


Article

Leisure Involvement, Leisure Benefits, and Subjective Well-Being of Bicycle Riders in an Urban Forest Park: The Moderation of Age

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Abstract: The prominence of participating in outdoor leisure activities has gained significance in individuals' lives as a result of the rapid growth of the economy and the rise in available leisure time. The present study employed structural equation modeling to examine the relationships among leisure involvement, the three distinct dimensions of leisure benefits (physiological benefits, psychological benefits, and social benefits), and subjective well-being of bicycle riders. Moreover, the moderating effect of age was also investigated. A field survey was undertaken within an urban forest park, Nanjing City, Jiangsu Province, China, in order to gather data, resulting in the collection of 512 questionnaires that were deemed usable. The results suggest that leisure involvement has a significant and positive impact on bicycle riders' physiological, psychological, and social benefits, as well as their overall subjective well-being. The subjective well-being of individuals is positively influenced by the physiological, psychological, and social benefits. Additionally, the results of the analysis on the moderating effects suggest that age significantly moderates the relationships between leisure involvement and leisure benefits. The present study also addresses the theoretical and practical implications, limitations, and potential avenues for future research.

Keywords: leisure involvement; leisure benefits; subjective well-being; bicycle riders; urban forest park



Citation: Geng, W.; Wan, Q.; Wang, H.; Dai, Y.; Weng, L.; Zhao, M.; Lei, Y.; Duan, Y. Leisure Involvement, Leisure Benefits, and Subjective Well-Being of Bicycle Riders in an Urban Forest Park: The Moderation of Age. *Forests* **2023**, *14*, 1676. <https://doi.org/10.3390/f14081676>

Academic Editor: Radu-Daniel Pintili

Received: 22 July 2023

Revised: 15 August 2023

Accepted: 17 August 2023

Published: 18 August 2023



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1. Introduction

With the rapid development of China's economy and the increase in leisure time, people's demand for leisure is growing, and participation in leisure activities has become an important part of people's daily lives [1,2]. A large number of studies have shown that participation in outdoor leisure activities (e.g., jogging, hiking, mountaineering, cycling, etc.) can increase people's pleasurable emotional experience, reduce individual stress and depressive symptoms, reduce negative emotions such as anger and anxiety, and help to reduce blood pressure, which positively affects their physiological, psychological, and social health and subjective well-being [3–7].

Participation in outdoor leisure activities is commonly referred to in the literature as leisure involvement [8]. Leisure involvement is essentially the attitude towards leisure activities, and the meaning and benefits that leisure activities bring to participants [9].

Although there has been literature discussing the impact of leisure involvement on participants' leisure benefits and subjective well-being, most of the existing studies regard leisure benefits as an overall variable instead of subdividing into distinctive aspects [10,11]. In fact, it has been suggested in the literature that leisure involvement can impact participants' leisure benefits at different levels and can usually be categorized into three areas: physiological benefits, psychological benefits, and social benefits [2,12]. Physiological benefits are concerned with the prevention of illnesses and improvement of health, psychological benefits are related to positive feelings like self-assurance and fulfillment, while social benefits are about expanding social connections and gaining more friendships [13–17]. However, investigations into the structural relationships among bicycle riders' leisure involvement, three specific dimensions of leisure benefits and subjective well-being still remain scarce.

Moreover, it is noteworthy that age may be a prominent factor differentiating the influence of leisure involvement on leisure benefits. Analyses in the previous studies have shown people in different age groups such as young adults aged 18–35 and seniors aged over 60 gain different leisure benefits from leisure activities [18,19]. More specifically, it has been suggested that engagement in leisure activities can be beneficial for young individuals in effectively alleviating stress, while participation in leisure pursuits has been found to assist older adults in fostering social interactions and enhancing their feelings of belongingness and fulfillment [20,21]. Nevertheless, there remains a lack of comprehensive understanding regarding the moderating effect of bicycle rider's age in relation to leisure engagement and the three dimensions of leisure benefits.

The objective of this study is to address the current deficiencies in the existing body of research. The primary aims of this study are twofold: firstly, to investigate the structural connections between leisure involvement, three distinct dimensions of leisure benefits, and the subjective well-being of bicycle riders; and secondly, to analyze the potential moderating impact of age on the relationship between leisure engagement and the three dimensions of leisure benefits. Zijinshan National Forest Park, located in Nanjing, Jiangsu Province, China, was selected as the research case for this study.

2. Literature Review and Hypotheses Development

2.1. The Importance of Urban Forest Parks

Urban forest parks encompass the collective presence of various tree species within urban areas [22]. This includes urban forest green spaces, urban gardens, urban greening initiatives, and other similar entities [22]. Urban forest parks boast a profusion of vegetation, creating a picturesque natural setting and providing urban dwellers with a refreshing atmosphere conducive to leisure and recreational activities. Exposure to nature has been associated with various pathways that contribute to the enhancement of human health and well-being. These pathways encompass contact with natural elements such as daylight and fresh air, engagement in physical activity, restoration of mental and emotional health, and the opportunity for social interaction [23,24]. Consequently, they have emerged as significant destinations for individuals seeking relaxation and engagement in sports, particularly in light of the COVID-19 pandemic. A plethora of studies have provided evidence that engaging in outdoor sports, such as cycling in urban forest parks, can have positive psychological effects by ameliorating negative emotional states and enhancing individuals' overall sense of well-being. Additionally, these activities have been found to contribute to physical well-being by aiding in the management of various diseases and enhancing overall quality of life [25,26]. Hence, urban forest parks assume a progressively vital role in facilitating outdoor sports activities for both tourists and local residents.

