

# A social-ecological analysis of barriers to sports and other forms of physical activity for female university students in China

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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## Abstract

### Background and Study Aim:

Female university students' participation rates in sports and others forms of physical activity have been low for decades in China. The purpose of this study is to identify the factors that impact female university students' participation in sports and others forms of physical activities.

### Material and Methods:

This study is grounded in the theoretical underpinnings of a social-ecological model of influences on participation in sports and others forms of physical activity. The study was conducted in China and focuses on an identification of the factors that impact the participation rate of female university students aged 18 to 22. Questionnaires were distributed to 2000 female university students between the ages of 18 and 22 in 11 cities.

### Results:

First, female university students who infrequently participated in sports and others forms of physical activity (sports/physical activity) primarily experienced strong intrapersonal barriers, whereas those who often engaged in sports/physical activity were more likely to encounter greater environmental barriers. Second, the factors examined using a social-ecological model that most affected female university students' participation in sports/physical activity included personal physiological factors, participation and the support of people around them, site and natural environmental factors, and a lack of female sports facilities and exercise opportunities for women.

### Conclusions:

Barriers to female university students' participation in sports and others forms of physical activity are affected by various factors under the social ecology model. To promote female university students' participation in sports/physical activity, a comprehensive support environment should also be constructed.

### Key words:

environmental factors • exercise • interpersonal factors • social ecological model

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Authors have declared that no competing interest exists

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**Physical activity** – exercise and general movement that a person carries out as part of their day.

**Sport** – organized play that is accompanied by physical exertion, guided by a formal structure, organized within the context of formal and explicit rules of behavior and procedures, and observed by spectators.

**Social-ecological system** – an area in the physical world in which human society interacts with 'nature' or 'the environment'.

**The Delphi method (Delphi technique)** – a method of group decision-making and forecasting that involves successively collating the judgments of experts [56].

**A Likert scale** – is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term (or more accurately the **Likert-type scale**) is often used interchangeably with **rating scale**, even though the two are not synonymous [57].

## INTRODUCTION

Globally, 28% of adults aged 18 and over (men 23% and women 32%) did not meet the global recommendations of at least 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity physical activity per week in 2016 [1]. Insufficient physical activity is a leading risk factor for non-communicable diseases and has negative impacts on both mental health and quality of life [2]. Sports and physical activity serves to prevent chronic diseases, promote healthy physical, mental, and intellectual development, encourage integration into society, improve interpersonal relationships, and enhance work and learning efficiency [3].

A robust understanding of barriers to women's physical activity is needed for evidence-based strategies to encourage greater participation. The United Kingdom, United States, Canada, Australia and several other developed countries have specialized research institutions that study women's sports and physical activity participation, many of which have conducted research on barriers to female physical activity; examples of these institutions include Women in Sport, The Women's Sports Foundation (WSF), and the Canadian Association for the Advancement of Women Sport and Physical Activity. However, there are no special institutions that study female participation in sports in China. Chinese women influenced by traditional Chinese culture face barriers to physical activity that may be different than what has been observed in other countries [4, 5]. Although the WHO has set-specific guidelines for physical activity for all age groups, it is estimated that only 20% of Chinese university students participate in moderate-intensity physical activity for at least 30 minutes three times a week [6]. Female university students have good sport and others forms of physical activity cognition as well as relatively rich physical education and sports facilities resources yet demonstrate low participation in sports/physical activity. The type of barriers to greater participation that they face merit a rigorous study.

An analysis of the influencing factors of female university students' participation in sports/physical activity should attend to the specific circumstances of their personal and external environments. Both subjective and objective factors affect their participation rates. For example, previous studies have demonstrated how subjective factors, such as a willingness to participate in sports or positive attitudes about physical activity, could lead to better exercise habits [7, 8]. However, a lack of interest

in participation or motivation could limit physical activity [9, 10]. Yet female university students have noted that physical exertion was the greatest perceived barrier to exercise. It is of great concern that the avoidance of effort and fatigue proved to be such a significant barrier [11]. The lack of effective exercise time has been shown to greatly reduce the participation rate of female university students in sports/physical activity [9, 12].

Personality also has been shown to impact the formation of physical exercise habits. For example, people who exercise often have more persistence than those who don't exercise often [13]. However, when there is a conflict between physical activity and study time, female university students typically have given lower priority to physical activity [14].

