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Article

Study on the influence of sports participation on happiness from the perspective of biological sports resource allocation in the Yellow River Basin perspective

Haifeng Guo[1,*], Yimei Guo[2], Junhui Ma[1]

[1] School of Physical Education, Henan University of Science and Technology, Luoyang 471000, China
[2] School of Physical Education, Wuhan Sports University, Wuhan 430000, China
*** Corresponding author:** Haifeng Guo, ghfroom1122@163.com

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Abstract: The relationship between physical activity and human well-being is based on biological mechanisms, and regular exercise positively affects physiological, psychological and social health dimensions. This study explores the impact of physical activity resource allocation on residents' well-being in the Yellow River Basin from a biological basis. Using data from CGSS2015, CGSS2017, and SSY2017, the study combines OLS multiple linear regression modeling and spatial econometrics techniques to reveal how the accessibility of fitness infrastructure, sports services, and resource distribution can enhance well-being by facilitating increased sports participation. Findings reveal significant spatial agglomeration effects, suggesting that a balanced distribution of sport resources can optimize regional health outcomes. However, differences in resource distribution prevent physical activity from yielding physiological and psychological benefits across provinces.

Keywords: happiness; Yellow River Basin; sports resource allocation; sports participation; spatial agglomeration

1. Introduction

The relationship between physical activity and human well-being is a central focus in both biological and social sciences, as exercise influences various physiological and psychological processes. The biological foundation of this relationship lies in how physical activity regulates neuroendocrine pathways, immune function, and metabolic processes, which ultimately affect mental health, disease prevention, and overall quality of life. Although happiness is often viewed as a psychological and social construct, it has strong biological underpinnings, as neurochemical changes, such as the release of endorphins, dopamine, and serotonin, during and after physical exercise, significantly contribute to an individual's sense of well-being. Understanding this connection provides a scientific basis for policies and practices aimed at enhancing public well-being through increased sports participation [1–4].

In China, the allocation of sports resources—such as fitness infrastructure, sports services, and public access to facilities—plays a critical role in determining the population's engagement in physical activity. The Yellow River Basin, one of the country's most ecologically and socioeconomically significant regions, presents unique challenges and opportunities for improving sports participation and well-being. This region, home to diverse populations and varying levels of economic development, faces considerable disparities in sports resource allocation, which directly impact

residents' ability to derive biological and psychological benefits from physical activity [5–8]. The Healthy China 2030 initiative and national strategies for ecological protection and high-quality development emphasize the importance of equitable access to sports resources to enhance health and happiness.

From a biological perspective, the disparities in sports resource allocation not only affect individual health but also influence population-level health outcomes. Regular physical activity has been linked to reduced risks of chronic diseases such as obesity, diabetes, and cardiovascular conditions, which are prevalent in many regions of the Yellow River Basin. Moreover, exercise enhances immune function, reduces systemic inflammation, and positively affects mental health by alleviating stress and depression, mediated through hormonal and neural pathways. When residents face barriers to accessing sports resources, they miss out on these critical health benefits, leading to a widening health and well-being gap across regions [9,10].

Spatial analysis of sports resource allocation reveals how geographical and regional factors shape participation in physical activity and its biological benefits. Studies using spatial regression models and the Moran's *I* index have shown that sports participation and its effects on happiness exhibit significant spatial agglomeration. In the Yellow River Basin, the proximity of sports resources generates a spatial lag effect, where inadequate allocation in one area negatively influences neighboring regions. These findings highlight the need for a systematic approach to optimizing the distribution of sports resources, ensuring that residents across provinces can access the facilities necessary to support their physical and mental health.

This study integrates data from multiple sources, including the Chinese General Social Survey (CGSS) and the Sports Statistical Yearbook (SSY), to analyze the impact of sports resource allocation on happiness from a biological well-being perspective. By employing OLS multiple linear regression models and spatial econometric analysis, this research evaluates the current state of sports resource distribution and its biological implications for improving residents' happiness. The findings aim to inform policies promoting equitable access to sports resources, fostering both individual and regional health benefits.

