The Influential Factors Affecting the Exercise Habits of Ethnic University Students at Kunming University: An Analysis Based onAMOS Structural Equation Modeling

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Abstract

This study investigates the factors influencing exercise habits among ethnic university students at Kunming University, utilizing a sample of 1,017 students. The Delphi method identified 24 factors that influence the exercise habits of ethnic minority university students. Exploratory factor analysis was then conducted to further analyze the data, leading to the development of a model of these influencing factors, which was empirically tested using AMOS software. The findings suggest that exercise habits among ethnic university students are shaped by multiple factors, with individual influences being the most significant, followed by family, campus, and societal influences. This study provides theoretical insights for improving physical activity among ethnic university students, and based on these findings, several recommendations are proposed to enhance their exercise habits at Kunming University.

Keywords：Ethnic minorities; University students; Exercise habits; Influencing factors

Introduction

Within China's multi-ethnic society, the health of university students from ethnic minority backgrounds has garnered increasing attention. The government has prioritized their well-being, introducing policy initiatives to support their holistic development. The "Healthy China 2030" Plan, issued in October 2016, is a comprehensive strategy addressing long-term health concerns from a national perspective. (The State Council of the People's Republic of China, 2016). The "Healthy China" concept was first elevated to a national strategy, redefining health as essential for comprehensive human development and a foundation for economic and social progress.

As a multi-ethnic nation, China has consistently prioritized strategies to enhance the physical health of ethnic minority students, recognizing their well-being as vital to the overall health of the student population nationwide. Health concerns among ethnic minority university students have become a key focus in higher education and public health in China. Studies show that while ethnic university students generally exhibit symmetrical body morphology and improved physical skills, there is a decline in overall physical fitness levels (Yue, H., & Xin, R., 2022).

Exercise habits are crucial for health promotion. Regular physical activity enhances fitness, strengthens the immune system, and prevents various diseases. Empirical studies show that consistent exercise significantly reduces the risk of cardiovascular diseases, diabetes, and obesity.(Warburton, Nicol, & Bredin, 2006). Moreover, physical activity exerts a considerable

positive influence on mental health. Moderate exercise has been shown to alleviate stress, improve mood, and bolster psychological resilience, thereby assisting in the prevention and management of anxiety and depression (Benjamin Gardner, Lee Smith, Fabiana Lorencatto, Mark Hamer, & Stuart Jh Biddle, 2015). Furthermore, the cultivation of exercise habits promotes a healthy lifestyle and encourages positive health behaviours, facilitating overall personal development. Consequently, exercise habits serve not only as an effective strategy for maintaining physical health but also as a crucial avenue for enhancing mental well-being and overall quality of life.

A comprehensive examination of the literature concerning exercise habits reveals that researchers have established a robust framework for future investigations. Nonetheless, the exploration of the determinants affecting exercise habits within ethnic minority populations is still in its nascent stages. The majority of existing studies are predominantly descriptive, concentrating on the present levels of exercise frequency, types, and attitudes among these groups. These investigations frequently lack rigorous quantitative analyses that could illuminate the various factors influencing exercise habits, thereby failing to adequately clarify the specific effects of these factors on the development of exercise habits among ethnic minority university students. Therefore, it is necessary to conduct more systematic and in-depth research using quantitative analysis methods to explore the specific impacts of different influencing factors on the exercise habits of ethnic minority university students. This research will enhance the theoretical comprehension of exercise behaviours among ethnic university students and offer a more robust scientific framework and practical recommendations for fostering the establishment of exercise habits within this demographic. Consequently, this will contribute to the overall health advancement of ethnic minority university students.

Research objectives

1. To study the factors that influence the formation of ethnic students' exercise habits at Kunming University.

2. To analyze constructing a theoretical model of influencing factors of ethnic students' Physical Exercise Habits at Kunming University.