2.2. The Relationship between Leisure Involvement, Leisure Benefits, and Subjective Well-Being

Involvement that refers to individual attitudes and behaviors in social psychology was originally proposed by Sherif et al. (1979), after which this concept has been widely used in research on leisure and recreation and many scholars have discussed the concept of leisure involvement [27]. For example, McIntyre et al. (1992) perceived leisure involvement

as a way of self-expression, which represented the significance of leisure participation and enjoyment [28]. Kyle et al. (2007) deemed leisure involvement as the strength or extent of the cognitive linkage between the self and a stimulus object [29]. In this study, leisure involvement refers to the concentration, freedom, and pleasure of people involved in cycling activities.

Leisure benefit focuses on subjective feeling rather than financial profits. Tinsley et al. (1986) argued that leisure benefit is the subjective feeling upon self-assessment of the involvement [30]. Ajzen (1991) regarded leisure benefit as the fulfillment of leisure goals. The measure of leisure benefit varies depending on the conceptual cognition [31]. Cordes et al. (1999) summarized that leisure benefits are composed of physiological benefits, psychological benefits, emotional benefits, and social benefits [32]. Bright (2000) concluded that leisure benefits constitute physiological benefits, psychological benefits, social benefits, economic benefits, and environmental benefits [33]. Cheng (2021) encapsulated leisure benefits for disabled people as consisting of physiological benefits, psychological benefits, and social benefits. In this study, leisure benefits are generally divided into three common dimensions including physiological benefits, psychological benefits, and social benefits [2]. Participating in leisure activities can yield physiological benefits, as it enables individuals to alleviate suboptimal health conditions resulting from insufficient physical exercise and enhance their overall physical fitness. Psychological benefits represent that people are able to strengthen confidence and gain the sense of achievement through leisure participation. Social benefits refer to the capacity of individuals to broaden their social networks and foster mutual trust through engagement in leisure activities.

Previous studies have explored the relationship between leisure involvement and leisure benefit. Leisure activities are beneficial to enhancing health and dissolving unpleasant emotions (Kerr 2002), as well as improving self-expression and social relationships (Kim 2015) [15,17]. For instance, Chen (2011) found that runners could gain physiological benefits, psychological benefits, and social benefits from participating in Tainan Marathon [34]. Yang et al. (2016) also demonstrated that long-term regular swimming activities could produce physiological, psychological, and social benefits [35]. Thus, the first three hypotheses are proposed below:

H1a. *Leisure involvement has a significant positive effect on physiological benefit.*

H1b. *Leisure involvement has a significant positive effect on psychological benefit.*

H1c. *Leisure involvement has a significant positive effect on social benefit.*

Andrews (1976) asserted that well-being is a measure of satisfaction, reflecting the quality of life [36]. Diener (1984) considered well-being as a cognitive and emotional evaluation of life perception [37]. In happiness research, well-being is split into subjective well-being and psychological well-being. Originating from hedonism in philosophy, subjective well-being is a pleasant emotional experience as well as the overall assessment of personal quality of life. In this study, cyclists' subjective well-being is defined as cyclists' estimate of their positive feelings and individual growth through riding activities.

Many scholars have researched the impact of leisure involvement on subjective well-being. According to Zhang's (2021) study, an examination of residents engaging in night-time leisure activities revealed that leisure involvement had a notable and positive impact on subjective well-being [38]. Moreover, Xu et al. (2017) found that achievement activities like fitness exercise have positive impacts on subjective well-being [39]. Physical activities can improve the subjective well-being of different groups of people (Zhang 2021) [40]. Middle-aged people can raise their subjective well-being from exercise like social dance and tai chi (Wang 2022), while young people like college students can gain self-identity and friendship to enhance subjective well-being from sports activities (Ma 2022) [41,42]. Based on the aforementioned research background, the following hypothesis was proposed:

H2. *Leisure involvement has a significant positive effect on subjective well-being.*

The relationship between leisure benefits and subjective well-being has also been intensively studied by scholars. In spite of the different benefits of different leisure involvement, they generally play the same role in maintaining and increasing subjective well-being (Wu 2020) [43]. For example, Stebbins (2001) asserted that leisure benefits that include self-fulfillment and connections with others contributed to subjective well-being [44]. Major (2001) highlighted that runners attained fitness and self-actualization from engaging in serious leisure activities, thus raising their subjective well-being [45]. According to Liu (2015), meaningful leisure participation gave individuals the opportunity to feel valued and eliminate negative emotions while promoting subjective well-being [46].

Furthermore, a number of studies have shown that engaging in leisure activities has significant beneficial impacts on people's leisure benefits, which in turn has a significant positive influence on their subjective well-being. For instance, Coleman et al. (1993) provided evidence that the advantages of leisure activities contributed to well-being [47]. Yu and Tian (2013) pointed out that leisure benefits were mediators and the key to subjective well-being using a survey of riders in Guangdong China [10]. Consistent with this, Huang (2022)'s study about long-distance runners also reflected that leisure benefits were the mediator variables in the relationship between deep leisure and happiness [48]. Based on the above discussion, the following hypotheses were proposed:

H3a. *Physiological benefits have a significant positive effect on subjective well-being.*

H3b. *Psychological benefits have a significant positive effect on subjective well-being.*

H3c. *Social benefits have a significant positive effect on subjective well-being.*

H4. *Leisure benefits mediate the relationship between leisure involvement and subjective well-being.*

2.3. The Moderating Effect of Age

Age-related differences exist in how people view the advantages of leisure involvement and their leisure benefits. Specifically, young and middle-aged individuals can relieve work pressure through leisure activities, whereas ageing people involved in leisure activities are more likely to socialize [20,49]. Moreover, several studies have revealed that age plays a vital role in affecting individuals' benefits from leisure involvement. For example, Liu (2016) found that the influence of age on sports participants' leisure benefits was characterized by a U-shaped graph from an investigation of the community in Jiangsu province, China, which means young and old people have higher levels of subjective well-being, while middle-aged people have lower subjective well-being [19]. Using the above evidence, age may moderate the relationship between leisure involvement and leisure benefits. Therefore, it is logical to propose the last three hypotheses as follows:

