (i.e., normal education; science and technology; and medicine). All participants were recruited from colleges through convenience sampling. After the removal of individuals with invalid responses (carelessly answered questionnaires such as monotonic responses, lack of attention to reversely worded items, and missed answers), 1155 (92.17%) valid samples were collected. The participants were comprised of 524 males and 631 females. Their ages ranged from 17 to 23, with a mean age of 19.38 (SD = 0.979) years.

Procedure

This study was supported by university administrators and PE teachers. Administrators, teachers, and participants were introduced to the purpose of this study, and answers were provided anonymously. During the study, the participants' anonymity was ensured, onsite Q&A was provided, and items with reverse wording were incorporated into the surveys. The questionnaire required approximately 15-25 min to complete.

Instrument

The autonomy support scale, basic psychological needs scale, physical activity rating scale-3 (PARS-3), and demographic information such as gender, grade, and birthday were included. The details are as follows.

The Autonomy Support Scale

The autonomy support was measured using the full version of the Sport Climate Scale (SCQ) by Lu (2012), which consists of 6 items, a single dimension, and rated on a 7-point Likert scale from 1 (“not at all”) to 7 (“completely compatible”). Example items include: “I feel that my PE teacher gives me a lot of choice and freedom of choice in terms of exercise.” etc. The scale has good reliability of Cronbach’s a= 0.968 in this study.

The Basic Psychological Needs Scale

The basic psychological needs scale was measured using the Psychological Need Satisfaction in Exercise Scale (PNSE) by Lu (2012), which consists of 18 items rated on a 6-point Likert scale from 1 (“strongly disagree”) to 6 (“strongly agree”). It is divided into three dimensions: autonomy needs satisfaction, competence needs satisfaction, and relatedness needs satisfaction, with six items in each dimension. Example items include: “I feel that I have the freedom to choose and decide my exercise program during exercise”, etc. The Cronbach's α=.978 reliability of the scale is good.

The Physical Exercise Behavior Scale

Physical exercise behavior was measured using the Physical Activity Rating Scale-3 (PARS-3) revised by Liang (1994), which had a test-retest reliability of 0.870. The scale contains 3 questions on exercise intensity, duration and frequency, and uses a 5- point Likert scale. Example items include: "What is the intensity of your physical exercise?" etc.

Data analysis

SPSS26.0 and AMOS23.0 software were used for statistical analysis of the data, including descriptive statistics was used to summarize the data characteristics. Pearson correlation analysis was used to investigate the associations among study variables. Linear regression models were used to test the effects of predictors and the mediation effect. We tested the mediating effect of basic psychological needs in the relation between PE teachers autonomy support and exercise behavior. The test steps for mediated effects according to Fang and Wen et al. (Fang et al., 2014; Wen et al., 2004). Subsequently, we tested the mediation effect within the structural equation modeling (SEM) framework with AMOS 23.0. A bootstrapping method with 5000 samples was applied to test the mediation effects. The bias-corrected bootstrap confidence interval was used to test the significance of indirect effects.

Ethics

This protocol was approved by the ethics committee of Mahasarakham University (No. 2022-JNV-001), and all study procedures were in accordance with the most recent version of the Declaration of Helsinki. All participants provided written informed consent to participate.

Results

Descriptive statistics and Pearson correlation among the variables in the measurement model

Table 1 shows the Pearson correlations among the study variables. Autonomy support, basic psychological needs, and physical exercise behavior were significantly and positively associated($p < 0.01$), with correlation coefficients of 0.235 and 0.330, and the correlation coefficient between autonomy support and basic psychological needs was $r = 0.643$. In summary, there was a significant positive correlation between all variables in this study ($p < 0.01$), providing a basis for subsequent analysis of mediating effects.

Table 1. Descriptive statistics and Pearson correlation among study variables (*N*=1155)

Variables	EAS	BPN	EB	*M*	*SD*
Autonomy Support (EAS)	1			6.160	1.034
Basic Psychological Needs (BPN)	.643**	1		5.013	0.865
Exercise Behavior (EB)	.235**	.330**	1	22.820	21.621

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

The effects of PE teachers' autonomy support on exercise behavior

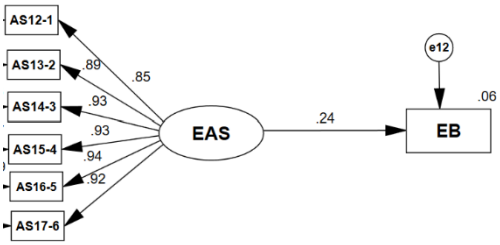
To test the mediating effect of PE teachers' autonomy support on college students' exercise behavior, this study used simple linear regression results for each predictor of Exercise behavior (see Table 2). Autonomy support($F_{(1,1153)}$ =67.561, β= 0.235, $p<0.01$) had significantly influenced exercise behavior. The SEM parameter estimates are shown in Figure 2, the model has good fit, x^2 = 94.688, df = 13, x^2/df = 7.284, GFI = 0.975, NFI = 0.989, TLI = 0.985, IFI = 0.991, CFI = 0.991, and RMSEA = 0.074.

