

The impact of physical activity participation on subjective well-being among middle-aged adults: The parallel mediating roles of perceived social fairness and aging anxiety

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ABSTRACT

The paper employs a large-scale dataset on physical exercise and subjective well-being in China to conduct an empirical analysis of the variables by using a national representative dataset of the society. Findings suggest the following: (1) physical exercise can be clearly shown to have significant positive effect on subjective well-being in middle-aged adults, (2) perceived social fairness and aging anxiety is shown to exhibit substantial mediating effects within the relationship that existed between physical exercise and subjective well-being, (3) demographic factors, such as gender, household registration, and educational level, are shown to have group differences in the specific pathways. The following policy suggestions can be offered: (1) the inclusion of sport participation space should be contributed to with an aim at making fairness perception well; (2) aged anxiety should be targeted by instituting interventions aimed at enhancing the conception of psychological resilience; (3) differentiated support strategies should be developed based on vulnerable groups; (4) institutional guarantee systems should be introduced to sustain participation; and (5) the cultural identity of the aging should be restructured to upgrade the concepts of values.

Keywords: Sport medicine, Physical exercise, Middle-aged adults, Subjective well-being, Perceived social fairness, Aging anxiety.

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INTRODUCTION

By the year 2023 the number of people aged 60 years or above in China is expected to be at 297 million which forms 21.1 percent of the total population of the country. This is a demographic shift that has made the issue of aging a high-priority socio-cultural matter and an important component of the national development program. In the 2023 report released by the China National Health Commission, it was stated that the elderly population would have exceeded 400 million in 2035 (which is over 30 percent of the total population) and thus clearly indicates the headlong rush towards a super-aged society. The improved happiness and fulfilment among older adults therefore has become a primary concern of the welfare of the people and a critical measure in the national action to the aging of the population.

Exercise has been generally recognized as an important factor of both physical and mental condition, and contributor to societal absorption. Empirical research proved that sports activities regularly lead to quality of life enhancement in various age and gender-based groups (Gill et al., 2013). A large amount of literature has established that there is a positive correlation between sports involvement and personal health (Bae, 2022; Balish, Conacher, & Dithurbide, 2016), that support the positive impact of sports involvement in the lowering of social anxiety (Ustundag, Haydaroglu, Sayan, & Gungor, 2025), building up social capital (Biernat, Nalecz, Skrok, & Majcherek, 2020), and increasing life satisfaction (Dings & Spinath, 2024). A lot of the literature that exists however tends to favour either the younger or the older population and not necessarily between middle-aged cohorts. Moreover, the underlying mechanisms including physiological health, emotional control, and social connectedness have not been well investigated and differences between subgroups characterized by household registration (hukou) status or education level are rarely studied.

Using the biological, behavioural, and environmental factors in adopting a life-course perspective, aging is seen as a process that occurs over the whole lifespan (Cho, Martin, Poon, & Georgia Centenarian, 2015). In this regard, there is life-course approach to active age suggested by scholars who have stressed that interventions be enacted at early and middle life stages to counter health risks later in life (Foster & Walker, 2021). In line with this paradigm, the current research will consider the middle aged as the subject of the research to examine the mechanisms through which physical workouts affect subjective wellbeing among this group.

In order to fill these gaps, the present study applies the data collected in online survey using the Chinese General Social Survey (CGSS), 2021 to discuss the issue of the connection between frequency of exercising and self-reported well-being among middle-aged adults. In particular, the following research questions are established.

1. Do physical exercise and subjective well-being have a positive correlation among middle-aged adults?
2. How do the mechanisms of affecting the perceptions of happiness about individuals work on the background of physical activity?
3. Are these effects varying among subpopulations in terms of their health status, household registration and education level?

Answering these research questions, the current study contributes to the existing empirical knowledge in terms of active aging and provides evidence-based information about the possibility to improve well-being by means of involving in physical exercise. Additionally, the results have practical implications on the formulation of health promotion policies that target the ageing populations.

Literature review and research hypothesis

Findings of impact of sports participation on well-being

Subjective well-being (SWB) is the overall judgment of life and living expressed by the individual in terms of his or her life satisfaction, moods, and meaning or sense in his or her life (Diener, 2012). A considerable amount of research has proven that the subjective wellbeing gives positive impacts on the physical and mental health outcomes. Precisely in the case of the older adult population, high subjective well-being has been associated with the reduced occurrence of long-term physical ailments, such as cardiovascular disease (CVD), diabetes, stroke, depression, cancer (Okely & Gale, 2016), and chronic lung disease (Stellar et al., 2015). Moreover, those who portray a greater level in subjective well-being would have more chances to participate in health-enhancing behaviours (Danner, Snowdon, & Friesen, 2001) and are in high levels of mental health status (De Souza, De Carvalho, & Ferreira, 2018).