Literature Review

Status of Physical Exercise Habits in China

Domestic scholars have made significant progress in studying exercise habits, particularly in the in-depth exploration of concepts, content, and measurement methods researcher proposed that exercise habits are self-aware, active, enjoyable, and frequently repeated behavioral patterns gradually formed during long-term physical activity and emphasized the developmental process of habits, pointing out that this behavioral pattern is gradually formed through long-term physical exercise practice. Research has shown that lifelong exercise habits are behaviors that gradually form in an individual's life and are not easily changed (Zou Xiaoyun,1994). Exercise habits differ from ordinary habits in their higher degree of socialization and distinct physical behavior characteristics. Some scholars have described the invariability and consolidation of exercise habits, suggesting that these habits are stable neural connections formed in the cerebral cortex, with motor skills as their foundation and volitional activities as key factors in their development (Chen Ming & Yu Jian, 2003).Other scholars believe that exercise habits are internal needs and relatively stable

automatic movement behavior patterns gradually formed based on repeated physical exercise (Xie Yifei et al., 2004).These definitions indicate that researchers focus on the process, motivation, and characteristics of habit formation. Based on previous research on the definition of exercise habits, most scholars agree that exercise habits result from the interaction and mutual promotion of exercise behavior and the habit formation process. Exercise habits are formed and developed through repeated practice activities and are characterized by being acquired, stable, self-aware, directional, energy-saving, and automated. It is generally believed that individuals with established exercise habits exhibit distinct and stable psychological characteristics in their awareness, emotions, and skills related to physical exercise (Xie Yifei et al., 2004). Some scholars have described the current status of exercise habit formation based on the function and characteristics of habits, the general rules of exercise habits, and the principles and methods of mastering physical exercise. Specifically, these habits manifest as engaging in physical exercise at least three times a week, for no less than 30 minutes each time, with moderate or higher intensity, sustained for over a year (Mo Lianfang, 2007).The formation of exercise habits requires an understanding of the functions and characteristics of physical exercise, knowledge of the general rules of exercise, mastery of exercise principles and methods, self-awareness of one's strengths and weaknesses, and the willpower and consciousness to engage in physical exercise (Chen Ming & Yu Jian, 2003). Physical exercise, as a key means of improving the physical health of children and adolescents and promoting their overall development, plays a crucial role in their healthy growth. The sports environments created by families, communities, and schools are vital areas where children and adolescents receive comprehensive physical education, collectively bearing the responsibility of promoting healthy growth through exercise. Scientific exercise habits have a significant positive impact on physical health. Therefore, researchers have increasingly focused on the manifestations of exercise habits, such as exercise frequency, duration, and content, while relatively less attention has been given to the causes or influencing factors of their formation.

Research Methodology

Research Subjects

Related research methods suggest that more than 200 samples are considered to be of medium size (Ming-Zhu Yuan, Chao-Chien Chen, I.-Shen Chen, Cheng-Chia Yang, & Chin-Hsien Hsu, 2022). If structural equation modelling is needed to analyze the results, an outcome study should not have less than 200 samples (Chiu, 2006).The research encompassed a sample of 1,100 ethnic minority university students from Kunming University, located in Kunming, Yunnan Province. A total of 1,050 questionnaires were successfully collected, resulting in a response rate of 92.5%. Out of these, 1,017 questionnaires were deemed valid, leading to an effective response rate of 96.9%. The primary objective of this study is to investigate the determinants that affect the exercise habits of ethnic minority university students and to analyze the influence of various factors on these habits. Data collection was conducted through an online stratified sampling approach, utilizing the WENJUANXING platform for the distribution and collection of the questionnaires.

Research Tools

The questionnaire utilized in this study was formulated through a series of three rounds of Delphi method interviews involving 17 experts, who contributed insights regarding the factors influencing exercise habits, in addition to items derived from the Self-Report Habit Index (SRHI). The initial round of the Delphi survey was conducted in October 2023 to elicit expert perspectives on the relevant influencing factors. Subsequently, the second round of the Delphi method took place in November 2023, informed by the outcomes of the first round. Ultimately, in December 2023, the comprehensive questionnaire addressing the influencing factors of exercise habits among ethnic minority university students was finalized, integrating the results from the third round of the Delphi survey alongside the Self-Report Habit Index (SRHI). The questionnaire is structured into three sections, encompassing a total of 40 questions.

