

Retraction

Retracted: The Relationship between Body Mass Index and Physical Activity Participation Rate Design Based on Fuzzy Breakpoint Regression Design

Journal of Sensors

Received 23 January 2024; Accepted 23 January 2024; Published 24 January 2024

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external

researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] J. Wu and L. He, "The Relationship between Body Mass Index and Physical Activity Participation Rate Design Based on Fuzzy Breakpoint Regression Design," *Journal of Sensors*, vol. 2022, Article ID 3721659, 11 pages, 2022.

Research Article

The Relationship between Body Mass Index and Physical Activity Participation Rate Design Based on Fuzzy Breakpoint Regression Design

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Received 7 July 2022; Accepted 28 July 2022; Published 8 August 2022

Academic Editor: Yaxiang Fan

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Obesity is a global public health problem in modern society. Body mass index (BMI) can measure whether a person's body is in obesity and health. Body mass is the quality of human body, which is a comprehensive and relatively stable characteristic of human body structure, physiological function, and psychological factors, and body mass is the basis of heredity and acquisition. Physical exercise is a kind of physical activity that people do in their spare time in order to exercise their body and mind. In this paper, we take the physical health problem of obesity as the background and combine the fuzzy breakpoint regression method to design the body mass index and physical exercise participation rate. The relationship between the body mass index and physical exercise participation rate design based on fuzzy breakpoint regression in this paper is mainly discussed as follows: background: the obesity rate is rising and chronic diseases caused by obesity affect health; results: jumps were observed for body health indices above 24.9 kg/m², while participation rates in physical activity decreased compared to the normal weight range; and conclusion: the greater the weight of the group, the less willingness to participate in physical activity and the lower the rate of participation in physical activity.

1. Introduction

Obesity is a global public health problem in modern society [1]. Body mass is the quality of the body. It is the property of complexity and relative stability of human structure, physiological functions, and psychological factors that underlie inheritance and acquisition. The American Academy of Sports Medicine (AASM) defines physical fitness as “the ability of an individual to participate in leisure-related activities without excessive fatigue, and to cope with unexpected events and perform daily tasks.” Scientists currently classify the body as healthy (including cardiorespiratory fitness, muscular endurance, and body composition), physical (including sensitivity, balance, harmony, speed, flexibility, and responsiveness), and physiological (including morphological and structural integrity, metabolic function, and bone health). It follows that the body is a factor that is closely

related to the level of physical activity and/or exercise capacity, which can be integrated in exercise to reflect and assess all structures and functions of the body, including oxygen capacity, strength and endurance, joint flexibility, exercise speed, sensitivity, coordination, and balance. Thus, the body includes the skeleton, body composition, cardiorespiratory function, circulation, endocrine, metabolism, nervous system, motivation, psychology, and nutrition. A strong organism implies that all these functions are well coordinated and adapted; weakness reflects multifunctional decline or abnormality in one or more parts of the body. Modern epidemiological studies focus on physical substances related to health, including oxygen (reflex functions) and muscles (participation in activities, daily activities, and disease prevention). Oxygen capacity tests, also known as maximum oxygen content tests, are commonly used to determine 20-meter concentricity, runner's tests, and motorcycle tests, and

traditional muscle tests include grip strength (upper body strength) and vertical jump (lower body strength). BMI measures whether the body is obese and healthy. Obesity has a huge impact on people, especially during childhood and adolescence. Obesity is strongly associated with adult obesity and cardiovascular disease. Numerous cross-sectional and vertical studies have shown that physical activity (especially high physical activity) and physical health (especially oxygen and muscle) in children and adolescents have a negative impact on future obesity. Therefore, an effective means of preventing obesity in the future is to expand physical activity, especially high-intensity physical activity, and to improve the physical fitness of children and adolescents. Life is running. Each of us is always exercising, but the form of exercise is just different, and we have a common goal, which is “exercise to strengthen the body.” In this regard, physical activity is inevitably linked to physical fitness. Physical exercise can certainly make a person’s physical strength. There are many factors that contribute to a person’s physical fitness, such as genetics, nutrition, and lifestyle habits, but physical exercise is certainly one of the very important aspects. People who are naturally weak can strengthen their physique through physical exercise. Those who are physically fit will become weak due to lack of nutrition or poor lifestyle habits. It can be seen that physical exercise is only a necessary condition to enhance physical fitness, and although it plays a very important role, it cannot play a decisive role. In order to better explain the relationship between the two, we carefully explore the influence from both rational understanding and physical exercise. Physical exercise is a kind of physical activity that people do in their spare time in order to exercise their body and mind. The results show that participation in physical exercise not only directly improves people’s physical performance during study but also improves their overall physical performance by improving exercise habits, which helps to reduce obesity and lower the risk of cardiovascular disease. Breakpoint regression is an empirical method based on randomized experiments only. It effectively uses real-world limitations to analyze the causal relationships between variables. In breakpoint regression, if the variable is greater than a threshold, the variable is processed; if the variable is less than a threshold, it is not processed. In general, the processed data cannot be directly observed. In breakpoint regression, people who did not reach the threshold can serve as a good control group to reflect what happened in the data processing, especially when the variables are continuous, and the difference between the threshold and the sample can appropriately reflect the relationship between sales and economic variables [2]. Breakpoint regression can be divided into two categories. The threshold is determined in the first category, that is, the threshold determined in the first category. All observations come from one side of the threshold, not all observations from the other side. In this case, the probability of removal from one side of the threshold shifts to the other. In the second case, the critical point is ambiguous; i.e., other matters in some cases, it is proved that regardless of the breakpoint regression method, the systematic change sampled near the threshold can be used to study the relationship