The correlation of physical exercise and wellbeing has also been studied widely under various fields of study such as physiology, psychology, sociology, and economics (Balish et al., 2016; Woodman et al., 2009). Indicatively, Ruseski, et al (2014) determined that engagement in sporting activities is associated with high levels of well-being (Ruseski, Humphreys, & Hallmann, 2014). On the same note, a cross-sectional analysis conducted on 2,345 participants found that, there was a significant positive relationship between physical activity and life satisfaction as well as well-being among middle-aged and old individuals (An et al., 2020). Moreover, a randomization controlled trial revealed that a randomized regimen of Pilates exercises performed three times a week significantly improved the effects of depressive symptoms and well-being in the elderly (Ravari, Mirzaei, Bahreman, Raeisi, & Kamiab, 2021). As the evidence presented in favour of the positive correlation between an exercise regimen and subjective well-being is strong, the current study develops the following hypothesis:

H 1: Greater subjective well-being (SWB) is related to more frequent physical activity.

The intermediary role of perceived social equity

Perceived social fairness is the measure related to how individuals would assess the extent to which the allocation of societal resources is fair and equitable. Such idea involves judgements on what is right or fair on areas like the allocation of wealth and income, employment, and rights and treatment of rural-urban areas, pension and social security benefits (Gao & Zhao, 2021; Zhi et al., 2022). Empirical studies have shown that a continuous sense of injustice may give rise to strong negative emotion and make people more vulnerable to shape the negative or unforeseen consequences negatively, which impair both the physical and mental health. The effects are manifested through high levels of obesity and depression (Hunte & Williams, 2009; Meier, Semmer, & Hupfeld, 2009). In the equity theory introduced by Adams, (1963), people can have positive affective reactions when they view things as fair and negative emotional reactions when they view them as unfair (Adams, 1963). In line with empirical results on the association of increased perceptions of social fairness and better subjective well-being (Liu et al., 2021; Scarpa, Di Martino, & Prilleltensky, 2021), the current study presents the following hypothesis:

H 2: The subjective well-being of the individuals is positively related with their perception of social fairness.

Even though there are no direct empirical methods that can directly relate physical activity engagement to the perceived social fairness, the literature in this area indicates that regular exercise might enhance the perceived fairness of individuals in a variety of ways. In an illustration, exercise has been proved to increase physical and mental health along with encouraging social trust and prosocial behaviours (Di Bartolomeo & Papa, 2019) as well as perceived social support (Sui, Zhao, Na, Liu, & Zhang, 2024). Moreover, these health

and psychosocial resource influences linked to the exercise have been demonstrated to have positive influences on subjective well-being (Kim, Ryu, Lee, Kim, & Heo, 2021). Taking into consideration these results the following hypotheses are introduced:

H3: Perceived social fairness in frequent engagement in physical activity is positively related.

H4: Perceived social fairness acts as a beneficial mediator in the physical activity engagement to subjective wellbeing.

Mediating role of the aging concerns

Aging anxiety refers to the negative effects of emotions with respect to the aging process, such as fears of physical degradation, the freedom of action, fear of intellectual decline (Yawar et al., 2024). This construct represents fears of health decline, economic instability, and mental debilitation of individuals and can, thus, contribute to already existing negative stereotyping of ageing such as the assumption that loneliness and later life disability are inescapable, thus having a detrimental effect on perceptions of self-mental health (Lynch, 2000; Ramírez & Palacios-Espinosa, 2016). Empirical studies have shown that aging anxiety does not necessarily lead to a lowered subjective wellbeing, but actually can lead to further physical degradation, creating a vicious circle of effect of anxiety-health degradation precisely to the disadvantage of both physical and mental wellbeing (Lukaschek, Vanajan, Johar, Weiland, & Ladwig, 2017). Furthermore, according to Lukaschek, et al (2017), aging anxiety produced the greatest effect of the factors studied by influencing well-being negatively, and women were much more affected by this factor than men. Considering these findings, the given study has the following hypothesis:

H5: Aging anxiety has a negative and significant relationship between their subjective well-being and high levels of aging anxiety.

Socially, physical exercise has the potential to reduce anxiety of aging and to lead to improved life satisfaction, through improved social integration and reducing the sense of loneliness (de Oliveira, Souza, Rodrigues, Fett, & Piva, 2019; Yi & Hwang, 2015). Physiologically, exercise brings out the release of endorphins/neurotransmitters, which are associated with enhanced moods and suppression of stress, anxiety, and decrease depression symptoms, and hence it promotes relaxation and general wellness (Ferrer-Uris, Ramos, Busquets, & Angulo-Barroso, 2022; Goodwin & Stein, 2021). A recent literature review by Ewuzie and Aderinto (2024) further supported the idea that there are both the social and biological means that also reduce the level of anxiety among the elderly (Ewuzie, Ezeano, & Aderinto, 2024). On the ground of these insights, the hypotheses developed are as follows:

H6: When physical activities become more frequent, anxiety about aging becomes lower.