Interpersonal relationships also have played a role in exercise habits. The participation behavior of family and friends has represented an important interpersonal relationship factor that affected female university students' participation in sports and physical activity. Sylvia-Bobiak and Caldwell [15] argued that the influence of peers and family directly impacted the self-efficacy of female university students. Levels of self-efficacy have been associated with participation in sports/physical activities. Support from family and friends encourages university women to engage in sports and physical activity [16]; greater levels of parental moderate-to-vigorous physical activity (MVPA) was associated with increased child MVPA [17, 18]. Female university students refrained from participation due to a lack of companionship [14].

Khalaf et al. [19] suggested that the physical activity participation rate of female university students was affected by the mother's education level. The higher the parents education level, the greater the child's level of participation [20]. Attention to environmental factors also proves imperative. The particular expectations with regard to the roles women are expected to play contribute to a unique cultural atmosphere with regard to women's participations in sports/physical activity. Subtle social norms contribute to social environments that impact female university students' participation in physical activity [7, 21]. Samara et al. [22] has offered a counter-argument. She suggested that the main barriers to female university students' participation in physical activity were not sociocultural factors, but rather a lack of facilities.

Previous studies have treated independent factors as the starting point and failed to take into consideration individual behaviors in the entire social ecological environment. Research on the barriers to female university students' participation in sports and others forms of physical activity has not proved systematic. Individual behavior may be affected by the overall social environment; small changes to environmental factors could affect the daily physical activity patterns of a large number of people. Therefore, it is important to use a comprehensive theoretical framework to study the impact of the environment on participation in sports and physical activities [23].

The social-ecological model permits an exploration of the factors that affect individual behavior from a perspective of the entire social environment. The approach has been widely used in the study of barriers to individual sport and physical activity participation. The Canadian Association for the Advancement of Women and Sport Physical Activity (CAAWS) built the "Social-Ecological Model of Influences on Sport and Physical Activity Participation for Women and Girls" by adapting the works of previous researchers. The model shows that barriers to women and girls' participation in sports/physical activity include intrapersonal, interpersonal, environmental, and policy-related factors. Women's values, beliefs, level of independence, experiences, and motivators all represent intrapersonal factors. Examples of interpersonal factors include attachments, relationships, competitions, family members' interest, their social role, interest and support from peers, role models, and employers. Environmental factors encompass the proximity, logistics and scheduling of participation, social climate, perceptions of safety and inclusion, the nature of the built environment, access to opportunities, availability of transportation, presence of others, and the quality of outdoor recreation spaces. Finally, the policy-related factors include the use of persuasive language and images, access to facilities, schedules, and the equitable allocation of resources such as budgets, equipment, human resources, and media coverage [24].

Although the social ecological model is generally atheoretical, some authors have attempted to bridge the gap between model and theory. Some study examined the factor structure of correlates of moderate/vigorous physical activity (MVPA) within a hypothesized social-ecological model [25]. Miller(2019) studied the factors

affecting physical activity from three aspects: personal, social and environmental, and used Confirmatory (CFA) and exploratory factor analyses (EFA) to determine the factor structure. However, individual activities are also influenced by policies. The "Social-Ecological Model of Influences on Sport and Physical Activity Participation for Women and Girls" covers the complex social factors that affect girls' behavior that can capture the opportunities as well as the constraints that exist for women and girls' physical activity . Therefore, this study is based on the work "Social-Ecological Model of Influences on Sport and Physical Activity Participation for Women and Girls" by CAAWS, to identify barriers among female university students in China.

The purpose of this study is to identify the factors that impact female university students' participation in sports and others forms of physical activities.

## MATERIAL AND METHODS

### Participants

Female university students between the ages of 18 and 22 years old were eligible to participate in this study. A total of 2,000 questionnaires were distributed. A total of 1,909 (95.4%) were returned. Excluding incomplete questionnaires, 1852 questionnaires were valid, with an effective rate of 92.6%.

The participants were divided into two groups: regular exercise group and infrequent exercise group.

### Materials

The questionnaire included two parts: participation behavior and perceived barriers. The section on participation included the following: intensity, time and frequency of sports participation. Some barrier factors were designed based on the "social ecology model" and combined with China's national conditions. The Delphi method (see glossary) was used to conduct three rounds of surveys with experts. Following the elaboration of a first draft, a small number of questionnaires were distributed in Kaifeng City; a total of 250 questionnaires were distributed, and exploratory factor analysis was conducted. The scale proved suitable for factor analysis, Kaiser-Meyer-Olkin (KMO) = 0.940,  $p = 0.000$ . A total of 14 principal factors were extracted; they served to explain the 75.66% variance among all of the variables (Table 1).