H5a. *Age has a moderating effect on the relationship between leisure involvement and physiological benefit.*

H5b. *Age has a moderating effect on the relationship between leisure involvement and psychological benefit.*

H5c. *Age has a moderating effect on the relationship between leisure involvement and social benefit.*

The conceptual framework of this study is presented in Figure 1 as follows:

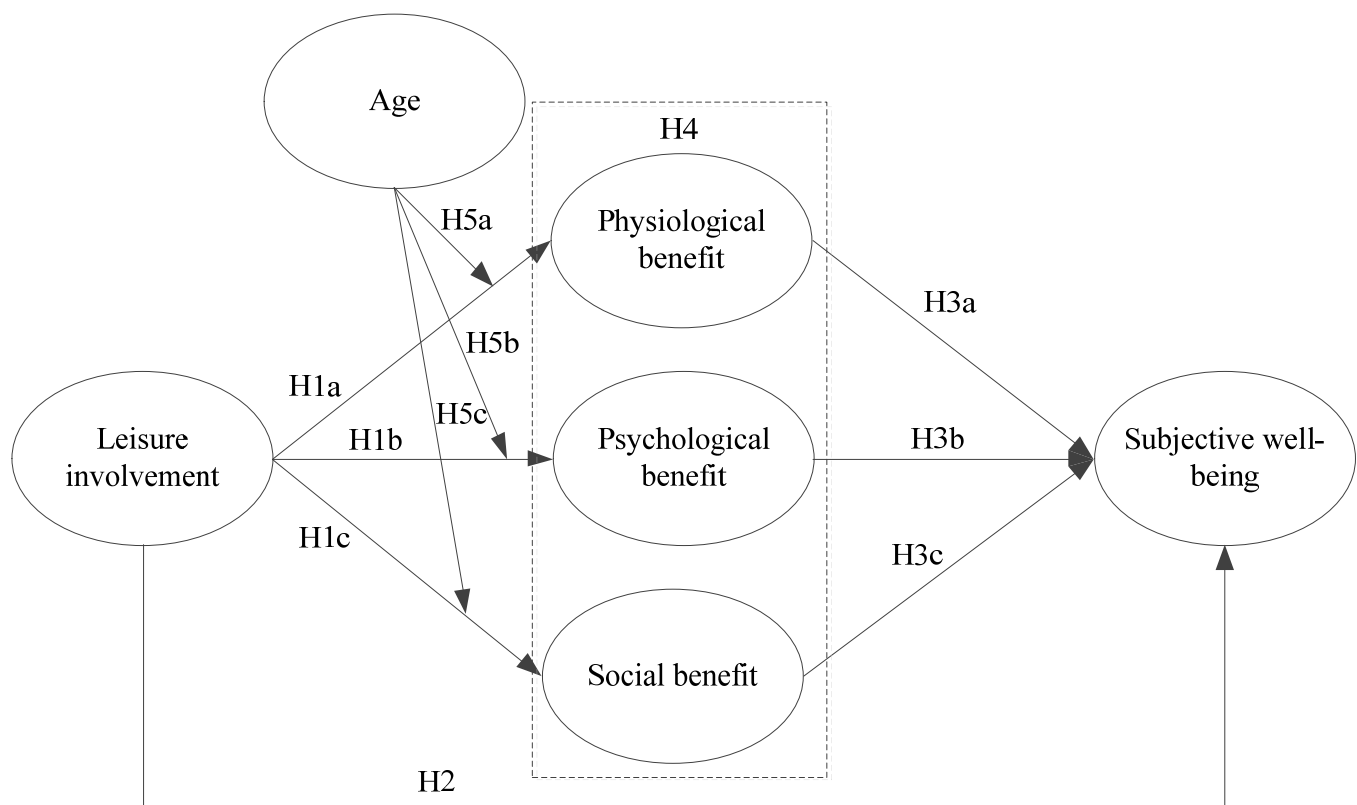


Figure 1. The conceptual framework of this study.

3. Materials and Methods

3.1. Description of the Research Case

Zijinshan National Forest Park, situated in Nanjing City, Jiangsu Province, China, is a large urban forested park that provides numerous leisure functions (Figure 2). With a total area of 3008.8 hectares and a forest coverage rate of 70.2%, this park embraces a peaceful atmosphere and is rich in plants and animals. Additionally, a mountain greenway spanning approximately 30 km has been constructed within the park and is accessible to the general public. Both local citizens and visitors are able to enjoy walking, jogging, and cycling on this greenway, and there are not only multiple routes for selection but also mass transit such as buses and subways near the twelve entrances as well as many bicycle lease points for convenience. Despite the ongoing COVID-19 pandemic, there has been a notable rise in the number of travelers and members of bicycle-riding clubs visiting the national forest park. Consequently, the Zijinshan greenway has emerged as a highly sought-after destination for cyclists, resembling a veritable paradise for them.

3.2. Questionnaire Design

A questionnaire was developed to gather data in order to gain a deeper comprehension of the interconnections between the leisure involvement, leisure benefits, and subjective well-being of bicycle riders. The survey instrument has been bifurcated into two distinct sections. The first segment of the questionnaire centers on the demographic attributes of the participants, encompassing their gender, age, educational background, occupation, etc. The second section of the questionnaire encompasses the assessment of three constructs.



Figure 2. The map of greenway around Zijinshan National Forest Park, Nanjing, Jiangsu Province, China.