Table 2. Simple linear regression on exercise behavior

Predictor	Exercise Behavior					
	B	SE	β	T	F	R^2
Autonomy Support	4.921	0.599	0.235	8.220	67.561***	0.055

Note. SE = standard error; **p < .01; ***p <.001.

Figure 2. Path relationship between Autonomy Support and Exercise Behavior



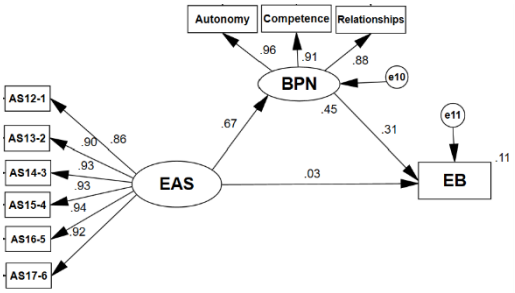
Mediation effects of basic psychological needs

The mediation test used the sequential method for regression analysis (see Table 3), with Model 1 using basic psychological needs as the dependent variable, and Models 2 and 3 using exercise behavior as the dependent variable for regression analysis. The results of Model 1 showed that autonomy support had a significant positive predictive effect on basic psychological needs (β= 0.643, p < 0.01). The results of Model 2 showed that basic psychological needs had a significant positive predictive effect on exercise behavior (β= 0.330, p < 0.01). The results of model 3 showed that after adding the mediator variable, the regression coefficient of basic psychological needs was still significant (β= 0.304, p < 0.01), but the effect of the independent variable (autonomy support) was weakened, and the regression coefficient decreased from 0.235 to 0.040 and was reduced to a non-significant level (p > 0.05), which indicated that basic psychological needs played the role of a complete mediator, and that autonomy support had a positive predictive effect on exercise behavior through basic psychological needs have a predictive effect on exercise behavior. Based on this, structural equation modeling was used to construct the mediation effect model (see Figure 3). The model had a good fit, x^2 = 274.433, df = 33, x^2/df =8.316, GFI = 0.951, NFI = 0.979, TLI = 0.974, IFI = 0.981, CFI = 0.981, and RMSEA = 0.080.

Table 3. Regression analysis result（Autonomy Support、Basic Psychological Needs and Exercise Behavior）

Predictor variable		Model 1	Model 2	Model 3
		Mediator variable	Dependent variable	
		Basic Psychological Needs	Exercise Behavior	
Independent variable	Autonomy Support	0.643**		0.040
Mediator variable	Basic Psychological Needs		0.330**	0.304**
	R^2	0.413	0.109	0.110
	F	811.435**	140.505**	70.871**

Figure 3. The mediating relationship between Autonomy Support, Basic Psychological Needs and Exercise Behavior



The mediation effect was verified using the Bootstrap method (Table 4), the path of autonomy support → basic psychological needs → exercise behavior showed an indirect effect of 4.085, 95% CI [3.013, 5.176], which did not include zero, thus indicating significant indirect effects. The path of autonomy support → exercise behavior showed a direct effect of 0.836, 95% CI [-0.654, 2.325] indicating no significance. The above validation results further validated hypothesis H2.

Table 4. Bootstrap test result（Autonomy Support、Basic Psychological Needs and Exercise Behavior）

	Effect	SE	T	P	BootLLCI	BootULCI
Direct effect	0.836	0.759	1.101	0.271	-0.654	2.325
Indirect Effect	4.085	0.551			3.013	5.176

Discussion

The results of this study indicate that autonomy support provided by PE teachers positively predicts the basic psychological needs of college students, that the satisfaction of basic psychological needs can positively predict their exercise behavior, and that basic psychological needs showed a full mediation effect between autonomy support and physical exercise behavior. The above results supported the study hypotheses.

Autonomy support and exercise behavior among college students

The results of the regression analysis showed that PE teachers' autonomy support has a significant positive effect on exercise behavior, $\beta = 0.235$($p < 0.01$), and can explain 6% of the variance in exercise behavior. The results obtained are consistent with those of previous studies (Xu, 2021; Raabe et al. 2019; Yoo, 2015). The results support the research hypothesis H1. The autonomy support provided by PE teachers has a positive predictive effect on the exercise behavior of college students, indicating that the more autonomy and independence that PE teachers give students in their teaching, the more active they are in participating in sports, and the more positive emotional experiences they have, the more beneficial it is to the development of their exercise behavior (Liu, 2021). PE teachers' provide exercise autonomy support that helps improve individual attitudes and motivation to exercise, stimulates students' interest and motivation to exercise, and leads to more persistent and high self-efficacy in physical exercise.