The confirmatory factor analysis performed demonstrated that there were correlations between B3, C3, C8, C10, C21, D2, D3, D9, D11 and multiple items; therefore, they were deleted. The final verification results showed that the  $X^2/df$ , the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the incremental fit index (IFI), and the Tucker-Lewis Index (TLI) of the model were 2.930, 0.051, 0.906, 0.907, and 0.900, respectively, suggesting that the questionnaire exhibited good structural validity (Figure 1).

The Cronbach coefficient was used to test the reliability of the questionnaire; the internal consistency coefficient of each variable of the questionnaire was found to be between 0.877 and 0.926, indicating that the questionnaire had good

reliability. The questionnaire ultimately included 50 items across four dimensions. The responses were scored on a five-point Likert scale with responses that ranged from “not important” to “very important”.

### Procedures

The data were collected during August 2019. The questionnaire was distributed in person and on the Internet. Sites for distribution in person were selected from developed cities in northern, central and southern China, including Beijing, Shanghai, Guangzhou, Chengdu, Wuhan, Zhengzhou, Xi'an, Harbin, Hangzhou, Nantong and Changzhou. The “questionnaire star” application was used to distribute online throughout the entire country. The final 1852 valid questionnaires involved 29 regions in China, namely Zhengzhou 575 (31.0%), Wuhan

**Table 1.** Summary of exploratory factor analysis results.

Second-order factor	First-order factors	Subject	Factor load
Intrapersonal factors	personal objective factors (A one)	A14 lack of household disposable income	0.794
		A15 lack of suitable exercise equipment	0.747
		A11 lack of exercise knowledge and skills	0.541
	personal time factors (A two)	A6 do not like sports	0.468
		A12 no time for sports and physical activity	0.795
		A13 busy with housework and work, tired and stressed	0.763
	personal image factors (A three)	A3 dislike of sweating during exercise	0.779
		A4 reluctance to show body during sports and physical activity	0.661
	personal physiological factors (A four)	A7 sick and unwilling to participate in sports or physical activity	0.800
		A5 menstruation and pregnancy	0.790
	personal perseverance quality (A five)	A8 inability to finish an exercise program	0.706
		A9 lazy	0.577
		A10 lack of confidence	0.503
	personal psychological factors (A six)	an unpleasant sport and physical activity experience in the past	0.720
		A2 lack of exercise awareness	0.560
Interpersonal factors	participation of people around (B one)	B3 absence of company during participation in sports and physical activity	0.812
		B4 nearby peers do not enjoy sports and physical activity	0.821
		B5 family members not interested in sports and physical activity	0.746
	problems in sports (B two)	B8 coach's gender	0.708
		B10 family members worry that it is not safe for women to go out and exercise	0.699
		B9 absence of role models to inspire participation	0.539
		B7 unwillingness to compete with friends in physical activity	0.517
	support from people others (B three)	B1 relationship with the people in the vicinity not harmonious	0.594
		B2 negative evaluation of women's participation in sports and physical activity	0.568
		B6 people in vicinity do not support participation in sports and physical activity	0.461