Previous research serves as the basis for the components of each construct. The scale utilized for assessing leisure involvement was derived from the scholarly works of Weng, Lei, and Pan (2020) and Kyle et al. (2007), and is comprised of five items [29,50]. A sample question from the instrument is “I have invested a significant amount of time in cycling”. The measurement of leisure benefits, adapted from the research of Dergance et al. (2003), Zhao and Wu (2013), and Cheng (2021), is a 3-dimensional 10-item scale [2,12,51]. The three dimensions are physiological benefit (three items, such as “It builds muscle and physique and makes me fitter”), psychological benefit (four items, such as “It relieves my tension and stress and makes me feel much more relaxed”), and social benefit (three items, such as “I have made more friends by taking part in cycling”). Subjective well-being was measured through a four-item scale from the study of Karademas (2006) and Weng, Lei and Pan (2020) [50,52]. A sample question from the instrument is “I feel satisfied with my life when riding”.

The measurements employed a five-point Likert scale ranging from “strongly disagree” to “strongly agree”, with a numerical value of 1–5, respectively. The English-designed items underwent a process of translation into the Chinese language. The utilization of back-translation was implemented to ensure the precision of the translated material [22,53–55]. Furthermore, a preliminary investigation involving a sample size of 50 individuals was carried out to confirm the clarity and comprehensibility of the questionnaire, with the aim of eliminating any potential ambiguities. During the pilot study, the participants were required to fill out questionnaires and furnish feedback and recommendations. Several ambiguous elements were modified in order to enhance the lucidity with respect to the framework of the current investigation, as indicated by the feedback received.

3.3. Field Survey

A formal field survey was carried out in Zijinshan National Forest Park during the period spanning from September to October of the year 2022. A station next to the greenway for cyclists to rest was selected to collect data. The questionnaire survey was administered by a team of four proficient research assistants. Based on the research purpose of this study, only young people aged 18 to 35 and elderly people over 60 years old were selected for the survey. Prior to completing the questionnaires, the research assistants provided each respondent with information regarding the research items. Subsequently, eligible participants were asked to express their level of agreement or disagreement with the statements featured in the questionnaire. The participants who responded to the survey were provided with modest incentives as a token of appreciation for their valuable time. In total, 550 questionnaires were distributed, out of which 38 were deemed incomplete, leading to a final count of 512 valid questionnaires.

3.4. Data Analysis

The statistical software packages utilized for data analysis in this study were SPSS 20.0 and Amos 21.0. Initially, assessments of reliability and validity were conducted to evaluate the soundness of the measurement scales. Subsequently, the measurement model underwent testing through the utilization of confirmation factor analysis (CFA) outcomes. Ultimately, the research hypotheses were tested through the implementation of hypothesis testing, mediating effect analysis, and moderating effect analysis.

4. Results

4.1. Sample Profile

Table 1 presents a detailed overview of the descriptive information pertaining to the sample. The data reveal that among the 512 respondents, males constituted 56.4% ($n = 289$) while females constituted 43.6% ($n = 223$). The sample was divided equally, with half of the participants falling within the age range of 18 to 35 and the other half being aged 60 and above. More than 60% of the participants possess a bachelor’s degree or a higher level of education. Furthermore, the majority of the participants (58.6%, $n = 300$) are engaged in employment as enterprise employees, self-employed individuals, or business owners. It can also be founded that 85.9% of the participants possess a monthly income exceeding RMB 3000 (USD 470).

4.2. Measurement Model Testing

4.2.1. Reliability Test and Confirmatory Factor Analysis

The purpose of a reliability test is to assess the internal consistency of a measurement scale [55]. In general, it can be stated that a Cronbach’s α coefficient greater than 0.7 is indicative of a high level of reliability for the scale [56]. The results of the analysis demonstrate that Cronbach’s α coefficient for the whole scale is 0.904. Additionally, the Cronbach’s α coefficients for the constructs of leisure involvement, physiological benefit, psychological benefit, social benefit, and subjective well-being are 0.913, 0.889, 0.862,

0.846, and 0.837, respectively, as presented in Table 2. These coefficients reveal that the measurement used in this study exhibits high levels of reliability.

Table 1. Sample profile.

		Frequency (<i>n</i> = 512)	Percentage (%)
Gender	Man	289	56.4
	Woman	223	43.6
Age	18 to 35 years	256	50.0
	Over 60 years	256	50.0
Education	High school or below	53	10.4
	Associate degree	147	28.7
	Bachelor's degree	223	43.6
	Master's degree or above	89	17.4
Occupation	Enterprise employee	218	42.6
	Self-employment or owner	82	16.0
	Student	63	12.3
	Government officials	36	7.0
	Professional, teacher or technical	79	15.4
	Other	34	6.6
Personal Monthly Income (RMB)	Less than 3000	72	14.1
	3001–6000	149	29.1
	6001–10,000	182	35.5
	10,001–15,000	78	15.2
	More than 15,000	31	6.1

Table 2. Reliability and validity analysis.

Variables	Mean (SD)	Factor Loading	CR	AVE	Cronbach's α
Leisure involvement			0.916	0.685	0.913
I have invested a significant amount of time in cycling	3.45 (0.058)	0.832			
I practice cycling a lot to improve my proficiency	3.39 (0.057)	0.836			
I feel that cycling is an indispensable leisure and sporting activity in my life	3.39 (0.056)	0.785			
I get pleasure from cycling	3.47 (0.055)	0.815			
I think cycling makes me feel better mentally	3.48 (0.059)	0.867			
Physiological benefit			0.885	0.719	0.889
Cycling helps my body to heal and reduces the risk of illness	3.45 (0.046)	0.864			
It builds muscle and physique and makes me fitter	3.47 (0.046)	0.846			
Riding makes me feel more refreshed, energized and motivated	3.54 (0.046)	0.837			
Psychological benefit			0.885	0.658	0.862
It relieves my tension and stress and makes me feel much more relaxed	3.54 (0.044)	0.820			
Riding reduces negative emotions such as depression and enhances positive emotions	3.51 (0.043)	0.809			
Riding makes me forget my worries, feel good and enjoy life	3.52 (0.043)	0.756			
Riding helps to boost self-esteem and have a positive view of yourself	3.52 (0.044)	0.857			

Table 2. Cont.