Data and Analysis

The valid questionnaires that were collected underwent statistical analysis, with the data being input into SPSS 27 for comprehensive examination. Furthermore, AMOS 21 software was employed to investigate the relationships among the variables. SPSS is a statistical software application that provides a graphical user interface for conducting analyses. In this research, SPSS was utilized for descriptive analysis, as well as for assessing the reliability and validity of the questionnaire, and for performing factor analysis concerning the influencing factors among university students from ethnic minority backgrounds. Conversely, AMOS statistical software, which also features a visual graphical interface, was utilized to construct, modify, and analyze complex structural equation models (SEM). In this study, AMOS facilitated the development of SEM and was instrumental in determining whether the path coefficients between the variables achieved statistically significant levels, thereby supporting the validation of the research hypotheses.3.6. Ethical Considerations The survey was conducted anonymously. The questionnaire was developed based on a review of relevant literature and the results of the Delphi method. To evaluate and refine the questionnaire content, methods such as content validity checks and reliability analysis were employed. Before completing the questionnaire, participants were asked to reconfirm their consent to participate and to allow their data to be used for this study, with an emphasis that their data would be presented anonymously. Thus, the study's design and content were grounded in the principles of fairness, transparency, and equity.

Research Conceptual Framework

This research seeks to investigate the determinants of exercise habits among ethnic university students. The proposed framework for the study, informed by the objectives of the research and relevant literature, in
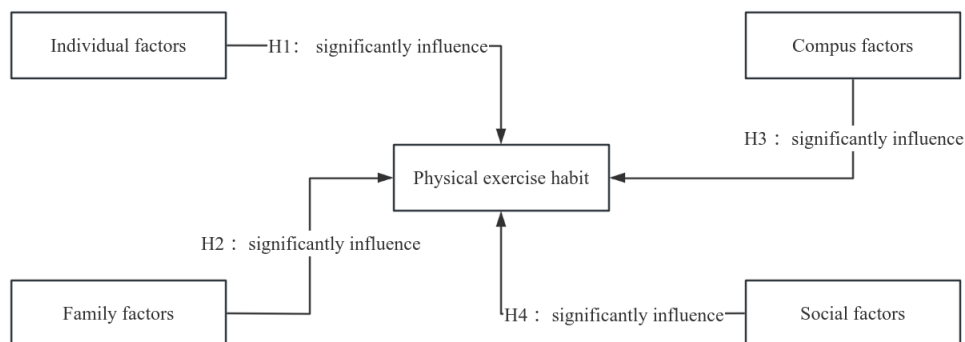
Figure **1**

Figure 1 Research Conceptual Framework

Research Scope

The study focuses on the following aspects: The study population is ethnic students aged 17-23 from grades 1-4 in Kunming University. **Independent variable** Looking back at previous research, there are many factors that affect the formation of students' physical exercise habits, which are generally divided into the following categories: (1) Individual factor (2) Family factors (3) Campus factors and (4) Social factors. **Research content** 1) The current situation of the physical exercise habits of ethnic students at Kunming University. 2) Analyzes the influencing factors of the formation of exercise habits on ethnic students at Kunming University. 3)The construction of a theoretical model of the influencing factors for the formation of ethnic students' physical exercise habits in Kunming University. and 4)Them mechanism of influencing factors of physical exercise of ethnic students at Kunming University .