between the removal of predictions and other economic variables. Breakpoint regression has many incomparable advantages: fast data processing speed and clear analysis structure. Therefore, fuzzy breakpoint regression of the relationship between BMI and physical exercise participation rate design has great advantages.

2. Research Background

Through reading and summarizing the literature, the research of fuzzy breakpoint and body weight exercise has made a lot of achievements, but few or even none of the studies combine the two aspects, so the starting point of this paper is very novel and unique. The following are the literature reviews.

2.1. Research Review of Breakpoint Regression Method. The breakpoint regression method has been widely applied in the field of labor education and economic development, and its main theories are as follows: as the government has formulated various laws and policies in the field of labor market and education, breakpoint regression has been widely applied in this field [3]. (1) According to the class size of the education system, the number of classes must be kept within 40, and more than 40 classes must be divided into two classes. Breakpoint regression is used to estimate the impact of class size on people’s grades and education quality. The research finds that the smaller the class size is, the better people’s test scores are. This paper uses the “cliff” method, namely, the breakpoint regression method, to test the impact of school autonomy on teaching quality, and finds that the proportion of independent school graduates is higher. (2) The breakpoint regression method is used to evaluate the impact of long-term service payment on the labor market. By analyzing the situation of the unemployed aged 50 and above, it can be concluded that the inconsistent duration of unemployment benefits affects the length of unemployment, treatment, and employment method, because the unemployed aged 50 and above have different periods of receiving state benefits. In the field of development economics, the particularity of regional administration is mainly used. In return, the kingdom took full advantage of the fact that the region’s formation depended on radiation seeping into the central city economy. If an area is far away from the urban center, the impact of radiation on the economic development of peripheral areas of the central city will be alleviated by the combination of production sectors, complementation of industries, and redistribution of resources. Therefore, zoning is related to the distance between the area and the central city. By comparing samples on both sides of the boundary, the influence of regional formation on regional economic performance can be determined [4]. Taking Beijing, Tianjin, Hebei, urban agglomeration area, Yangtze River Delta, and Pearl River as examples, Yu and Zhao used the breakpoint regression method and component regression method to determine the income differences in urban areas, to form the centralized effect and the radiation effect, and to explore the comprehensive effect of government reform. The prices and values of 37 agricultural

products produced in 224 markets in 15 cities in the Yangtze River Delta region were sampled and investigated. The income differences in the region did not lead to consistent development. Margherita and Marco used breakpoint regression to analyze the impact of provincial boundaries on price differences [5]. Zhang Chuan and Chen Binkai used the breakpoint regression method to explore the impact of the new rural insurance scheme on the rural pension model based on the micro data of China's health and pension follow-up. They found that the probability of the old people participating in the new rural insurance scheme receiving private transfer payments would decrease by 32%-53%. The new rural insurance system has no significant impact on the transfer payment amount of the elderly who receive transfer payments. The social pension model can replace the family pension model to some extent, but the effect is limited, and the level of rural social security needs to be further improved (with age as the entry point). Liu Chang and Ma Guangrong conducted a natural experiment on national and county division in 1994. Using the county-level panel data from 1999 to 2009, this paper reestimated the "fly-paper effect" of fiscal transfer payments by using the breakpoint regression method. With the increase of general and special transfer payments, the proportion of fiscal expenditure to GDP will increase by 1.5% and 3.0%, respectively, in 2015. Zhang Yi and his colleagues use the western development strategy as a natural experiment to analyze the impact of transfer payments on the urban-rural income gap using fuzzy geographical points based on the county-level data of 15 central and western regions in 2000 and 2007. The study found that transfer expenditures in the western region were higher than those in the central region, while the urban-rural income gap in the western region was 20 percent. The results are stable when variables are implemented using different ranges, distances, or measurements as breakpoints. According to the literature analysis, there are many applications and studies of breakpoint regression method, but there are no studies on the topic of this paper, so the research in this paper is somewhat innovative [6].