The Yellow River is not only an essential ecological security barrier but also a vital region for population activities and economic development in China. It plays a strategic role in the national development and socialist modernization efforts. In October 2021, the Central Committee of the Communist Party of China and The State Council issued the Outline of the Yellow River Basin Ecological Protection and High-quality Development Plan, which identified the inadequate development of people's livelihoods as the basin's greatest weakness. Therefore, studying sports participation in this region from the perspective of sports resource distribution is crucial for improving sports participation across the Yellow River Basin, boosting the development of livelihood projects, and enhancing departmental coordination. It also supports realizing regional spatial agglomeration, linkage effects, and the strategy of balanced regional development and integration. Based on data from the Chinese General Social Survey (CGSS 2015, CGSS 2017) and the SSY 2017 databases, this paper uses OLS multiple linear regression models, spatial lag, and error models to conduct spatial evaluations and provide insights for future sports resource allocation in the Yellow River Basin.

2. Data sources and research methods

2.1. Data sources

Some data of this study (CGSS2018, CGSS2020)[1] is from the Chinese General Social Survey (CGSS) conducted by the China Survey and Data Center of Renmin University of China. The survey covered 31 provinces, municipalities and autonomous regions in China, whose data was released on the website of China National Survey Database (CNSDA) on 1 January 2018 and 1 October 2020 respectively. In this study, 23,550 valid samples were collected from 9 provinces and autonomous regions involving the Yellow River Basin (Qinghai, Sichuan, Gansu, Ningxia, Inner Mongolia, Shaanxi, Shanxi, Henan, Shandong, etc.). At the same time, the latest data from Sports Statistics Yearbook 2017 (SSY[2] 2017 for short) is also used as the data source for statistical analysis.

2.2. Research methods

2.2.1. OLS multiple linear regression model

Taking happiness as a dependent variable and sports participation and residents' attributes as independent and control variables, this paper explores the impact of sports participation on Chinese residents' happiness index from the perspective of sports resource allocation. OLS multiple linear regression model (Equation (1)) is as follows:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \ldots + \beta_k X_{kt} + u_t$$

Value range:

$$Y = (Y_1, Y_2, \ldots, Y_t)_{t\times 1}$$

$$X = (1, X_1, X_2, \ldots, X_k) = (1, X_{1t}, \ldots, X_{jt}, \ldots, X_{kt})_{t\times(k+1)}$$

$$\beta = (\beta_0, \beta_1, \ldots, \beta_k)_{(k+1)\times 1}$$

$$u = (u_1, u_2, \ldots, u_t)_{t\times 1}$$

Rank(X) = k (k is the number of parameters), conditional homovariance of an OLS multiple linear regression model without sequence autocorrelation, X as the independent variable, β as the independent variable's parameter, u as the mean value of 0, X not correlated with u, and no perfect linear relationship between X. The model's specific calculation was finished using Stata 14.0.

2.2.2. Spatial weight matrix

Since CGSS data are panel data, for further spatial econometric analysis, panel data should be spatially weighted. Geoda 2.0 is used to create a spatial weight matrix (W)with the following form:

$$\mathrm{W} = \begin{bmatrix} W_{11} & W_{12} & A & W_{1m} \\ W_{21} & W_{22} & A & W_{2m} \\ A & A & A & A \\ W_{x1} & W_{x2} & A & W_{xm} \end{bmatrix}$$

2.2.3. Spatial regression analysis

Spatial regression analysis consists of three models, of which the first model is

OLS spatial regression model (Equation (2)), the second model is spatial lag model (Equation (3)), and the third model is spatial error model (Equation (4)). Spatial regression analysis was performed by Geoda 2.0.

Equation (2): $Y = \alpha + X\beta + \varepsilon$

Equation (3): $Y = \alpha + \beta WY + X\beta + \varepsilon$

Equation (4): $Y = \alpha + X\beta + \varepsilon$ and $\varepsilon = \lambda W\varepsilon + \mu$

2.3. Variable selection and measurement

Dependent Variable: Happiness, which reflects the happiness index of Chinese residents based on various influencing factors. The CGSS questionnaire measures residents' self-reported well-being with the question, "Do you feel happy with your life?"