H7: There is an overall mediating role of anxiety in aging in the relationship between physical activity frequency and subjective well-being.

Several of the questions I have previously answered revolve around group differences in sports participation

The question of gender is one of the essential demographic factors of research on sports participation. Previous research has recorded the consistent increase in the rate of sports participation amongst men in relation to women (Moreno-Llamas & García-Mayor, 2022; Talebpour, Nazari Azad, & Kashani, 2019). However, to the contrary, a recent cross-sectional study of Chinese adults showed that the female gender was more inclined towards physical activity as compared with men and that the Han population was more

likely to be involved in it as compared to ethnic minorities (Peng, Yang, Chang, & Liu, 2025). Regarding gender-related impacts, a study carried out in the United Kingdom showed that women who participate in athletics indicate greater amounts of well-being as compared to non-participants of the same sex with similar traits (McHale & Forrest, 2009). However, exercise is a factor in creating greater happiness in both genders, men seem to gain a greater level of happiness (Huang & Humphreys, 2010).

The effect of education level and the geographical area in sport participation has also been highlighted. There has been empirical evidence of people with higher education levels being more likely to engage in physical activity through the fact that education levels lead to increased awareness of health and appreciation of the positive effect of exercise (Hallmann, Breuer, & Beermann, 2023). Moreover, people in countryside are less interested in sports recreation than urban residents are (Chen et al., 2017). Taken together, the results of the most recent study that used the data provided by the China Social Survey estimated the relationships between sports participation and happiness empirically and showed that the positive advantages of engagement in physical activity towards well-being vary among different population subgroups (Li, Ning, & Xia, 2023). Taken together, the findings of the given studies mean that the mechanisms by which sports participation is related to happiness are statistically different between different population groups. Accordingly, we hypothesize:

H8: The pathways through which sports participation can influence the well-being of middle-aged adults are different based on gender and hukou status and educational level.

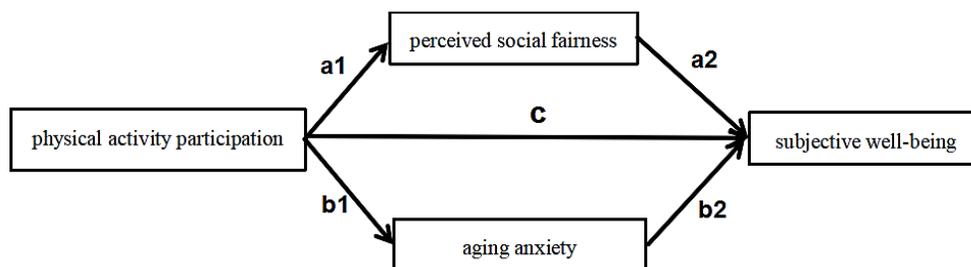


Figure 1. Research model flowchart.

RESEARCH DESIGN

Data source

The statistics used in this research were taken in 2021 as a result of the Chinese General Social Survey (CGSS). To select the sample population, a multi-stage stratified random sampling methodology was used. This survey covered 28 provincial-level administrative regions in China without considering the Xinjiang, Tibet, Hainan and the Hong Kong, Macao and Taiwan regions. The collected data were considered of excellent quality and representative following the rigorous quality control procedures. The demographic data, lifestyle, health status, and social attitude of the respondents were also sought through the survey instrument, which led to a final sample size of 8,148 people. To facilitate this study, the sample population was limited to people between the ages of 45 and 60 years. Having resolved missing data and reverse coded, and reclassified some variables, the analytic sample finally comprised 1,347 respondents.

Variable selection

This study has subjective well-being as the dependent variable. (1) The CGSS questionnaire can directly get subjective well-being. The question is A36 Overall, what are your general satisfaction with life? Points will be

rated as follows: "Very happy" = 5, "Fairly happy" = 4, "Neither happy nor unhappy" = 3, "Fairly unhappy" = 2, "Very unhappy" = 1.

An independent variable was used; participation in physical exercise. The question found in CGSS questionnaire; A30.9 How often do you exercise in your free time in the last one year? was inversed to provide an evaluation of participation. Options scoring was as follows; "Every day" = 5, "Several times a week" = 4, "Several times a month" = 3, "Several times a year or less" = 2, and "Never" = 1. Increased values were a sign of increased exercise.