Variables	Mean (SD)	Factor Loading	CR	AVE	Cronbach's α
Social benefit			0.849	0.653	0.846
I have made more friends by taking part in cycling	3.67 (0.042)	0.795			
Riding has fostered mutual trust with my friends	3.57 (0.041)	0.788			
Riding gives me more care from friends or the outside world	3.67 (0.043)	0.840			
Subjective well-being			0.845	0.577	0.837
I have fun riding	3.55 (0.046)	0.728			
I feel satisfied with my life when riding	3.47 (0.044)	0.793			
Riding gives meaning to my life	3.46 (0.041)	0.708			
Cycling brings harmony to my relationships	3.56 (0.046)	0.806			

Note: Model fit indices: $\chi^2/df = 1.698$, NFI = 0.958, CFI = 0.982, GFI = 0.953, AGFI = 0.937, RMSEA = 0.037, SRMR = 0.032. All the factor loads are greater than 0.5, and the p values are significant ($p < 0.001$).

The measurement model was also evaluated using confirmatory factor analysis (CFA). Table 2 shows the model fit indices that meet the cutoff points ($\chi^2/df = 1.155$, NFI = 0.910, CFI = 0.987, GFI = 0.910, AGFI = 0.901, RMSEA = 0.018, SRMR = 0.031) [55,57–59], which confirms that the measurement model fits well with the data.

Confirmatory factor analysis (CFA) was employed to assess the measurement model. The results presented in Table 2 indicate that the model fit indices meet the specified cutoff points ($\chi^2/df = 1.698$, NFI = 0.958, CFI = 0.982, GFI = 0.953, AGFI = 0.937, RMSEA = 0.037, SRMR = 0.032) [54,60,61]. These findings provide confirmation that the measurement model is a good fit for the observed data.

4.2.2. Validity Test

The assessment of validity primarily involves the examination of convergent validity and discriminant validity. Convergent validity pertains to the degree of correlation observed among various items that measure the same construct [61]. According to the criteria outlined by Hair et al. (2006), all factor loadings in the current study exceed 0.5, and the associated p values demonstrate statistical significance [56]. Additionally, it is evident from the data presented in Table 2 that the average variance extracted (AVE) exceeds the threshold of 0.5, while the composite reliability (CR) surpasses the minimum requirement of 0.6. [57]. This suggests that the latent variables exhibit strong convergence validity.

Discriminant validity pertains to the ability to distinguish between distinct variables [57]. Hu and Bentler (1999) posit that discriminant validity can be considered satisfactory when the square root of the average variance extracted (AVE) exceeds the correlation coefficient with other variables [58]. According to the results presented in Table 3, the correlation coefficients for each variable range from 0.220 to 0.464. The square root of the average variance extracted (AVE) for each variable surpasses its correlation coefficient with other variables, suggesting that the variables exhibit favorable discriminant validity.

Table 3. Discriminant validity and the correlations of variables.

Variables	Leisure Involvement	Physiological Benefit	Psychological Benefit	Social Benefit	Subjective Well-Being
Leisure involvement	0.828 *				
Physiological benefit	0.386	0.848 *			
Psychological benefit	0.220	0.305	0.811 *		
Social benefit	0.336	0.439	0.413	0.808 *	
Subjective well-being	0.464	0.403	0.379	0.430	0.760 *

Note: * indicates that the data are the square root of each variable AVE, and the rest of the data are the correlation coefficients between the variables.

4.3. Structural Model and Hypotheses Testing

4.3.1. Structural Model Goodness-Of-Fit Test

The data underwent an examination for skewness and kurtosis in order to verify their adherence to normality. The range of skewness values observed in the data was -0.492 to -0.114 , while the range of kurtosis values was -1.043 to 0.051 . These findings suggest that the data followed a normal distribution [56].

Furthermore, a goodness-of-fit test was conducted on the structural model to assess the fit between latent variables. The findings of the study revealed that the structural model demonstrated a satisfactory fit to the collected data, as evidenced by the following fit indices: $\chi^2/df = 2.620$, NFI = 0.934, CFI = 0.958, GFI = 0.925, AGFI = 0.902, RMSEA = 0.056, and SRMR = 0.095 [56,58,59].