2.2. Research Review on Body Mass Index and Physical Exercise. Obesity has a variety of harmful health consequences and is an underlying factor in chronic diseases and many other conditions. In earlier studies, most of the literature has focused on physical activity to prevent obesity, as a therapeutic strategy for fat and weight control and as an important aspect of a healthy lifestyle. However, little research has been conducted on the behavior of overweight or obese people who participate in physical activity, i.e., whether obese people spend more time participating in physical activity than normal people or weigh less or whether obese people increase the frequency or frequency of exercise when their BMI is elevated; differences in attitudes and behaviors toward physical activity also vary among obese people, with some fat people actively participating in physical activity while others do not [7].

According to overseas studies, physical activity declines sharply from high school to college. According to overseas

researchers, obesity may be a driver of physical inactivity. That is, high obesity rates may be responsible for physical activity in general. In a study of the relationship between obesity and physical activity in adults, researchers found that more than 60 percent of BMI exercised people, suggesting that as BMI increased, the rate of physical activity increased, which is consistent with Banerjee's findings. However, it is unclear whether a higher BMI would encourage people to be more physically active. Fear of injury, lack of skills, lack of finances, and lack of time were the main reasons for lower participation in physical activity among adults. In the case of youth physical activity, overweight or obese people engage in physical activity than the average person [8].

In studies of adult men and women, women were more susceptible to external assessments of their weight or size, as well as to media portrayals and suggestions of the ideal body. Andrew (2000) claimed that in social settings, obese people are discriminated against and stigmatized by others, leading to weight stigma, which is one of the reasons why obese people self-reject exercise and physical activity. According to another study, people with low BMI, low weight, or normal activity engage in physical activity to lose weight. It also corresponds to overweight or obese women who do not engage in regular physical activity. The external social environment can influence obese people to participate in physical activity [9].

Women are more sensitive to body image than men, and they are more likely to feel chubby and obese. According to a study, fewer women and overweight people participated in physical activity. Finding that men or women feel or think they are too big is also a barrier to physical activity, Yiquan et al. analyzed self-perceptions of obesity between men and women [10].

Another aspect of this study showed that obese adults who participated in exercise had physical barriers (hindrances) that limited their physical activity. Miguel argued that obese individuals have higher barriers to physical activity and therefore physical activity participation is negatively associated with physical health markers. Ekakis argues that obese people have a different experience of exercise than people of average weight. Exercise intensity, energy expenditure, interest in activity, and emotions of self-obesity are all factors to be considered (evaluation). According to Aleksandra et al.'s study, boredom, embarrassment, difficulty, and energy-intensive tasks all prevent people from participating [11].

Depending on the level of physical activity, some studies found an opposite relationship or no relationship between physical activity and BMI. According to some studies, those with a lower BMI were more likely to regularly participate in high-intensity physical activity. In addition, studies have not shown a consistent association between obesity and physical inactivity in women, implying that obese and overweight women are more likely to be physically active than women who are not physically active [12].

3. Study Methods and Materials

3.1. Main Concepts

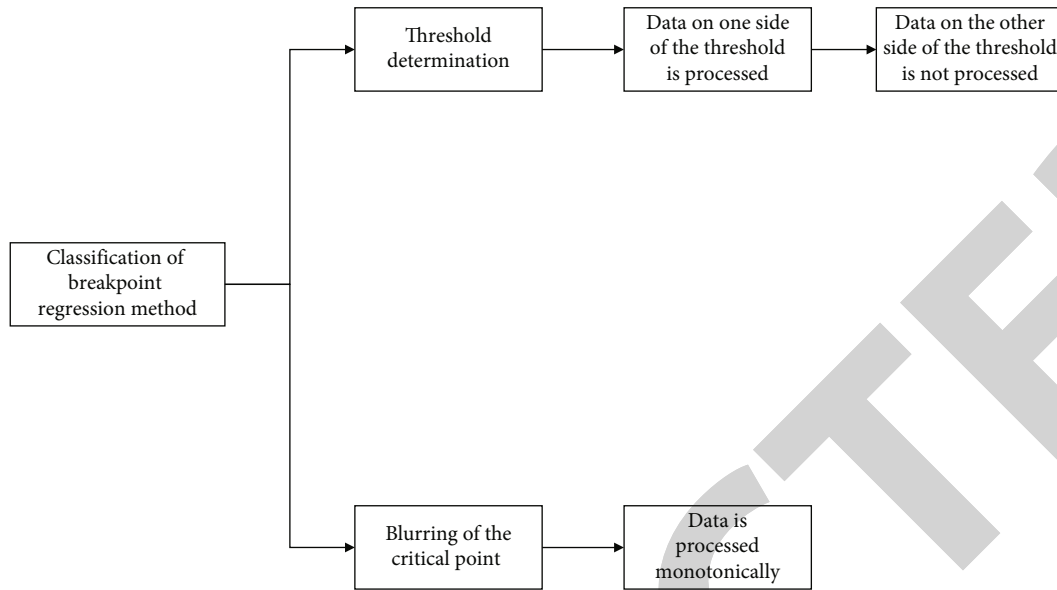


FIGURE 1: Classification of breakpoint regression methods.