Research Results

An exploration of influencing factors of ethnic university students

The research engaged 17 specialists from pertinent academic disciplines to implement the Delphi method, aimed at identifying the determinants of exercise habits among university students from ethnic minority backgrounds through a series of three consecutive consultations. The criteria for expert selection included: 1) voluntary participation in the study; 2) demonstrated expertise in the fields of physical education or psychology; 3) holding an academic rank of associate professor or higher, or possessing a doctoral degree; and 4) a minimum of five years of relevant professional experience. Following the three rounds of expert consultations, a total of 24 items about the factors influencing exercise habits among ethnic minority university students were identified. Utilizing the outcomes of the Delphi

method alongside the Self-Report Habit Index (SRHI), an exploratory factor analysis was performed, leading to the identification of five distinct factors. These factors were classified as Individual, Family, Campus, Society, and Exercise Habit, as presented in Table 1

Table 1 Influencing Factors of Ethnic university students' Exercise

Code	Name of value	Code	Name of value
Q1.1	The motivation to participate in the exercise	Q3.1	Stadium site conditions of the school
Q1.2	Soothing psychological stress	Q3.2	Participate in the school's sports club
Q1.3	Expand the circle of friends	Q3.3	Peers participate in physical exercise
Q1.4	The awareness of personal exercise	Q3.4	The guidance level of the PE teacher
Q1.5	The satisfaction of goal achievement	Q3.5	School health education curriculum
Q1.6	Fun of sports	Q3.6	The teaching idea of PE teachers
Q2.1	The degree to which the family likes physical activity	Q4.1	Sports and fitness information access channel
Q2.2	Parents' sports knowledge and sports habits	Q4.2	Commercial fitness center
Q2.3	Home physical exercise atmosphere	Q4.3	Large government sports events
Q2.4	The economic conditions of the family	Q4.4	Guidance by a fitness instructor
Q2.5	Relatives' support for physical exercise	Q4.5	The convenience of urban sports facilities
Q2.6	Parent's education level	Q4.6	The degree to which the government has promoted the movement

Table 2 Rotated Component Matrix for the Factor Analysis

	Rotated Component Matrixa					
	Component					Factors
	1	2	3	4	5	
Q1.1					0.681	
Q1.2					0.713	
Q1.3					0.7	Individual factor
Q1.4					0.674	
Q1.5					0.755	
Q1.6					0.726	

Table 2 Rotated Component Matrix for the Factor Analysis

			Rotated Component Matrixa		
			Component		Factors
Q2.1				0.712	
Q2.2				0.739	
Q2.3				0.725	Family factor
Q2.4				0.725	
Q2.5				0.703	
Q2.6				0.72	
Q3.1			0.703		
Q3.2			0.725		
Q3.3			0.715		
Q3.4			0.742		Campus factor
Q3.5			0.74		
Q3.6			0.708		
Q4.1		0.771			
Q4.2		0.787			
Q4.3		0.777			
Q4.4		0.767			Social factor
Q4.5		0.753			
Q4.6		0.769			
Q5.1	0.71				
Q5.2	0.674				
Q5.3	0.683				
Q5.4	0.716				
Q5.5	0.705				
Q5.6	0.715				
Q5.7	0.706				Exercise Habit
Q5.8	0.692				
Q5.9	0.711				
Q5.10	0.681				
Q5.11	0.676				
Q5.12	0.689				

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Sample Characteristics

In this study, there were 1017 valid samples, and the sample characteristics are shown in Teble 3.

Table 3 Sample Characteristics

Variable	Category	Frequency	Percentage (%)
Gender	Female	721	70.9
	Male	296	29.1
Grade	First Year	264	26
	Second Year	330	32.4
	Third Year	219	21.5
	Fourth Year	204	20.1
Age	17 years old	1	0.1
	18 years old	87	8.6
	19 years old	180	17.7
	20 years old	210	20.6
	21 years old	296	29.1
	22 years old	232	22.8
	23 years old	8	0.8
	24 years old	3	0.3
Ethnic groups	Yi	396	38.9
	Other	182	17.9
	Bai	104	10.2
	Zhuang	95	9.3
	Hui	75	7.4
	Hani	73	7.2
	Dai	50	4.9
	Miao	42	4.1

Notes: Student samples with smaller numbers were combined into the "Other" category. The "Other" category included 22 samples of Lisu and 9 samples of Yao. Smaller groups such as Naxi, Wa, Tibetan, and others had sample sizes ranging from 1 to 16.