Allocation of Sports Resources: To ensure the quality of sports participation for the Chinese population and meet the construction goals outlined in the Healthy China 2030 planning framework, sports facilities, services, and resource allocation are essential. This paper examines three key aspects: fitness infrastructure, sports services, and fitness resource allocation. From the perspective of sports resource allocation, the paper explores the impact of sports participation on the happiness of Chinese residents and evaluates the spatial distribution of each factor through spatial agglomeration analysis.

Sports Participation: Sports participation is the central variable in this study, aiming to explore how various factors, under the influence of sports participation, affect the happiness of Chinese residents. The CGSS questionnaire measures whether individuals regularly engage in physical exercise.

Control Variables: Happiness and well-being are hot topics in contemporary society and have been the focus of numerous studies. Based on previous research on happiness [11–14], demographic characteristics, social security, and health status are crucial factors in determining happiness. Therefore, this paper selects the following control variables for happiness research: gender, age, household registration status, marital status, education level, medical insurance, pension insurance, general trust, self-reported mood, and self-reported health. According to the work of Chinese scholar Li [15], age is categorized into five generations for OLS multiple linear regression analysis (refer to **Table 1** for the classification and coding of all variables).

Table 1. Descriptive statistical characteristics of the sample.

variable metric	Operation variables and item sources	Encoding method	Mean (standard deviation)
Dependent variable	happinessA36	1–5 continuous variables (Unhappiness–Happiness)	3.851 (0.930)
Independent variable	Sports participationA3009	1–5 continuous variables (Every day–Never)	3.513 (1.629)
	Sports servicesB168	dissatisfy: 59 and below = 1/relatively satisfied:60～79 = 2/Very satisfied:80 and above = 3	2.197 (0.745)
	InfrastructureB169	insufficiency: 59 and below = 1/Relatively sufficient: 60～79 = 2/Very sufficient: 80 and above = 3	2.239 (0.739)
	Resource allocationB174	dissatisfy = 1/middle = 2/satisfied = 3	1.939 (0.844)

Table 1. (*Continued*).

variable metric	Operation variables and item sources	Encoding method	Mean (standard deviation)
Control variable	genderA2	male = 1/female = 2	1.531 (0.499)
	ageA301	Traditional generation: Before 1945 = 1 The lost generation:1945–1960 = 2 The Lucky Generation:1961–1970 = 3 Transforming Generation:1971–1980 = 4 Only child generation: After 1981 = 5	3.031 (1.331)
	domicileA18	village = 1/city = 2	1.889 (1.341)
	marriageA69	Single: unmarried, cohabiting, divorced, widowed = 1 Married: First marriage, remarriage, separation = 2	1.777 (0.416)
	Sense of fairnessA35	1–5 continuous variables (very unfair–very fair)	3.131 (1.315)
	Education levelA7a	Low: High school and below = 1/Middle: Junior college and undergraduate = 2/High: graduate student or above = 3	1.614 (0.105)
	Medical insuranceA611	have = 1/not have = 2	1.063 (0.513)
	Endowment insuranceA612	have = 1/not have = 2	1.236 (0.802)
	Universal trustA33	1–5 continuous variables (very distrustful–very trusting)	3.428 (1.185)
	Self describing emotionsA17	1–5 continuous variables (very unhappy–very happy)	3.811 (1.087)
	Self-rated healthA15	1–5 continuous variables (very unhealthy–very healthy)	3.600 (1.113)

3. Spatial characteristics of the impact of sports participation on well-being of residents in the Yellow River Basin from the perspective of sports resource allocation

3.1. OLS multiple linear regression analysis panel data

This paper sets up a nested model to explore the impact of sports participation on residents' happiness in the Yellow River Basin from the perspective of sports resource allocation. Beginning from setting the basic model only with control variables, to gradually adding influencing factors, the paper shows the impact of each factor on residents' happiness index through the change of model explanation rate (R^2) and overall significance.