3.1.1. Breakpoint Regression Method. Breakpoint regression is an empirical method based only on randomized experiments that effectively uses real-world limitations to analyze causal relationships between variables. In breakpoint regression, if the variable is greater than a threshold, the variable is processed; if the variable is less than a threshold, it is not processed [13]. In general, the processed data cannot be directly observed. In breakpoint regression, those who do not reach the threshold can serve as a good control group to reflect what is happening in the data processing, especially when the variables are continuous and the difference between the threshold and the sample can appropriately reflect the relationship between sales and economic variables. Breakpoint regressions can be divided into two categories. In the first category, the thresholds are determined, i.e., the thresholds identified in the first category. All observations in other matters are from one side of the threshold and not all observations from the other side. In this case, the probability of removal from one side of the threshold is transferred to the other side. In the second case, the threshold is ambiguous, i.e., other matters in some cases, proving that the systematic variation sampled near the threshold can be used to study the relationship between the predicted removal and other economic variables regardless of the breakpoint regression method [14]. The classification of breakpoint regression methods is shown in Figure 1.

3.1.2. Body Mass Index. Body mass index (BMI) is calculated by dividing body weight (kg) by the square of height (m). It is a global indicator of human weight and health. For statistical purposes, BMI is a neutral and reliable indicator for comparing and analyzing the effects of weight on health in different populations. BMI was originally considered as a statistical tool for public health research. If we need to know if obesity causes any particular disease, we can convert the height and weight of the patient to a weight indicator to see if there is a linear relationship between the number of diseases and their incidence. However, with advances in

technology, BMI is only a benchmark. In order to truly assess the degree of obesity in a patient, it is necessary to measure the patient's fat thickness by measuring the patient's resistance. Therefore, the role of BMI has gradually changed—from medical use to the physical condition of the general population [15]. The formula is as follows.

$$\text{BMI} = \frac{\text{Weight}}{\text{height}^2}. \quad (1)$$

The relationship function between height and weight under standard BMI is as follows: this figure is taken when the BMI is 20, where the X-axis is the height of the person and the Y-axis is the person's weight, and the analysis of the figure shows that when the BMI is a normal value, the height and weight are proportional to each other when the BMI is 20, and the relationship function between height and weight under standard BMI is shown in Figure 2.

3.1.3. Physical Exercise. Physical exercise is a kind of physical activity that people do in their spare time in order to exercise their body and mind. The results show that participation in physical exercise can not only directly improve people's physical activity level during exercise but also improve people's overall physical activity level by improving their exercise habits, which can help reduce the incidence of obesity and lower the level of cardiovascular disease risk factors [16]. Physical training especially refers to physical activity with a certain intensity, frequency, and duration that is performed consciously in spare time for the purpose of health protection [17]. Physical activity should be distinguished from physical activity in the field of physical education. The main purpose of physical activity is to promote and maintain physical health, and the purpose of physical activity is to learn motor skills, so that learners can master one or more motor skills and build a good foundation for physical activity. Although they have some common points, the basic points and starting points are different [18].

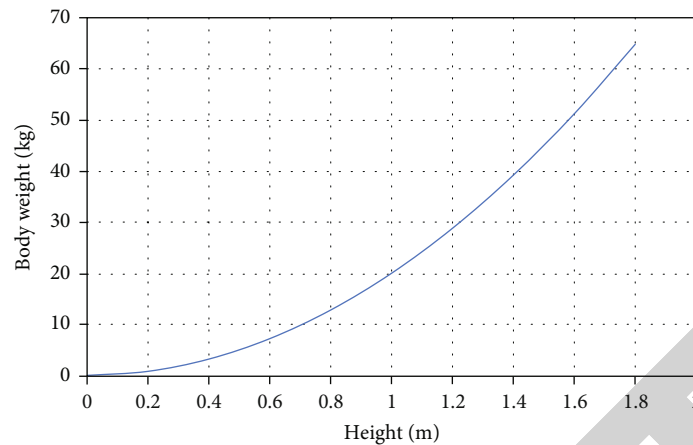


FIGURE 2: Relationship function between height and weight under standard BMI.

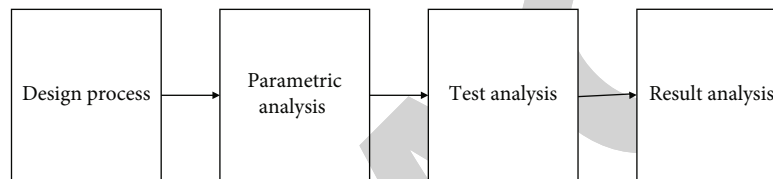


FIGURE 3: Main design flow.