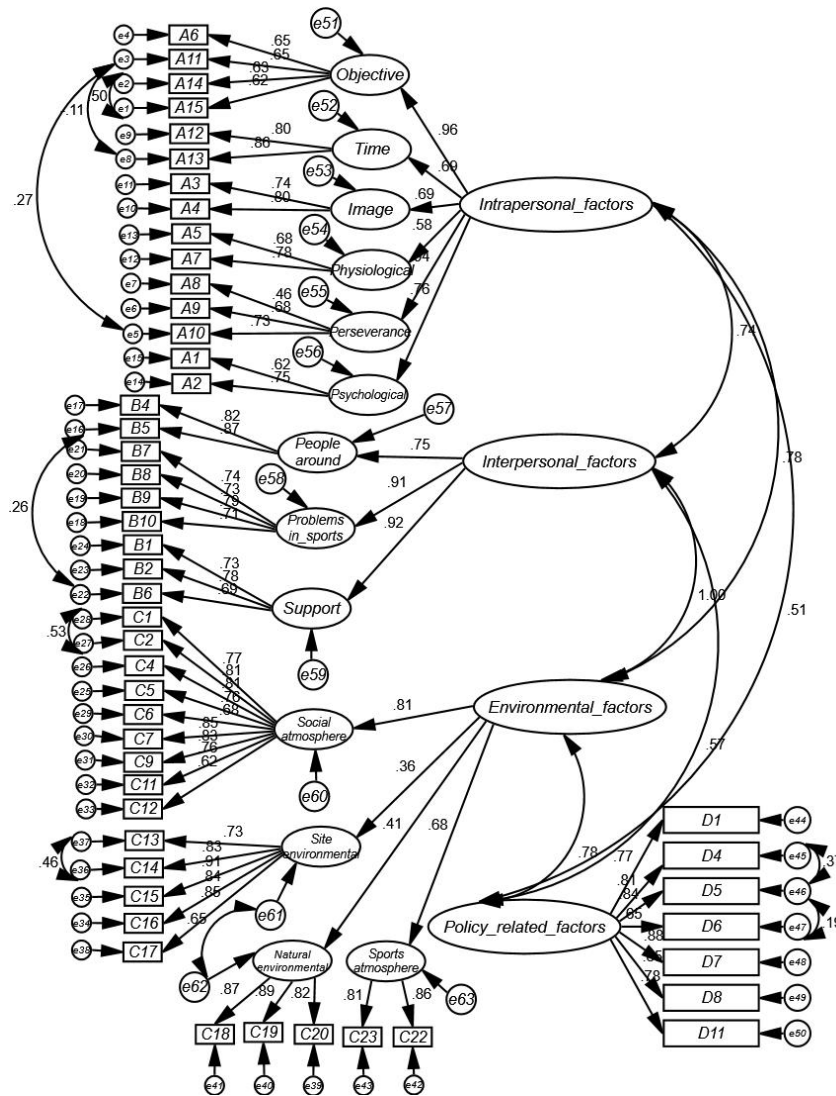
Second-order factor	First-order factors	Subject	Factor load
Environmental factors	social sports and physical activity atmosphere (C one)	C7 sports and physical activity is not a major concern for women	0.800
		C8 media coverage of women's sports and physical activity neglects exercise skills	0.782
		C5 sports and physical activity is not good for women	0.789
		C4 sense that normal that women do not like sports and physical activity	0.781
		C3 sports and physical activity should be led and developed by men	0.802
		C2 female coaches are not as professional as male coaches	0.774
		C9 few people in society speak for women's sports and physical activity	0.731
		C10 women may encounter harassment in sports and physical activity	0.554
		C11 women who love sports and physical activity are more likely to be considered gay	0.729
		C6 too much exercise will do harm to body	0.714
	site environmental (C two)	C1 common misconception of society for female athletes	0.696
		C12 women's family role is far more important than men's	0.556
		C14 venues are too old and hygienic conditions are poor	0.875
		C15 the sports ground is old and far away	0.866
		C16 there are too many people in the sports grounds	0.861
		C17 transportation to exercise venues is not convenient	0.764
		C13 There are hidden dangers in facilities	0.763
	natural environmental (C three)	C19 too sunny and too hot in the summer	0.854
		C18 bad weather, such as rain or wind	0.827
		C20 too cold in the winter to exercise outdoors	0.737
sports and physical activity atmosphere (C four)	C21 some activities are not suitable for women	0.681	
	C22 sports and physical activity organizations and staff are mostly male	0.763	
	C23 the environment is not inviting	0.720	
Policy-related factors	D9 women have less access to public facilities than men	0.793	
	D8 sports facilities near residence lack female activity facilities	0.830	
	D7 never heard of women's sports and physical activity clubs	0.824	
	D5 local clubs do not offer exercise opportunities for women	0.807	
	D4 there are few activities for women in community	0.803	
	D2 never heard of women's activity organizations in the local area	0.781	
	D3 the publicity of female images in sports and physical activity is less	0.768	
	D10 does not know where to propose or complain about sports and physical activity services	0.791	
	D1 never heard of policies to promote women's participation in sports and physical activity	0.723	
	D11 lack of awareness of how to access physical exercise information	0.761	
D6 no childcare service available or affordable to be able to participate in sports and physical activity	0.682		