Measurement Model Analysis

1.Verification of Convergent Validity and Discriminant Validity

The validity can also be characterized as convergence validity and discriminant validity. Bagozzi and Yi pointed The convergent validity of the questionnaire dimensions should be assessed using Composite Reliability (CR) and Average Variance Extracted (AVE) (Bagozzi & Yi, 1988). It is recommended that for good convergent validity, the CR value should exceed 0.6, and the AVE value should be greater than 0.5(Fornell, 1981). When the standardized factor load is> 0.5, AVE> 0.5, and CR> 0.6, it indicates that the measurement model has good convergence validity. If the value of the square root of AVE is higher than the absolute value of each potential variable and the correlation coefficient between the variable and the other potential variables, it indicates that the potential variables have good

differential validity between the potential variables. All AVE values are greater than 0.5, and all CR values are higher than 0.7, which means that the analyzed data has good aggregation (convergence) validity. The bold numbers in the above table are the AVE square root, and the AVE square root values of all factors are greater than the maximum value of the absolute value of the correlation coefficient between factors, which means good Discriminant Validity. as presented in Table 4.

Validity can be defined in terms of convergent validity and discriminant validity. According to Bagozzi and Yi, the convergent validity of the dimensions in a questionnaire should be evaluated using Composite Reliability (CR) and Average Variance Extracted (AVE) (Bagozzi & Yi, 1988). For strong convergent validity, it is suggested that the CR should be above 0.6 and the AVE should exceed 0.5 (Fornell, 1981). When the standardized factor loading is greater than 0.5, and both AVE and CR are above their respective thresholds, it indicates that the measurement model demonstrates good convergent validity. Additionally, if the square root of the AVE is greater than the absolute values of each latent variable and the correlation coefficients between the variables, it suggests that there is good discriminant validity among the latent variables. All AVE values exceeding 0.5 and CR values above 0.7 indicate that the data analyzed possesses strong convergent validity. The bold figures in the table represent the square roots of the AVE, and since these values for all factors are greater than the highest absolute correlation coefficient among the factors, it confirms good discriminant validity, as shown in Table 4.

Table 4 Validity Analysis of Structural Equation

Latent variables	CR	AVE	Individual factors	Family factors	Campus factors	Society factors	Exercise habits
Individual factors	0.845	0.521	**0.722**				
Family factors	0.875	0.540	0.514***	**0.735**			
Campus factors	0.872	0.531	0.516***	0.504***	**0.729**		
Society factors	0.910	0.626	0.497***	0.486***	0.451***	**0.791**	
Exercise habits	0.927	0.537	0.598***	0.576***	0.558***	0.535***	**0.733**

2. Structural Model Analysis

In the development of structural equation models, the initial step involves performing a moderation analysis of the measurement model to ascertain its capacity to accurately represent the relationship between observed variables and latent variables. Evaluating the goodness of fit of a model presents a complex challenge, as the significance attributed to various fit indices can differ in the context of model assessment.

Table 5 Structural model.

Commonly used indicators	Chi-square degrees of freedom than χ^2/df	GFI	RMSEA	RMR	CFI	NFI	TLI
Criterion for judgement	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Value	1.386	0.958	0.020	0.027	0.988	0.960	0.988

It is widely accepted that the evaluation of a model's quality should not rely on a single metric, but rather on a combination of multiple indicators. This study assesses the model's fit by focusing on three primary dimensions: absolute fit, relative fit, and parsimony fit. The absolute fit indices employed include the chi-square degrees of freedom ratio ($\chi 2/df$), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), Normed Fit Index (NFI), and Tucker-Lewis Index (TLI). The results indicate that all model fitting indicators met the established criteria, suggesting that the model demonstrates a satisfactory level of fit.

Table 6 illustrates that the exercise habits of ethnic students are shaped by a complex interplay of multiple influencing factors.