4.3.2. Hypotheses Test

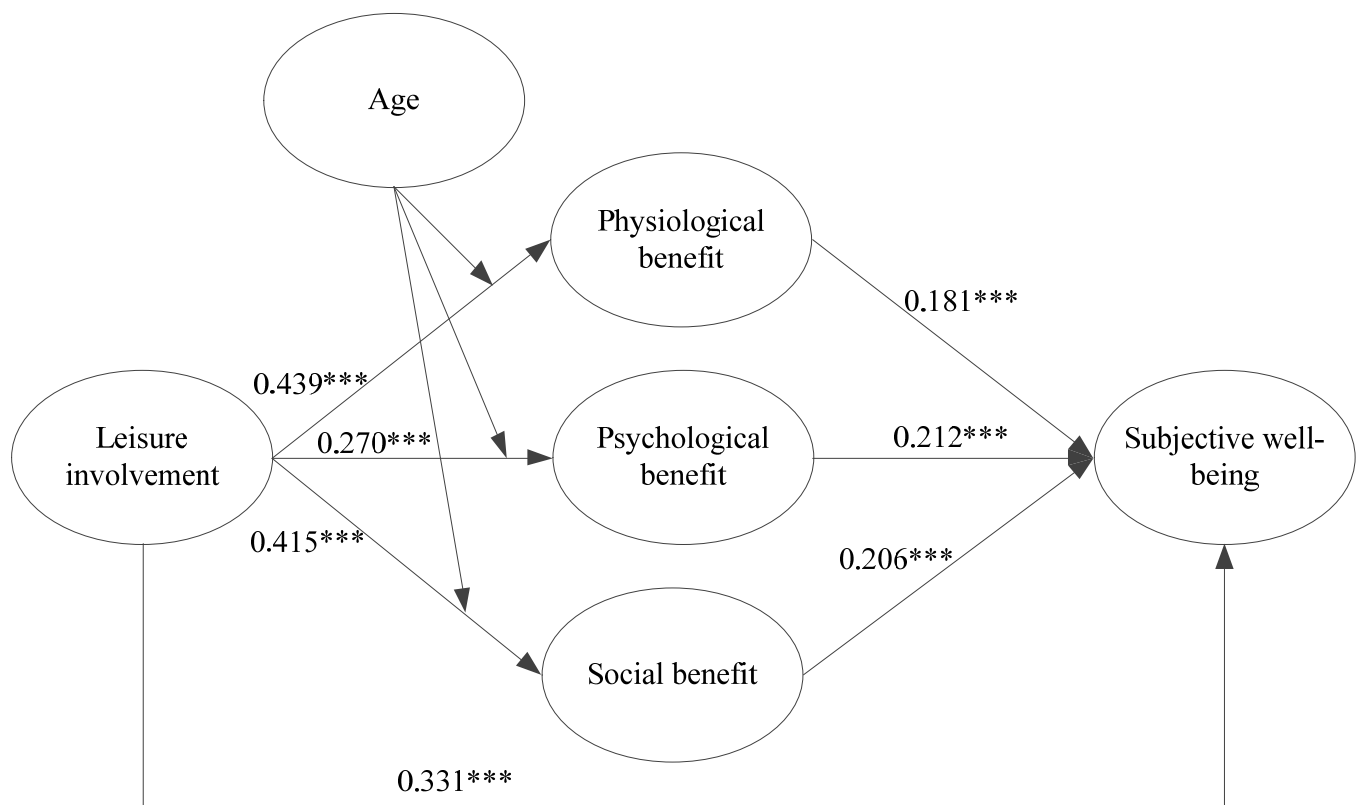
The research hypothesis proposed above was tested using structural equation model, and the findings are presented in Table 4 and Figure 3. The standardized path coefficient for H1a is 0.439 ($t = 9.370$, $p = 0.000 < 0.001$), suggesting that there is a statistically significant positive relationship between bicycle riders' leisure involvement and physiological benefit. Therefore, hypothesis H1a was confirmed. The standardized path coefficient for H1b is 0.270 ($t = 5.575$, $p = 0.000 < 0.001$), suggesting that there is a statistically significant positive relationship between the leisure involvement of bicycle riders and their psychological benefit. Therefore, hypothesis H1b was also confirmed. The standardized path coefficient for H1c is 0.415 ($t = 8.322$, $p = 0.000 < 0.001$), indicating a significant positive impact of bicycle riders' leisure involvement on social benefit. Thus, hypothesis H1c was found to be supported.

Table 4. Standardization path coefficient and hypothesis testing results.

Hypothesis Paths	Estimate	S.E.	t	p	Results
H1a: Leisure involvement → Physiological benefit	0.439	0.038	9.370	***	Support
H1b: Leisure involvement → Psychological benefit	0.270	0.036	5.575	***	Support
H1c: Leisure involvement → Social benefit	0.415	0.033	8.322	***	Support
H2: Leisure involvement → Subjective well-being	0.331	0.038	6.017	***	Support
H3a: Physiological benefit → Subjective well-being	0.181	0.041	3.783	***	Support
H3b: Psychological benefit → Subjective well-being	0.212	0.041	4.732	***	Support
H3c: Social benefit → Subjective well-being	0.206	0.051	4.189	***	Support

Note: *** < 0.001 .

The standardized path coefficient of H2 is 0.331 ($t = 6.017$, $p = 0.000 < 0.001$), suggesting that there is a statistically significant and positive relationship between the leisure involvement of bicycle riders and their subjective well-being. Therefore, the findings of this study provide support for Hypothesis 2 (H2). In addition, the standardized path coefficients for H3a, H3b, and H3c are 0.181, 0.212, and 0.206, respectively ($t = 3.783$, $p = 0.000 < 0.001$, $t = 4.732$, $p = 0.000 < 0.001$, $t = 4.189$, $p = 0.000 < 0.001$). The results demonstrate that the physiological benefit, psychological benefit, and social benefit of bicycle riders have significant positive impacts on their subjective well-being. Therefore, H3a, H3b, and H3c were all supported.



Note: *** $p < 0.001$

Figure 3. The hypothesis testing results.

4.4. Mediating Effect of Leisure Benefits

The current study employs leisure benefit as the mediating variable. To examine the mediating effect, this study utilized the Bootstrap method by conducting 2000 sampling tests and calculating the indirect effect. The results are presented in Table 5. The results showed that the bias-corrected 95% confidence interval (CI) of the indirect effect (the mediating effect) ranged from 0.034 to 0.139. Additionally, the percentile 95% CI ranged from 0.031 to 0.136. These findings provide evidence for the existence of the mediating effect of physiological benefit. Similarly, the bias-corrected 95% confidence interval of the indirect effect is 0.027 to 0.100 and 0.036 to 0.143, and the percentile 95% confidence interval is 0.025 to 0.096 and 0.035 to 0.142, indicating that the mediating effect of psychological benefit and social benefit also exists.