3.1.1. Model setup

Among the 30 models in **Table 2**, Model (1) is the basic model, including gender, age, household registration, marriage, sense of fairness, medical insurance, endowment insurance, general trust, self-reported mood and self-reported health. In model (2–5), sports participation, sports service, infrastructure and resource allocation variables are added respectively on the basis of basic model (1). Model (6) is the total model that contains all the variables in **Table 1**. Model (7–15) divides the total model (6) into 9 provincial models according to provincial data. Model (16–30) is the display model of 2017 data.

Table 2. the impact of sports participation on well-being of residents in the Yellow River Basin from the perspective of resource allocation.

	2015				2017		
model	***N***	**Prob > *F***	R^2	**model**	***N***	**Prob > *F***	R^2
(1) base model	10,968	0.000	0.187	(16) base model	12,582	0.000	0.168
(2) Sports participation	10,968	0.000	0.198	(17) Sports participation	12,582	0.000	0.211
(3) Sports service	10,968	0.000	0.198	(18) Sports service	12,582	0.000	0.209
(4) Infrastructure	10,968	0.000	0.201	(19) Infrastructure	12,582	0.000	0.198
(5) Resource allocation	10,968	0.000	0.202	(20) Resource allocation	12,582	0.000	0.218
(6) Overall Model	10,968	0.000	0.204	(21) Overall Model	12,582	0.000	0.223
(7) Qinghai Province	101	0.106	0.285	(22) Qinghai Province	100	0.000	0.410
(8) Sichuan Province	566	0.000	0.543	(23) Sichuan Province	606	0.000	0.460
(9) Gansu Province	195	0.000	0.366	(14) Gansu Province	200	0.000	0.258
(10) Ningxia province	94	0.000	0.558	(25) Ningxia province	100	0.410	0.190
(11) Inner Mongolia	99	0.397	0.331	(26) Inner Mongolia	100	0.743	0.134
(12) Shaanxi Province	369	0.000	0.276	(27) Shaanxi Province	397	0.000	0.122
(13) Shanxi Province	280	0.000	0.390	(28) Shanxi Province	303	0.000	0.228
(14) Henan Province	582	0.000	0.242	(29) Henan Province	600	0.000	0.133
(15) Shandong Province	575	0.000	0.217	(30) Shandong Province	600	0.000	0.128

3.1.2. Effects of sports participation on well-being of residents in the Yellow River Basin from the perspective of sports resource allocation

Table 2 shows the effect of sports participation on residents' happiness from the perspective of sports resource allocation in the Yellow River Basin in 2015 and 2017, in which Inner Mongolia, Qinghai and Ningxia are not significant, and other models are significant, and the interpretation rate is fluctuating. It can be seen that sports participation, sports service resource allocation and infrastructure can boost residents' happiness, the joint effect of multiple factors being especially better (total model R^2 = 0.204 and R^2 = 0.223). However, as to the effect of sports resource allocation on residents' happiness, there exist sharp inter-provincial differences, the effect being best with Shandong and Sichuan provinces. Generally, residents' happiness of in the Yellow River Basin varies greatly between provinces and years, and the promotion benefit of sports resource allocation has not formed regional linkage effect.

3.2. Spatial regression analysis—Spatial weight data

Happiness remains the dependent variable in the spatial regression analysis, which also examines the impact of other contributing factors. Health variables are included in the spatial regression analysis since physical health is the ultimate goal of factors like sports participation and the allocation of sports resources. Spatial regression analysis was performed after the Queen adjacency spatial weight matrix (a spatial adjacency connection is defined as common vertices or common edges between two provinces) was created using Geoda 2.0. As can be seen from **Tables 3–5**, explanation ratio (R^2) of three model were above 0.7 and 0.9 respectively (showing strong spatial regression stability and overall progressive trend of well-being), the

significance level is above 5% sports with space weight, participation and health, which means that there exists significant spatial proximity effect between sports resource allocation and participation. Since the database selected in this paper is not a monthly survey, the relationship between sports participation and health should be explained with the spatial lag model, in which, every increase of 0.392 units of CGSS sports participation group leads to an increase of 0.368 units of health group; every increase of 0.288 units of SSY sports participation group leads to an increase of 0.696 units of health group. However, the infrastructure and resource allocation of the two data sources show a negative spatial lag pattern, which means that insufficient attention is paid to the spatial governance and optimization of infrastructure construction and resource allocation at the policy level.