3.2. Fuzzy Breakpoint Regression Design. The current analysis used data from the China Social Survey (CGSS), a cross-sectional study that began in 2003 as the first national, comprehensive, and continuous academic survey project in China. The CGSS collects data at multiple levels of society, including communities, households, and individuals [19]. This study uses the 2018 General China Social Survey (CGSS). This paper uses breakpoint regression to address endogeneity and appropriately identify the causal relationship between participation rate and BMI. The estimation methods of breakpoint regression are divided into explicit breakpoint regression and fuzzy breakpoint regression. The fuzzy breakpoint regression model was chosen to test for causal effects during model selection, and then, the mechanism regression was used to assess potential influences. The first stage is to determine the presence of jump points, and the most critical step is to conduct extensive testing to ensure that the breakpoints are obvious and convincing. Results and Discussion will provide the results of the fuzzy breakpoint regression and the results of other tests [20]. The main design flow is shown in Figure 3.

4. Results and Discussion

4.1. Analysis of Specific Parameters

4.1.1. Physical Activity and Body Mass Index (BMI). “In the past year, did you regularly use your leisure time to do the following?” Ask participants “During the past 12 months, how often did you engage in 30 minutes of sweaty physical activity per week?” These two items were examined together

to determine the respondent’s physical activity status. Physical activity was further divided into two categories.

Three exact numbers were set aside for height and weight to remove missing values based on the data from the follow-up survey. BMI was calculated using the kg/m^2 formula. Data smaller than $18.5 \text{ kg}/\text{m}^2$ were excluded because the relationship between mean weight and overweight and obesity was explored.

4.1.2. Obesity Status. BMI was categorized as normal weight, overweight, or obese. In the final mechanistic regression analysis, obesity status was divided into two categorical variables.

4.1.3. Dependent Variable: Participation in Physical Activity. The dependent variable for participation in physical activity was the rate of physical activity based on the age class of the respondent related to physical activity.

4.1.4. Mechanistic Variables. Mechanistic variables were also aimed at explaining why the breakpoint jump eventually occurs. In this paper, the mechanistic variables are divided into three dimensions: socioeconomic status, physiology, mental health, and degree of social interaction.

4.1.5. Socioeconomic Status. Participants were asked, “In summary, your socioeconomic dimension belongs to today’s society.” The response options were upper, middle, and lower class. Finally, socioeconomic status was divided into three groups.

4.1.6. Health Variables. Both physical and mental health were considered as health variables. Respondents’ overall

TABLE 1: Breakpoint regression estimates.

	Exercise participation rate Estimation method	Coefficient	Whole population	
			se	z-value
First-order mounting	Traditional estimation method	(-0.116) ^{***}	0.038	-3.02
	Strong estimation method	—	—	-2.49
Second-order fitting	Traditional estimation method	(-0.178) ^{***}	0.057	-3.010
	Strong estimation method	—	—	-3.925
Third-order fitting	Traditional estimation method	(-0.146) ^{***}	0.047	-3.102
	Strong estimation method	—	—	-3.718
	Breakpoint design		24.9	
	Kernel features		Triangle kernel	
	<i>n</i>		6528	

* $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$.

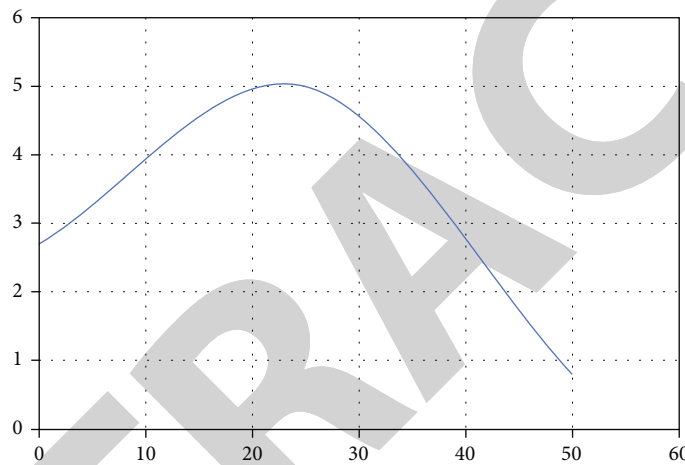


FIGURE 4: Relationship between BMI and PA rates.

health level is an estimate and judgment of their own health level. Respondents' assessment and evaluation of their level of depression determines their level of mental health. Your perceived current health status and how often you have felt depressed or down in the past four weeks were the questions in the questionnaire.

4.1.7. Social Connection. The purpose of determining the degree of social connectedness was to examine the relationship between the respondents and their relatives and friends.

4.2. Test Analysis

- (1) Breakpoint regression estimates: the data are shown in Table 1
- (2) Relationship between BMI and PA rate

The rate of physical activity participation in the general population increased considerably before and after a BMI of 24.9 kg/m^2 . People with a BMI above 24.9 kg/m^2 were no longer considered normal weight. The PA rate for physical activity climbs and then decreases as BMI increases. On

the other hand, people who are slightly overweight or obese value physical activity and actively participate in it. However, when BMI and more severe obesity are reached, exercise at overweight levels may be detrimental to a person's health, so diet and health interventions should be implemented first to lose weight and then gradually regain exercise participation so that the rate of physical activity participation begins to decline in this group. The most important component is the check link. Robustness tests are used to determine if the causal effect of the independent variable causes the dependent variable to jump, to remove interference from other factors, and to ensure stability of the results. Validity testing, robustness testing, nonbandwidth testing, and placebo testing are all necessary to determine if the RD can be approximated by the method. Membership in the group began to decrease. The relationship between BMI and PA rate climbs and then decreases as BMI increases, as shown in Figure 4.