239 (12.9%), Harbin 165 (8.9%), Jiangsu 151 (8.2%), Beijing 110 (5.9%), Xi'an 110 (5.9%), Guangzhou 99 (5.3%), Hangzhou 84 (4.5%), Chengdu 80 (4.3%), Shanghai 66 (3.6%), Liaoning 50 (2.7%), Shandong 26 (1.4%), Hebei 15 (0.8%), Hunan 13 (0.7%), Chongqing 12 (0.6%), Anhui 8 (0.4%), Guizhou 7 (0.4%), Fujian 6 (0.3%), Shanxi 6 (0.3%), Yunnan 6 (0.3%), Jilin 5 (0.3%), Guangxi 4 (0.2%), Inner Mongolia 4 (0.2%), Xinjiang 3 (0.2%), Gansu

2 (0.1%), Jiangxi 2 (0.1%), Ningxia 2 (0.1%), Hainan 1 (0.1%), Qinghai 1 (0.1%).

During the on-site distribution, members of the research group provided questionnaires in parks, squares, fitness venues, university campuses, libraries, and other public places. The questionnaire was submitted following the consent process. The questionnaire was anonymous. Participants recorded

**Figure 1.** Confirmatory factor analysis of barriers to female university students' participation in sports and physical activity.



their responses directly on the questionnaire; they took approximately 10–15 minutes to complete the entire packet.

**Data analysis**

In this study, SPSS 23.0 was employed to test the reliability of the questionnaire, conduct a descriptive analysis, and perform the independent sample t test. Amos24.0 was used to test the validity of the questionnaire. The product of exercise intensity, duration, and times were used to calculate the amount of exercise for each participant. The visualization of the results is based on the following indicators: mean (M); standard deviation (SD or ±); t-value; significance level, probability (p). Statistical significance was assumed at  $p \leq 0.05$ .

**RESULTS**

**T Test**

Female university students were impacted by barrier factors, regardless of whether they participated regularly or infrequently in sports and physical activity (Table 2). Even if there were barriers, women exercised. Importantly, there were significant differences in the four dimensions based on whether a participant exercised regularly or infrequently ( $p < 0.05$ ). Women who exercised infrequently perceived the barriers to be greater along all four dimensions than those who exercised regularly. The women who exercised infrequently were most impacted by intrapersonal barriers, whereas women who exercised regularly were most impacted by environmental barriers.

**Table 2.** T-test list of barrier factors for regular/infrequent (M and SD) sports and other forms of physical activity for female university students .

Barriers	Engage in regular exercise	Do not exercise regularly	T value	p
Intrapersonal barrier factors	2.700 ±0.745	3.140 ±0.632	11.345	<b>0.000</b>
Interpersonal barrier factors	2.496 ±0.872	2.787 ±0.767	6.377	<b>0.000</b>
Environmental barrier factors	2.900 ±0.834	3.064 ±0.652	4.045	<b>0.000</b>
Policy-related barrier factors	2.618 ±1.052	2.730 ±0.923	2.031	<b>0.043</b>

**Analysis of barriers for female university students with different participation levels**

There were four important findings (Table 3). First, female university students who often participated in sport/physical activity (M = 3.31 ±1.096) and those who infrequently participated in sport/physical activity (M = 3.72 ±1.013) often were most affected by personal physiological factors. Second, students who infrequently

participated in sport/physical activity were most affected by the participation of people around them (M = 2.87 ±1.012), whereas those who often participated were most affected by the support of people around them (M = 2.55 ±0.973). Third, natural and site environmental factors were the main environmental barriers that impacted female university students' participation in sports. However, the extent of the

**Table 3.** Barriers to female university students' participation in sports and other forms of physical activity (M and SD).

Second-order Factor	First-order factor	Do not exercise regularly	Regular exercise
Intrapersonal Factors	personal objective factors	2.76 ±0.834	2.46 ±0.912
	personal time factor	3.26 ±0.975	2.86 ±1.100
	personal image factor	2.74 ±1.040	2.19 ±1.042
	personal physiological factors	3.72 ±1.013	3.31 ±1.096
	personal perseverance quality	3.32 ±0.778	2.73 ±0.825
	personal psychological factors	3.33 ±0.928	2.86 ±1.050
Interpersonal Factors	people around	2.87 ±1.012	2.46 ±1.060
	problems in sports	2.68 ±0.862	2.40 ±0.938
	support from people around	2.77 ±0.926	2.55 ±0.973
Environmental Factors	social sports atmosphere	2.75 ±0.774	2.46 ±0.872
	site environmental factors	3.89 ±0.862	3.68 ±0.992
	natural environmental factors	3.90 ±0.884	3.50 ±1.037
	sports atmosphere factor	3.10 ±1.005	2.91 ±1.109
Policy related Factors	D1	2.69 ±1.078	2.62 ±1.221
	D4	2.79 ±1.108	2.59 ±1.169
	D5	2.76 ±1.084	2.67 ±1.208
	D6	2.61 ±1.153	2.53 ±1.234
	D7 <sup>l</sup>	2.66 ±1.092	2.56 ±1.201
	D8	2.83 ±1.122	2.63 ±1.223
	D10	2.78 ±1.089	2.65 ±1.201