Table 3. OLS spatial linear regression model analysis (n = 9, unit: province).

Data source	Factors	Spatial Weight	Sports Participation	Sports Service	Infrastructure	Infrastructure	Health
CGSS	coefficient	0.801	0.404	0.329	0.327	0.038	0.416
	residual	0.420	0.120	0.367	0.351	0.208	0.123
	p	0.042	0.002	0.378	0.361	0.854	0.002
SSY	coefficient	1.165	0.291	4.023	0.003	−0.013	0.698
	residual	0.367	0.110	8.083	0.003	0.005	0.169
	p	0.047	0.014	0.623	0.260	0.034	0.000

Note: CGSS R^2 = 0.716, SSY R^2 = 0.924.

Table 4. Analysis of spatial lag model (n = 9, unit: province).

Data source	Factors	Spatial Weight	Sports Participation	Sports Service	Infrastructure	Infrastructure	Health
CGSS	coefficient	1.537	0.392	0.371	−0.338	−0.004	0.368
	residual	2.381	0.102	0.321	0.307	0.179	0.108
	p	0.048	0.000	0.248	0.270	0.981	0.000
SSY	coefficient	2.082	0.288	4.566	−0.003	−0.013	0.696
	residual	0.106	0.098	7.416	0.002	0.005	0.149
	p	0.037	0.003	0.538	0.184	0.011	0.000

Note: CGSS R^2 = 0.736, SSY R^2 = 0.924.

Table 5. Analysis of spatial error model (n = 9, unit: province).

Data source	Factors	Spatial Weight	Sports Participation	Sports Service	Infrastructure	Infrastructure	Health
CGSS	coefficient	0.373	0.371	0.161	−0.095	−0.001	0.343
	residual	0.218	0.101	0.326	0.317	0.176	0.112
	p	0.046	0.000	0.619	0.764	0.993	0.002
SSY	coefficient	1.971	0.266	7.190	0.002	−0.014	0.753
	residual	1.112	0.086	7.223	0.002	0.004	0.137
	p	0.031	0.001	0.319	0.237	0.002	0.000

Note: CGSS R^2 = 0.741, SSY R^2 = 0.943.

4. Discussion

The above OLS multivariate linear panel data analysis shows that sports

participation, sports service, infrastructure and resource allocation can indeed promote residents' happiness in the Yellow River Basin. Many previous studies have proved the impact of sports participation on residents' happiness [11,16], but the evidence from the perspective of sports services and resource allocation is not very sufficient, and more attention is paid to spatial differences and the role of the government in of sports resources allocation [17,18]. According to the variable model of this study, resource allocation has the best promotion effect on happiness (R^2 = 0.202 and R^2 = 0.218), and sports service also shows a very high contribution degree (R^2 = 0.198 and R^2 = 0.209). On one hand, it shows that sports service and infrastructure construction are the prerequisites to guarantee residents' sports participation. On the other hand, it also shows that with the development of the times, the role of the two is strengthening. It has been confirmed by related research that sports service is playing a significant role. Xu [19] proved improvement in sports service can significantly increase residents more happiness through assessing public sports service development index. Previous studies prefer to make the assessment from the angle of object. However, the sports service system in this study is a kind of institutional experience, which can be better assessed from the angle of subject to show the continuous progress of Chinese residents in the subject system experience.