- (3) Breakpoint regression requires that the sample data meet specific requirements and that the breakpoints on either side of the breakpoint be smoothed to eliminate breakpoint processing effects. Two methods were used to test the smoothness of the independent

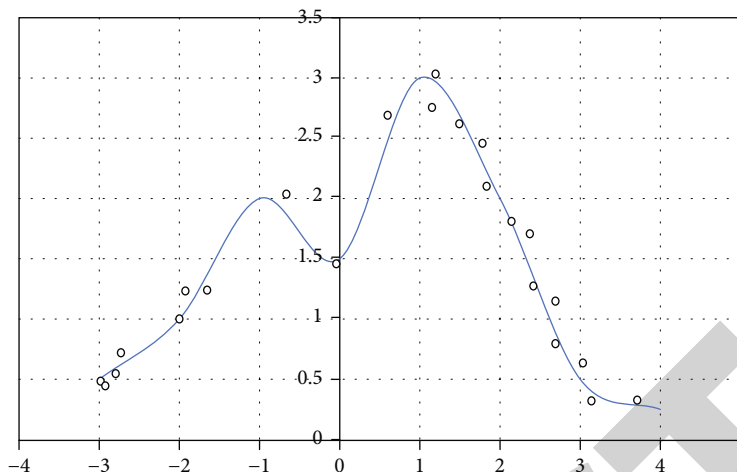


FIGURE 5: Density functions on both sides of the breakpoints.

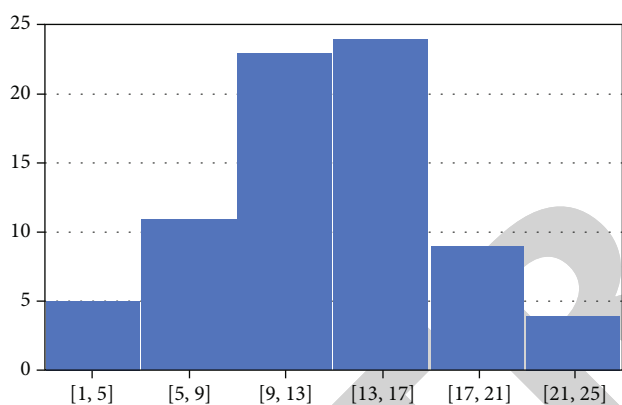


FIGURE 6: Histogram of independent variable smoothness test.

Figure 5 shows that the confidence intervals for the density function estimates with overlapping breakpoints consist of mostly overlapping, indicating that there is no significant difference between the density functions on the two sides of the breakpoints, as shown in Figure 5

(4) In this paper, the histogram technique is used to test simply and explicitly whether the independent variables satisfy continuous Q and smoothing to verify the accuracy of the test results. Figure 6 shows that the independent variables are continuously smoothed and there are no discontinuity points, as shown in Figure 6

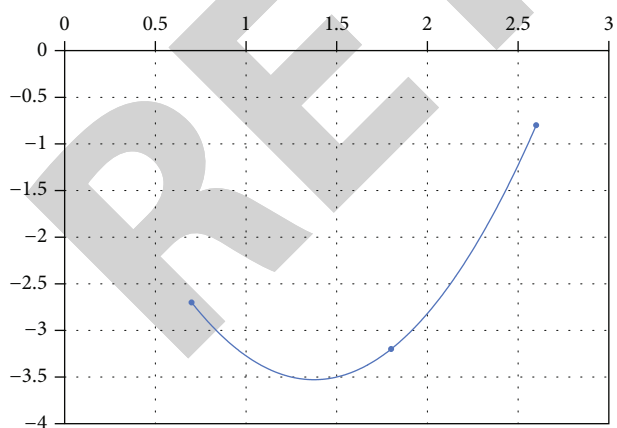


FIGURE 7: The range of the rectangular kernel function.

variables. First, McCrary (2008) proposes a testing technique for the kernel density function to check that the parameter is smooth and balanced and does not jump at the breakpoints, thus denying the existence of an endogenous group for the parameter.

(5) Since the default kernel for fuzzy breakpoint regression is the triangular kernel function, this study evaluates the robustness by switching to the rectangular kernel function. Figure 7 shows that both are shown to be negative when the rectangular kernel function is replaced and the LWALD value changes in an unsuitable range

(6) The concept of RD estimation requires that the estimation sample is selected around the breakpoint and then if the sample size is large enough, a local linear estimation similar to the random experiment can be performed. However, in most cases, we are unable to collect sufficient sample size on both sides of the breakpoint due to the limitation of the actual data. In the case of limited samples, we chose to adjust the bandwidth to test the elasticity of the estimation results. The IK method proposed by Imbens and Kalyanaraman (2012) and the CCT method proposed by Calonocattaneo and Titiunik were used

TABLE 2: Results in Imbens bandwidth test.