Table 5. Result of mediation effect analysis.

Hypothesis Paths	Path Effects	Effect Size	Bias-Corrected 95% CI		Percentile 95% CI		<i>p</i>
			Lower	Upper	Lower	Upper	
Leisure involvement → Physiological benefit → Subjective well-being	Indirect	0.080	0.034	0.139	0.031	0.136	0.001
Leisure involvement → Psychological benefit → Subjective well-being	Indirect	0.057	0.027	0.100	0.025	0.096	0.000
Leisure involvement → Social benefit → Subjective well-being	Indirect	0.085	0.036	0.143	0.035	0.142	0.001

Therefore, it can be concluded that the influence of the leisure benefit is partially mediated. In essence, the engagement of individuals in bicycling activities can both directly and indirectly have an impact on their subjective well-being. Therefore, H4 was found to be supported.

4.5. Moderating Effect of Age

This study investigated the moderating effect of age by utilizing a multi-group sample within a structural equation model. According to the findings presented in Table 6, it is evident that in the sample of young groups, the influence coefficient of leisure involvement on physiological benefit is 0.407 ($t = 5.530$, $p = 0.000 < 0.001$), indicating a significant relationship at the 0.001 level. In the sample of old groups, the influence coefficient of leisure involvement on physiological benefit is 0.374 ($t = 8.215$, $p = 0.000 < 0.001$), also demonstrating a significant relationship at the 0.001 level. Similarly, the influence of leisure involvement on psychological benefit and social benefit is also positively significant ($p = 0.000 < 0.001$).

Table 6. The moderating effect of age.

Hypothesis Paths	Young Group			Old Group		
	Estimate	<i>t</i>	<i>p</i>	Estimate	<i>t</i>	<i>p</i>
H1a: Leisure involvement → Physiological benefit	0.407	5.530	***	0.374	8.215	***
H1b: Leisure involvement → Psychological benefit	0.312	4.671	***	0.202	4.337	***
H1c: Leisure involvement → Social benefit	0.272	4.478	***	0.319	7.497	***

Note: *** $p < 0.001$.

In addition, it can be found from Table 6 that the influence coefficient of leisure involvement on physiological and psychological benefit for the sample of young groups is generally larger than that for the sample of old groups (0.407 vs. 0.304, 0.312 vs. 0.202). This suggests that the more leisure activities young people engage in, the more physiological and psychological benefits they will reap compared to old people. The influence coefficient of leisure involvement on social benefit for the sample of old groups is larger than that for the sample of young groups (0.319 vs. 0.272), demonstrating that the more leisure activities old people are involved in, the more social benefits they will gain.

In general, the findings of the study indicate that age plays a significant role in moderating the relationship between leisure involvement, physiological benefit, and psychological benefit. Thus, hypotheses H5a, H5b, and H5c were all confirmed.

5. Discussion

5.1. Theoretical Implications

The present study offers several notable contributions to the extant body of literature. This study represents an initial attempt to empirically investigate and analyze the structural relationships between bicycle riders' leisure involvement, leisure benefits, and subjective well-being. Bicycle recreation indirectly encourages people to experience a slower lifestyle. It is a way to rebuild the ties with family and society that have been severed due to busyness. Despite the growing popularity of cycling as a leisure activity, there is a noticeable dearth of theoretical research in this field. Existing theoretical research primarily centers around topics such as training, physiology, biochemistry, sports medicine, and sports competition [10,62,63]. Although there are a few studies on cycling leisure activities, there still remains a dearth of adequate theoretical focus on the behavioral characteristics of cycling leisure activities and the possible personal benefits and social impacts. This study closes this research gap and examines the influences of participation in cycling leisure activities on their personal benefits and subjective well-being. The present study is

anticipated to establish a fundamental basis for subsequent investigations in this particular field, thereby fostering further substantial research endeavors.

Second, this study explores the three subdivided dimensions of leisure benefits and examines the mediating effects of leisure benefits in the influence of bicycle riders' leisure involvement on their subjective well-being. The majority of previous studies typically assess the overall leisure benefits experienced by bicycle riders, disregarding the various specific dimensions involved [10,11]. This study fills this research gap and verifies the three dimensions of leisure benefits: physiological benefits, psychological benefits, and social benefits. The outcomes of the reliability test, validity test, and confirmatory factor analysis demonstrate that the pertinent values align with the established statistical criteria. Additionally, the results also show that leisure involvement has a significant positive influence on bicycle riders' physiological, psychological, and social benefits as well as their subjective well-being. Bicycle riders' physiological, psychological, and social benefits also have positive impacts on their subjective well-being. Moreover, the mediating role of the three dimensions of leisure benefits is also verified. Thus, the application of the subdivision of leisure benefits is deemed necessary for future research.

Third, the current study acknowledges the moderating influence of age on the relationship between bicycle riders' leisure involvement and leisure benefits. Prior research has indicated that individuals belonging to distinct age cohorts may derive varying leisure benefits from engaging in leisure activities [18,19]. More specifically, it has been suggested that engagement in leisure activities can be beneficial for young individuals in effectively alleviating stress [20], while participation in leisure pursuits has been found to assist older adults in fostering social interactions and enhancing their feelings of belongingness and fulfillment [21]. Scholars have proposed that involvement in recreational activities can have positive effects on the ability of young individuals to effectively reduce stress [20]. Additionally, research has indicated that engaging in leisure pursuits can aid older adults in cultivating social interactions and augmenting their sense of belongingness and fulfillment [21]. Comparable findings were also observed in the present study. The findings show that age has significant moderating effects between leisure involvement and leisure benefits. Engaging in cycling leisure activities can yield more physiological and psychological benefits for young individuals, whereas older individuals can derive more social benefits from such activities.