At the same time, the common impact of multiple factors is greater than that of a single factor (total model R^2 = 0.204 and R^2 = 0.223), However, the impacts differ greatly between provinces, and there is no regional linkage effect, which is in line with the research findings of some domestic scholars [20,21]. Therefore, it can be inferred that the regional imbalance is still an important factor influencing residents' sports participation. The results of spatial regression analysis show that the explanatory rates of the three spatial regression models are $R^2 > 0.7$ and $R^2 > 0.9$ respectively, which shows the spatial progressive trend and spatial regression stability of residents' happiness in the Yellow River Basin. The finding is consistent with the overall results of OLS panel data analysis. Sports participation and health shows a certain inverted relationship, which is inconsistent with the studies of some Chinese scholars [22,23], it shows that health effect of sports participation in the Yellow River basin is still very limited and that more efforts should be made in infrastructure construction and space governance and optimization of sports resource allocation, Considering the negative spatial lag model between sports participation and residents' health, more attention should be paid to breaking the spatial lag model in the future planning and construction, providing the people and proximate sports and fitness facilities of national standards.

5. Strategy for future development

5.1. Paying attention to fitness infrastructure, gradually forming a spatial agglomeration

The State Council has recently issued a notice entitled Opinions on strengthening the construction of the national fitness facilities to develop mass sports (hereinafter referred to as 'opinions'). The notice clearly points out that the fitness facilitiy is an important part of public sports. In particular, it puts forward clear stipulations and requirements for the use of non-sports land and the construction of new carriers such

as sports parks.

This made it clear that in addition to traditional land used for sports and fitness, how to make full use of the non-sports land for the construction of fitness place also becomes the top priority. Chinese scholars Chen [24] put forward suggestions for to mature physical fitness facilities for the implementation of the land for construction, for how to use the non-sports land for construction of the fitness field provides a good idea. Therefore, how to make good use of sports land and non-sports land, to build fitness facilities and new fitness carrier facilities is an important task. According to the above data, fitness infrastructure shows a negative impact of spatial lag, which indicates that China's fitness infrastructure still has large shortcomings.

At the same time, the study demonstrates that, according to a nationwide panel data analysis, playing sports significantly improves the well-being of locals. The allocation of resources and infrastructure, however, has a negative impact, indicating the absence of substantial spatial agglomeration. Planning fitness facilities (such as a national fitness center, sports park, fitness trail, small football field, and other fitness facilities carriers) that are convenient for the local population should therefore be prioritized; at the same time, a regional spatial agglomeration effect should be gradually achieved. The recent notice entitled Several Opinions on the High-quality Development of Integrated Sports in the Yangtze River Delta (No. 2020 159, issued by Shanghai Sports Office), has clearly put forward the task of implementing the national fitness strategy, which provides an important reference for the policy initiation of the efficient joint development at the provincial level.

5.2. Evaluating the effectiveness of fitness facilities and optimizing the allocation of resources

According to the statistics of sports Statistics Yearbook 2018, the number of fitness venues in China is 122,325, with an area of 75,243,035.13m^2, but the per capita area is 1.86m^2. It has become a consensus to continue to increase the investment in fitness facilities. However, there is still a lack of assessment of the effectiveness of fitness facilities in different regions, namely, input-output ratio. Many scholars have explored fitness effectiveness from the perspectives of spatial accessibility and GIS evaluation methods [25,26]. These studies have offered some ideas concerning the effectiveness and regulation of fitness venue layout in certain regional case studies. But nationwide, evaluation of the effectiveness of regional fitness facilities is not enough, because empirical studies of the effectiveness are especially wanted when new fitness facilities are planned in the process of urbanization, which also makes the optimization control an important task. It is very necessary to strengthen the construction of fitness facilities or new carrier in the new era. Nevertheless, more attention should be paid to optimizing control and avoiding unnecessary resources waste.