Table 6 Path coefficient testing

			STD-Estimate	S.E.	C.R.	P
Exercise habit	<---	Individual	0.27	0.037	7.414	***
Exercise habit	<---	Family	0.24	0.035	6.652	***
Exercise habit	<---	Campus	0.21	0.036	6.063	***
Exercise habit	<---	Society	0.19	0.030	5.736	***

Noted：***represent＜0.001

As can be seen from the above data, when Individual factors influence exercise habits, the standardized path coefficient value is 0.273> 0, and this path is significant (z=7.414, p <0.05), thus indicating that Individual has a significant positive influence on the formation of exercise habit.

Family factors For the formation of Exercise habit, the standardized pathway value is 0.237> 0, and this pathway is significant (z=6.652, p <0.05), thus indicating that family factors have a significant positive impact on the formation of exercise habits.

Campus factors For the formation of Exercise habit, the standardized path coefficient value is 0.212> 0, and this path is significant (z=6.063, p <0.05), thus indicating that campus factors have a significant positive impact on the formation of exercise habits.

Society factors For the formation of Exercise habit, the standardized pathway value is 0.189> 0, and this path is significant (z=5.736, p <0.05), thus indicating that society factors have a significant positive impact on the formation of exercise habits.

Discussion

Based on the above analysis of factors affecting ethnic university students, we can see that the exercise habits of ethnic university students are affected by many aspects. The following main conclusions have been obtained from the empirical analysis of this study:

Discussion Based on the analysis of

Table 6 and

Figure 2, it is evident that Hypothesis 1 (H1) is supported, indicating that individual factors have a significant positive impact on the exercise habits of ethnic minority university students. Specifically, individual factors encompass the motivation to participate in exercise, the alleviation of psychological stress, the opportunity to expand social circles, the awareness of personal exercise, the satisfaction derived from goal achievement, and the enjoyment of sports. These factors directly influence students' enthusiasm and engagement in physical activities. For example, intrinsic motivation and the sense of accomplishment gained from exercise not only encourage students to participate more frequently but also help them maintain this habit over time. Additionally, the reduction of psychological stress and the expansion of social networks enhance students' dependence on and persistence in exercise, thereby reinforcing their exercise habits. Moreover, empirical results indicate that Hypothesis 2 (H2) is also supported, demonstrating that family factors have a significant positive impact on the exercise habits of ethnic minority university students. Family factors include the family's overall appreciation of physical activity, parents' sports knowledge and habits, the home environment's emphasis on physical exercise, the economic conditions of the family, relatives' support for physical activity, and parents' education level. These family factors contribute to promoting students' exercise habits through various channels. For instance, a family environment that values and supports physical activity can foster students' interest in exercise and help them sustain it over time. Furthermore, parents' education levels and understanding of sports can guide and encourage students' exercise behaviours, further facilitating the formation of exercise habits. Hypotheses 3 (H3) and 4 (H4) are also confirmed, indicating that campus and societal factors significantly influence the exercise habits of ethnic minority university students. Campus factors, such as the school's sports facilities, opportunities to participate in school sports clubs, peer participation in physical exercise, the guidance level of physical education teachers, the integration of health education curricula, and the teaching philosophies of physical education teachers, all positively impact students' exercise behaviours. Notably, the sports resources and courses provided by schools offer essential material conditions and psychological support, which stimulate students' interest in physical activities. Societal factors, including access to sports and fitness information, the availability of commercial fitness centres, participation in large government sports events, guidance by fitness instructors, the convenience of urban sports facilities, and government promotion of physical activity, further support the cultivation of exercise habits by creating a favourable social environment. In terms of the impact magnitude, individual factors exert the most significant influence on the exercise habits of ethnic minority university students, followed by family factors, and then campus factors. Although societal factors have a relatively weaker influence, they still significantly contribute to shaping the exercise habits of these students. This suggests that the formation of exercise habits among ethnic minority university students is a complex process, influenced by multiple factors at the individual, family, campus, and