	Model 1	Model 2	Model 3	Model 4
Breakpoint (kg/m ²)	24	25	28	29
LWALD	0.008 (0.88)	0.000 (0.02)	-0.003 (-0.25)	0.005 (0.33)
<i>N</i>	6528	6528	6528	6528

* $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$.

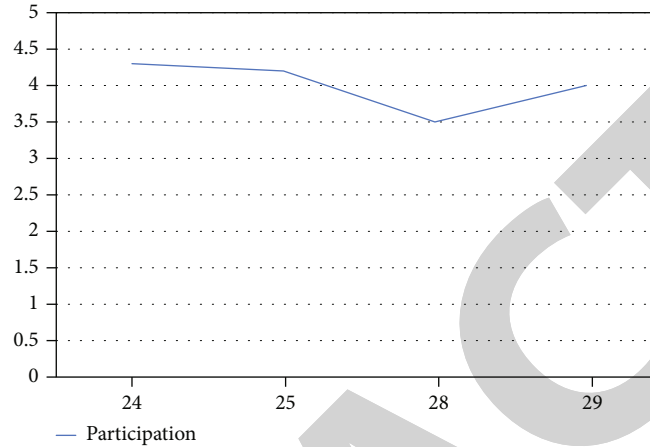


FIGURE 8: Placebo test.

to determine the bandwidth (2014). The results of the IK and CCT tests are very similar, indicating that the bandwidth is reasonable. The WALD estimates of 0.5x (0.661), the optimal bandwidth (1.323) and the bandwidth of 2x (2.646) were not particularly different in the Imbens bandwidth test and both were negative, as shown in Table 2

(7) Placebo test

The purpose of the placebo test is to see if the breakpoint is indeed unique. The main premise of the placebo test is that the artificial selection of a new BMI breakpoint does not have a substantial effect on physical activity participation; i.e., there is no increase (significant) in physical activity participation at the new breakpoint. If test results showed that physical activity participation did not occur at these breakpoints, 24, 25, 28, and 29 kg/m² were chosen as breakpoints in this paper. Jumping can demonstrate that changes in physical activity participation rates can be attributed to BMI (obesity) rather than to other variables. The results of the placebo test are shown in Figure 8, and none of the other BMI values showed a significant increase in physical activity participation at the breakpoint, as shown in Figure 8.

4.3. Test Results. By confirming that there is a significant breakpoint in BMI outside of the usual range and why this leap occurs in people with abnormal weight ranges, a mechanism for further research can be established. Changes in individual behavioral habits are the result of physical activ-

ity, which encompasses many interrelated factors. According to Adrian, the social and physical environment is a component that discourages fat individuals from engaging in physical activity.

Obesity is directly influenced by socioeconomic class, and physical activity is similarly influenced by socioeconomic status. Highly affluent individuals have a high degree of autonomy and flexibility in their work, giving them the freedom to set their work hours and schedules without limiting their possibilities for exercise. Overweight and obesity are associated with socioeconomic status, and among both men and women, those in higher economic status are more aware of weight management and work harder to maintain their weight through diet and physical activity. When the obesity variable was not included, the caste and physical activity rates were high and significant in the upper class. This also supports the higher physical activity rates of the upper class. However, when combining the obesity variables, the lower middle and middle classes and the rate of physical activity participation show substantial adverse effects. The lower the socioeconomic status, the lower the rate of physical activity participation.

Lack of exercise can lead to illness and mental health problems, but this can also lead to reduced activity when a person is dealing with negative issues such as illness or mental distress. According to Adrian, social and physical circumstances are components that make fat people reluctant to engage in physical activity. The negative effects of weight stigma in social and physical conditions are detrimental to obese people. One of the reasons for the self-exclusion of fat people from exercise and physical activity is weight stigma. According to Andrew (2000), obese people are

discriminated and stigmatized by others in a social context and face weight stigma, which is a double blow to the body and mind. In Ball's study (2000), it was noted that weight stigma allows many people to give up physical activity altogether. Rebecca's study also showed that weight stigma has a negative impact on health behaviors. When the depression variable did not interact with the obesity variable, depression negatively affected participation in physical activity, but the results were not significant. Obesity and depression had deleterious effects on physical activity when they interacted with obesity factors. Puhl and Andrew found that weight stigma increased mental health problems (depression and anxiety) in obese individuals, which limited participation in physical activity.