Note: **D1** has never heard of a policy to promote women's sports participation; **D4** school offer fewer opportunities for physical activity to women; **D5** local sports clubs do not provide opportunities for women to exercise; **D6** does not have available or affordable sports in addition to participation in the sports coaching project; **D7** has never heard of female sports teams and clubs; **D8** lacks female sports facilities near the residence hall; **D10** does not know where to provide suggestions or complaints about sports services.

impact differed for the groups. Those who infrequently participated in sports/physical activity were most affected by natural environmental factors ( $M = 3.90 \pm 0.884$ ), followed by site environmental factors ( $M = 3.89 \pm 0.862$ ). Women who often participated in sports/physical activity were most affected by site environmental factors ( $M = 3.68 \pm 0.992$ ), followed by natural environmental factors ( $M = 3.50 \pm 1.037$ ). Fourth, the women who did not regularly participate in sports/physical activity were most affected by D8, the lack of sports facilities around their residences ( $M = 2.83 \pm 1.122$ ), whereas those who often participated were affected primarily by D5, the local club does not provide exercise for women ( $M = 2.67 \pm 1.208$ ).

## DISCUSSION

This paper provided an analysis of the barriers that female university students face regarding sports and physical activity participation. The analysis included an examination of groups in two different levels of exercise regarding their sports and physical activity participation. The use of the social ecological model served to demonstrate that environmental factors were the primary barrier for female university students who regularly participated in sports and physical activity. Intrapersonal factors represented the primary barrier for female university students who infrequently participated in sports and physical activity. It is possible that female college students that participated in greater levels of physical activity found satisfaction in their ability to overcome intrapersonal barriers [26]. However, in China, school exercise areas are often quite limited in size for the number of students that use them; the lack of facilities is thus an objective constraint that cannot be individually overcome.

Female university students, regardless of their different levels of physical activity, noted that menstruation was the personal physiological factor that most affected their exercise routine. Previous studies demonstrated that the intrapersonal barriers that impacted sports and physical activity participation were related to personal interests, time and other factors [14, 23, 8]. However, the results from the current study are different, suggesting that the physiological aspects of menstruation may be important barriers to physical activity participation for female students. The menstrual period often has affected female university

students' sleep quality, diet, academic performance and exercise [27, 28]. For example, one study showed that 41.7% of women believe that the menstrual cycle has a negative impact on exercise, training and performance [29]. Other studies have shown that excessive physical activity could affect female reproductive health [30]. Some competitive athletes have been known to relinquish the opportunity to participate in the World Cup for this reason [31].

In recent years, the negative focus on menstruation has changed in the professional sports world. For example, Chinese Olympic swimmer Fu Yuanhui stated that she participated in competitions during her menstruation when she was interviewed at the Rio 2016 Summer Olympics [32]. However, it is very common for girls to avoid exercise when they have their period [33]. Previous research has suggested that exercise can reduce primary dysmenorrhea and associated symptoms [34-36]. Moreover, exercise during menstruation has many benefits, such as improved mood, reduced fatigue, and decreased pain [37]. One possible means by which to address this problem would be to make scientific information related to women's physiology more readily available. Physical education in schools could include information on appropriate exercise, body mechanics, and intensity during menstruation.

Female university students who did not regularly participate in sports and physical activity were most affected by the participation of people around them. Participants noted that "people around me do not like sports" and "family members are not interested in sports". Female university students' participation behaviors and choices were influenced by their peers [23]. Some research has suggested that female university students who did not regularly participate in physical activity were influenced by the presence or absence of support from family and friends [38].