societal levels. Individual intrinsic motivation and health awareness serve as the primary drivers, while family and campus environments provide supportive conditions, and societal factors reinforce the development and consolidation of these exercise habits through policies and resource allocation.
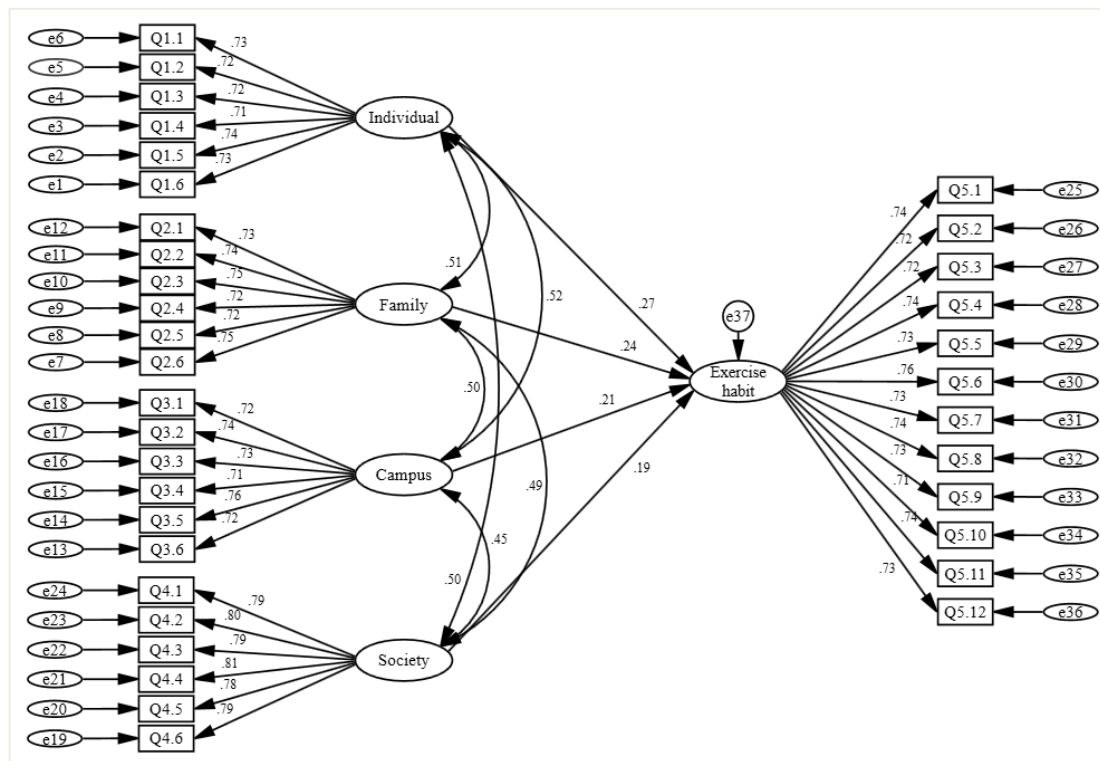
Figure 2 Structural Equation Modeling (standardized coefficients)

Recommendations

Theoretical Recommendation

Streng then physical education courses and health education, improve the minority college students 'cognition of physical exercise, increase physical education in physical education course science knowledge teaching, help ethnic students realize exercise for people's physical and mental health, social interaction to promote, the important role of establishing a good way of life, help students to form the correct belief, master scientific exercise methods and knowledge, enhance their exercise consciousness and ability.

Policy Recommendations

To promote extracurricular sports activities and associations, the school should actively formulate corresponding measures to encourage colorful girls to actively participate in extracurricular sports activities and associations, and stimulate the sports interest of ethnic students at Kunming University through a variety of sports activities. Organize various sports competitions and sports games to provide more opportunities and platforms for ethnic students.

Practical Recommendations

To improve school sports facilities, schools should increase the investment and maintenance of sports facilities to ensure that students have sufficient sports venues and equipment. According to the needs of students, reasonable planning and arrangement of the use of sports venues and to strength hen family and social support, students 'parents should actively support and participate in students' physical exercise, to create a good family sports atmosphere. All sectors of the society should also pay attention to and support the physical exercise of young people, and provide students with more exercise opportunities and resources through community activities and large-scale social sports activities.

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