When the levels of social interaction and obesity are combined, the effect of obesity on physical activity participation becomes negative. In the absence of an interaction program, the effect of noninteraction and physical activity participation is positive and significant, suggesting that exercise is occurring in a specific context. When people do not engage in social contact, physical activity participation rates decrease. The impact of obesity changes when it interacts with society, possibly due to an alternative coping technique of fat people in the face of social stigma: not socializing, not going to busy fitness centers, and instead doing exercise and other activities alone at home or alone.

In conclusion, there is a direct link between obesity and physical activity participation rates, and more attention should be paid to the individual and environmental influences on exercise behavior. An individual's socioeconomic status, social contact, and health status must all be taken into account in order to design effective methods to enhance individual exercise behavior.

5. Conclusion

In this paper, body mass index and physical activity participation rate were designed in the context of the physical health problem of obesity and combined with fuzzy breakpoint regression method, and the relationship between body mass index and physical activity participation rate design based on fuzzy breakpoint regression design was discussed in this paper. There is a direct link between obesity and physical activity participation rate, and more attention should be paid to the influence of individuals and the environment on exercise behavior. An individual's socioeconomic status, social contact, and health status must all be taken into account in order to design effective methods to enhance individual exercise behavior. Obesity is a global public health problem in modern society. Physical fitness is the quality of the body. It is the property of complexity and relative stability of human structures, physiological functions, and psychological factors that are the basis of inheritance and acquisition. Physical exercise is a kind of physical activity that people do in their spare time in order to exercise their body and mind. With the development of the economy and the improvement of people's living standards, the diet structure is becoming more and more unreasonable, leading to obesity and social care. Nowadays, the

international body mass index (BMI) has become the standard for measuring body fat and weight loss. Physical education is a supplement to physical education, a means to fully mobilize motivation and creativity, and an important means to build character and improve physical and mental health. Participation of obese people in extracurricular physical activities helps to enrich their lives, improve their physical condition, and maintain a healthy lifestyle. The problems arising from obesity are as follows.

- (1) The physiological consequences of simple obesity: simple obesity is easily induced, penetrates into the heart and lungs, and destroys the function. In most obese people, oxygen consumption increases, cardiac output increases, ventricular filling increases, and centrifugal cardiomegaly occurs. His heart reserves are reduced, the myocardium contracts, the force is reduced, and the heart and volume are larger than usual. Fat accumulates in the chest and abdomen of a fat person. The growth of septum, the limitation of breast movements, and the weakening of lung respiration lead to the limitation of lung respiration and, acutely, to the cardiovascular syndrome
- (2) The psychological consequences of simple obesity: simple obesity tends to cause negative emotions, such as depression and low self-esteem. Experts have found that moderately obese children have a more moderate and tolerant personality. In addition, obese children's personality, qualities, and social adaptability are inhibited to varying degrees. Because of their abnormal body image, obese children are often exposed to environmental factors. In particular, families are pressured to worry too much about their bodies. Low tolerance for frustration tends to develop an isolated personality, which leads to impaired self-confidence and motivation to learn and affects intellectual development

Physical exercise has the following effects.

- (1) Physical exercise can improve health and brain development. The human thinking organ is the brain, and thinking activities depend on social practices. There are many small muscles in the hands, with which a billion kinds of movements are accomplished. According to brain function localization theory, each small hand muscle has a corresponding "resting point" on the cerebral cortex. In sports activities, due to the frequent activities of small human hand muscles, the cerebral cortex is stimulated, each "brain rest point," and promotes the expansion of the "brain rest point," that is, to promote the development and growth of the cerebral cortex, making people more intelligent. This is the reason for the so-called "dexterity"
- (2) Physical exercise ensures that the brain gets food and oxygen, which helps improve thinking and memory. The brain must have adequate nutrition and oxygen

to be healthy, and adequate oxygen and nutrition are directly related to a person's health. Experiments have shown that people's breadth and degree of perception increases after participating in physical activity!" Memory speed increases. This shows that physical exercise can develop one's intelligence. Physical exercise increases the reaction speed of the brain, thus promoting the brain's potential. Human intelligence, especially memory and various parts of the cerebral cortex, is closely related to the level of establishing temporal connections and integrity. Those who regularly participate in physical activity are more susceptible to visual perception, auditory, and other sensory influences. Nerve cells are responsive and have a powerful ability to analyze and synthesize the cerebral cortex. The brain has the function of receiving and selecting, analyzing and judging, processing, storing, and transmitting information. In the physiological sense of the brain, the left brain is used for thinking and analysis, and the right brain is used for emotion and volition. Left brain activity is necessary for the development of creative thinking in the right brain. Right-brain movements based on left-brain activity allow the free use of both brains. This biobrain synthesis is very useful for developing creativity and intuitive imagination. Most of the human brain is undeveloped, especially in the right hemisphere. Physical exercise is a powerful tool for developing the right brain and should emphasize left-handed activities. The complexity, flexibility, and diversity of sports programs are more useful for training people to react quickly, observe and judge accurately, and have a rich imagination and are more useful for developing the brain and realizing its potential

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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