However, other studies have demonstrated shows that female university students who did not participate in physical activity regularly were not affected by family support [39]. The results of this study showed that one factor that shaped women's lack of participation in exercise was the participation behavior of the people around them and not the degree of support. This study demonstrated that female university students who frequently participated in physical activities were most affected by the support of people around



them. Women with higher levels of participation often noted that their relationships with people in the area were not harmonious, that women's participation in sports and physical activity were often viewed negatively, and that they did not receive support in their efforts to become more engaged. Although the exercise behaviors of female university students who frequently participated in physical activity did not rely on the participation of people around them, they still hoped to garner support for their efforts to engage. The attitudes of the people around them towards their participation in sports and other forms of physical activity affected their exercise behavior.

Site and natural environmental factors were the environmental barriers that most affected female university students' participation in sports and physical activity. The participants' comments about the sites included the following: "venues are too old and hygienic conditions are poor", "the sports field is old and far away", "there are too many people in the sports grounds", "transportation to exercise venues is not convenient", "there are hidden dangers in the facilities". Their concerns about environmental factors included the following comments: "it's too sunny and too hot in the summer", "bad weather, such as rain or wind", "it's too cold in the winter to exercise outdoors". The greatest barrier for students was the lack of facilities and their distance; this finding sustained conclusions from other studies [40, 41, 22, 42]. However, natural factors rarely had been mentioned separately from site factors in previous studies. Natural environmental conditions directly determined whether places for outdoor exercise were available. The stadiums and facilities available to Chinese female university students frequently were outdoors. The improvement of resources such as indoor stadiums and facilities would serve to encourage Chinese female university students' participation in sports and physical activity.

Female university students who did not regularly participate in exercise were most affected by the lack of female sports facilities close to their places of residence. Students who regularly participated in exercise were most affected by the fact that local clubs did not offer exercise opportunities for women. The World Health Organization has issued national guidelines on the steps and actions to take when providing advice on physical activity to promote health and reduce risk of disease [43]. Policy factors included women's sports policy, activity guides, and school physical education

policies. The concept of sports policy proves broad in scope. Therefore, the impact of policy on exercise behavior should be examined on-site. For example, it could be determined whether or not the schools and communities where female university students live provide opportunities for them to participate [44]. The presence or absence of opportunities would prove crucial to women's engagement in sports and physical activities. Therefore, in places where social forces limit women fair opportunities for exercise, the country should introduce women's physical activity policies to compulsorily guarantee women's special exercise stadiums and participation opportunities.

This study represents an important contribution to the literature in at least two ways. First, the survey was widely distributed. Therefore, the results presented can be seen as relevant to the situation of the country in general. Second, the treatment of the participants as two distinct groups (characterized by regular and infrequent participation), permitted an analysis that could distinguish the barriers particular to each. Consequently, the study also provided a means by which to develop appropriate interventions designed specifically for each group.

There also were two important limitations of the study. First, this was a cross-sectional study. Greater insight into the participation barriers could be achieved through a longitudinal study. Second, the barriers and participation behaviors were identified through self-reported data obtained from the participants. Future studies could include the use of wearable devices to add a greater measure of objectivity regarding participant activity levels.

Although our work does not deal directly with the subject of martial arts, it is on the borderline of issues discussed in the sections of *Health Promotion and Prevention* and *Prophylactic and Therapeutic Agonology*. The issues of breaking barriers in the sense of well-established paradigms of science and practice (in both cases related to broadly understood health promotion, prophylaxis and therapy [45-47]) are related to the new applied science – innovative agonology [48-51]. In this case, our work may be broadly discussed in the future also in the context of positive and accepted by students (in interpersonal relations, environmental, etc.) effects of implementing innovative methods and organizational solutions [e.g. 52-55].

## CONCLUSIONS

Female university students live in a complex ecological environment. Their sports and physical activity participation behavior has been affected by many factors such as intrapersonal and environmental factors, interpersonal relationships, and policy factors. Female university students with various levels of participation helped to identify factors with varying degrees of influence and barriers. Therefore, the promotion of female university students' participation should include a social ecological model. Moreover, distinct interventions should be developed for different groups of people. Finally, future initiatives should be coordinated to effectively promote increased female participation in sports and physical activity.

## HIGHLIGHTS

This study investigates the factors that impact Chinese female university students' participation in sports and other forms of physical activities. We believe that our study makes a significant contribution to the literature because it surveyed 11 cities in China.

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