In summary, the higher the perceived level of autonomy support for PE teachers, the higher the motivation and self-discipline of college students to actively participate in physical exercise. PE teachers' attitudes and teaching styles are important external factors that influence college students' participation in physical exercise. Therefore, in future research, physical exercise interventions must act to increase teacher autonomy support, promote autonomy-supportive teaching practices and reduce controlling teaching behaviors during the teaching process, satisfy individual exercise needs, enhance students' autonomy motivation levels, and contribute to stimulating motivation and participation in exercise.

Mediating effect of basic psychological needs

The results of this study showed that the predictive effect of autonomy support on exercise behavior is no longer significant due to the intervention of basic psychological needs. The regression coefficient of autonomy support on exercise behavior decreased from 0.235 to 0.040 and decreased to a non-significant level ($p > 0.05$), explaining 11.0% of the variation. This indicates that basic psychological needs had a full mediation effect between PE teachers' autonomy support and physical exercise behavior, and the findings support hypothesis H2. Cronin et al. (2020) study also argues that teachers' autonomy support satisfies students' basic psychological needs, thereby encouraging them to engage more deeply in the learning of sports skills and achieving better learning outcomes. PE teachers' autonomy support can promote the satisfaction of students' basic psychological needs, and this satisfaction can motivate students to participate actively in physical activities and maintain and improve their exercise behavior. The results of this study are consistent with previous findings (Zhu & Yin, 2017; Tilga et al., 2020; Tang et al., 2021; Carriedo et al., 2023).

Self-determination theory suggests that when the external environment serves as a supportive environment, it promotes the satisfaction of basic psychological needs, leading to the internalization of their external motivation, which in turn influences exercise behavior, and conversely when the social environment hinders the satisfaction of psychological needs, exercise motivation, and behavior are negatively affected (Ryan & Deci, 2017). Therefore, psychological need satisfaction helps to promote individual exercise motivation and behavior. PE teachers who provide autonomy support give students more opportunities for autonomous choices and autonomous practices during physical exercise, reduce controlling language and behaviors, provide guidance and encouragement for self-enlightenment, under-

stand students' feelings, and satisfy individual exercise needs, which will help to enhance students' enjoyment, effort, participation, and future willingness to engage in physical exercise, thereby promoting exercise behavior (Fin et al. 2019; Lu & Hui, 2020; Tian & Shen, 2023). In summary, the higher the level of perceived autonomy support from PE teachers by students, the more favorable it is for the satisfaction of students' basic psychological needs. Autonomy support has been shown to not only allow students to perceive higher levels of autonomy, but also help students perceive teachers' competence support and emotional support, and obtain higher satisfaction of basic psychological needs, which leads to stronger motivation for autonomous exercise and positive exercise behavior.

This study confirmed the mediating role of basic psychological needs between autonomy support and exercise behavior; the results suggest that PE teachers can stimulate students' intrinsic needs for autonomy, competence, and relationships in physical exercise by providing various types of autonomy support teaching strategies, such as choice, positive feedback, and emotional care, to give the students a sense of autonomy, fulfillment, and accomplishment, which in turn enhances their persistence in and involvement. Therefore, it is crucial to encourage PE teachers to create more exercise autonomy support environments and meet the basic psychological needs of college students. For example, during instruction, PE teachers can provide incentives and feedback to guide students in exercising independently, cultivate their interest in exercise, inspire students to experience positive emotions, and increase the intrinsic motivation of individuals to participate in exercise. At the same time, create a relaxed and active teaching atmosphere to help students regulate their anxiety, appropriately reduce the difficulty of the learning content, mobilize the enthusiasm of students to exercise, and fully demonstrate the recognition and affirmation of students. In creating an environment for independent exercise, helping students establish exercise goals, designing reasonable challenge tasks, encouraging participation in a variety of physical activities, forming physical exercise groups or teams, establishing correct attitudes towards physical exercise and self-confidence, improving students' enthusiasm and initiative for physical exercise, and showing positive participation behavior when students perceive the positive interactive environment of teachers. In summary, the satisfaction of basic psychological needs is an important medium for autonomy support in the process of college students' exercise behavior.

This study also has some limitations, and future studies needs to explore and validate the experimental intervention with longitudinal tracking to more fully reveal the causal relationship of each variable. The study attempted to adopt a combination of multiple measures to objectively measure exercise behavior, such as accelerometers, Polar scales, and other objective measurement tools, to improve the accuracy of the measurements. In future studies, multiple factors are included in the model to consider the support of other social contexts, such as the influence of competence support and relationship support provided in the motivational style of teachers, to create conditions for the comprehensive satisfaction of basic psychological needs and the development of autonomous motivation in college students.

Conclusions

Autonomy support and basic psychological needs were antecedent variables of exercise behavior, and all had significant direct effects on exercise behavior. Basic psychological needs had a fully mediated effect between teacher autonomy support and college students' physical exercise behavior. A good external environment can promote the satisfaction of individual psychological needs. The stronger the autonomy support provided by PE teachers, the higher the degree of satisfaction with basic psychological needs among college students, which in turn promotes their participation in physical exercise and the development of good exercise volition and behavioral habits. This study provided theoretical guidance and action strategies to promote college students' participation in physical exercise.

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