5.2. Practical Implications

This study provides important practical insights into the construction and management of greenways in urban forest parks. First, it is imperative for managers overseeing urban forest parks to recognize the significance of greenways in relation to the physiological, psychological, and social benefits they offer, as well as their impact on subjective well-being. Consequently, these managers should proactively engage in the construction of greenways and the enhancement of associated infrastructure. With the rapid development of the economy and the improvement of the quality of life, cycling is favored by the public for being green, environmentally friendly and low-carbon, and has become one of the most popular sports among many outdoor leisure activities [10]. The managers of urban forest parks bear the responsibility of cultivating greenways and allocating resources towards the development of associated infrastructure. One potential approach to promoting cycling as a mode of transportation is to draw lessons from the successful practices implemented by European cities. This can be achieved by enacting local regulations that prioritize and accommodate cycling as a viable transport option. Additionally, raising awareness about the environmental and social advantages of cycling through mass media platforms can help emphasize the significance of cycling for recreational purposes.

Second, it is significant for managers overseeing urban forest parks to possess an understanding of the diverse impacts of cycling on various age cohorts. Consequently, they must ensure the provision of distinct infrastructural elements alongside greenways. The findings of the current study indicate that participating in cycling recreational pursuits can

result in greater physiological and psychological advantages for younger individuals, while older individuals can experience enhanced social benefits. Based on this discovery, it is recommended that managers of urban forest parks consider incorporating suitable resting areas, such as pavilions, along the greenways. This provision would cater specifically to the needs of the elderly population, facilitating opportunities for rest and the potential for expanding their social circles. Simultaneously, if conditions permit, it would be advantageous to construct rest and exercise facilities adjacent to the greenway, thereby affording young individuals increased opportunities for both physiological and psychological relaxation.

Third, it is recommended that urban forest parks consider periodically organizing cycling competitions as a means to enhance participation in cycling activities. Moreover, it is advisable for the pertinent departments to enhance the promotion of cycling in order to raise awareness among the general public regarding the advantages associated with engaging in cycling activities, thereby fostering the development of a sense of self-efficacy. In addition, individuals, particularly urban residents, are suggested to engage more in outdoor recreational pursuits, such as cycling, as a means to mitigate adverse emotional states and psychological strain, ultimately leading to heightened contentment and well-being. This study posits that the structural relationship between the leisure involvement of bicyclists, the benefits they derive from leisure activities, and their overall well-being can be seen as a manifestation of individuals' endeavor to lead a healthy and contented life within the context of the leisure-oriented society.

6. Conclusions

The significance of engaging in outdoor leisure activities has become increasingly prominent in individuals' lives due to the rapid growth of the economy and the increase in leisure time. This empirical study utilized structural equation modeling to investigate the structural relationships between leisure involvement, the three subdivided dimensions of leisure benefits (physiological benefits, psychological benefits, and social benefits), and subjective well-being among bicycle riders. Additionally, the study explored the moderating effect of age on the relationship between leisure involvement and leisure benefits. The results suggest that leisure involvement has a noteworthy and positive impact on the physiological, psychological, and social benefits experienced by individuals who engage in bicycle riding, as well as their overall subjective well-being. The subjective well-being of individuals is positively influenced by the physiological, psychological, and social benefits. Furthermore, the verification of the mediating role of the three dimensions of leisure benefits is also established. Additionally, the moderating role of age is also examined in the present study. The results suggest that participation in cycling leisure activity can have greater physiological and psychological benefits for younger individuals, while older individuals may experience more social benefits from engaging in such activities.

While the present study has laid a robust foundation for subsequent research, it is important to acknowledge its inherent limitations. First, the examination of the structural relationship in this study was limited to a single study site. Future research should aim to conduct similar studies in other case sites in order to assess and substantiate the findings of this research. Furthermore, the present study solely examined the moderating influence of age. Subsequent investigations could incorporate other potential moderating factors, such as gender, to enhance the comprehensiveness of the research. Third, the present study only analyzed and compared the differences between young and old groups (18–35 and over 60 years old), while ignoring the middle-aged group. It is recommended that future studies include this group for a more integrated and comprehensive comparative analysis.

Author Contributions: Conceptualization, L.W. and W.G.; methodology, L.W. and H.W.; software, H.W.; validation, L.W. and Y.D. (Yumin Duan); formal analysis, H.W.; investigation, W.G., M.Z., Y.L. and Y.D. (Yushunan Dai); resources, L.W.; data curation, L.W.; writing—original draft preparation, L.W., W.G., Q.W. and H.W.; writing—review and editing, L.W. and W.G.; visualization, L.W.; supervision, L.W.; project administration, L.W.; funding acquisition, W.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Social Science Fund of China [21CH197], The Humanities and Social Sciences Research Planning Fund Project of the Ministry of Education “Research on the Design and Preliminary Implementation of College Sports Comprehensive Service Application Program (APP)” [18YJA890004], the China Postdoctoral Science Foundation [2023M731716], General project of China Resources & Environment and Development Academy [070-803165], 2020 Central University Basic Scientific Research Business Fee Humanities and Social Sciences Fund [SKYZ2020022], and Jiangsu Province Education Science “Thirteenth Five-Year Plan” Project [D/2020/01/59].

Data Availability Statement: Data available on request.

Acknowledgments: The authors would like to acknowledge the helpful support received from the respondents in the field data collection.

Conflicts of Interest: The authors declare no conflict of interest.

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