Empirical evidence from this study indicates a negative impact from the spatial lag in resource allocation in the Yellow River Basin. Specifically, the input model reveals a significant weakness in the current resource allocation framework, highlighting a key shortcoming in the allocation of sports resources in China. Achieving optimal allocation of mass sports resources requires efficient coordination

among various functional departments, which underscores the need for a more robust working mechanism and more reasonable and efficient fitness facilities. A total of 462 national fitness-related policies have been issued by multiple departments, including the State Council, the General Administration of Sports, the Ministry of Education, the National Federation of Trade Unions, the Ministry of Finance, the Communist Youth League, the Ministry of Agriculture, the Ministry of Civil Affairs, the National Development and Reform Commission, the All-China Women's Federation, the All-China Disabled Persons' Federation, the National Tourism Administration, the National Ethnic Affairs Commission, the Ministry of Culture, the Ministry of Housing and Urban-Rural Development, the Ministry of Science and Technology, and the Ministry of Land and Resources, among others. The challenge lies in coordinating the implementation of these policies to improve efficiency and ensure the construction of fitness venues, ultimately achieving optimal regulation. This coordination will be crucial for establishing an effective linkage mechanism.

5.3. Paying attention to new fitness carriers, formulating industry standards

This study shows that sports resource allocation in the Yellow River Basin can significantly improve the impact of sports participation on people's happiness. And the clear requirements in the OPINIONS for constructing new fitness carriers also point out the direction for the construction of sports and fitness facilities in the Yellow River Basin. Health China 2030 program points out that the number of people participating in regular physical exercise will have reached 530 million by 2030. Among the many negative factors, insufficient facility is the major element (released in National Fitness Activities Survey). So far, the Yellow River basin is still lack of relevant implementation standard for physical fitness facilities, such as ecological space of sports, fitness trails, ecological fitness theme park and so on, which has a certain negative effect on constructing fitness facilities in the Yellow River Basin. With regard to previous investment in sports facilities in China, certain criteria and star rating standards have been formed. For example, National Fitness Project has stipulations for location, construction, quality and safety in constructing township sports facilities. A floodlit basketball court with steps covers an area of about 1240 m^2 (about 40 m long and 31 m wide). Health China 2030 stipulates that sports facilities coverage should reach 100% in rural administrative villages. but these are mainly unilateral criteria for sports arenas, which lack specific construction standards like indicators of ecological compatibility and accessibility. Therefore, the establishment of corresponding linkage standards for the integrated construction of the Yellow River Basin is an important implementation and evaluation basis to ensure that China's sports resource allocation enters the stage of innovative development.

6. Conclusion

An increasing body of research confirms that sports participation enhances residents' happiness, but this benefit is closely tied to the distribution of sports resources. Studies indicate that sports participation has a significant impact on happiness in the Yellow River Basin. However, in terms of global spatial

autocorrelation, the influence has not yet reached a significant level, and the spatial agglomeration effect is not apparent. With sports resource allocation as a variable, there is a notable regional disparity in its effects, suggesting that the overall level of sports resource allocation in the Yellow River Basin is low, and there is still a need for balanced distribution. Additionally, the study identifies a significant spatial proximity effect, where the allocation of sports resources and sports participation contribute to happiness.

In terms of the spatial lag model, infrastructure and resource allocation variables showed negative effects, indicating that the provinces in the Yellow River Basin need not only to invest more in health infrastructure but also to optimize the spatial distribution of resources. Achieving regional linkage effects and balancing resource allocation should be key goals moving forward.

For future research, it is important to explore several directions:

- Conducting follow-up studies over a longer time span to capture the long-term effects of sports participation on happiness.
- Investigating the impact of sports participation on the well-being of specific groups, such as the elderly, to better understand targeted intervention strategies.

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Notes

[1] CGSS general social survey (China) began in 2003, by the Chinese people's university of China is responsible for the investigation and data center, is China's earliest nationwide, comprehensive, continuous academic investigation project, a comprehensive collection of social, community, family and individual multiple layers of data, Chinese society has become the research the main data source.

[2] The SSY (Sports Statistical Yearbook) is the only comprehensive data that reflects the development of sports in China. The data is mainly compiled according to the statistical annual reports of sports in all provinces, autonomous regions and municipalities directly under the Central Government.

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