These mediating variables are divided into two components: "aging anxiety" and the perceived social fairness. (1) In case with aging - related concerns, one uses the item E44 I worry that I will not be able to take care of myself when I am old). The answer options will have a mark of as follows: "Completely disagree" = 5, Disagree = 4, Neither agree nor disagree = 3, Agree = 2 and Completely agree = 1. The higher the scores, the less the aging-related apprehensions. (2) To the question of perceived social fairness, the question overall, how fair or unfair do you think the modern society is? is used. The following were the scores of the options; Completely fair = 5, Fair = 4, Neither fair nor unfair = 3, Unfair = 2, Completely unfair = 1. Such an increase in the score shows that the residents have a stronger sense of social fairness.

Table 1. Overview of sample distribution characteristics, n = 1347.

Category		Frequency	Percentage	Cumulative percentage
Gender	Male	626	46.5	46.5
	Female	721	53.5	100.0
Education Level	Junior high school or below	1098	81.5	81.5
	High school/ Technical secondary school	169	12.5	94.1
	College or above	80	5.9	100.0
Household Registration	Agricultural	1038	77.1	77.1
	Non-agricultural	309	22.9	100.0
Subjective well-being	Very unhappy	25	1.9	1.9
	Unhappy	74	5.5	7.3
	Neither happy nor unhappy	168	12.5	19.8
	Happy	720	53.5	73.3
	Very happy	360	26.7	100
Physical activity participation	Never	630	46.8	46.8
	Several times a year	121	9.0	55.8
	Several times a month	108	8.0	63.8
	Several times a week	155	11.5	75.3
	Daily	333	24.7	100
Aging anxiety	Strongly disagree	65	4.8	4.8
	Disagree	235	17.4	22.3
	Neither agree nor disagree	118	8.8	31.0
	Agree	568	42.2	73.2
	Strongly agree	361	26.8	100.0
Perceived social fairness	Completely unfair	65	4.8	4.8
	Fairly unfair	188	14.0	18.8
	Can't say it's fair but not unfair either	218	16.2	35.0
	Fairly fair	723	53.7	88.6
	Completely fair	153	11.4	100.0
	Total	1347	100.0	

There were four demographic variables used including (1) Gender: 1s: male, 2s: female. (2) Education level 1 = lower secondary and below, 2 = upper secondary and vocation school and 3 = associate degree and higher. (3) Household registration: 1 agricultural, 2 non- agricultural. (4) Self rated socioeconomic status: Lower - middle is combined and rated 1, Middle rated 2, and Upper - middle/ upper rated 3. Table 1 displays the properties of sample distribution.

Statistical analysis

Statistical analysis was done using SPSS 20.0 and AMOS 24.0. The first one was the analysis of common method bias and multicollinearity via SPSS 20.0. After that, the fit and path coefficients of the structural equation model were tested with AMOS 24.0. Then, the mediating effect analysis was done by the Bootstrap methodology. Lastly, multigroup path analysis has been done concerning demographical variables.

RESULTS

Common method bias and collinearity

A single-factor test that was conducted by Harman was done before the analysis in order to achieve rigor. The first cause of variance, as shown by an unrotated principal component analysis of all the variables, was 37.01, which was less than the 40 percent mark. Also, all variable variance inflation factors (VIF), 1.0061.018, were significantly lower than 10 and did not cause any indication of intense common methods bias or multicollinearity.

Correlation analysis and descriptive statistics

Table 2 gives the means, standard deviations and Pearson correlation matrix of the variables. The findings showed that the frequency of exercise had a significant and positive association with perceived social fairness, perceived aging-related concerns, and perceived happiness, and also that perceived social fairness was associated with aged-related concerns and perceived happiness. These correlates facilitate the testing of hypotheses that follow.

Table 2. Descriptive statistics and correlations among variables, n = 1347.

Variable	Mean	Standard Deviation	1	2	3	4
Physical activity participation	2.58	1.701	1			
Perceived social fairness	3.53	1.137	.083**	1		
Aging anxiety	3.69	1.179	.069*	.046	1	
Subjective Well-being	3.98	.883	.167**	.335**	.121**	1

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

Model fit and path analysis

Structural equation modelling (SEM) was used to test hypothesized model, which involves a general test of model as well as a distance individual test on relationships between latent constructs. The outcomes showed that there is a good model data fit: CMIN /DF = 2.181, RMSEA = 0.030, CFI = 0.995, TLI = 0.967, NF I = 0.990, and it is possible to continue with the subsequent phases of analyses.

As illustrated in Table 3, the path analysis reveals that the physical exercise participation is directly positively predicted to perceived social fairness (-0.083 , $p < .05$), aging-related concerns (-0.069 , $p < .05$), and Subjective Well-being (-0.134 , $p < .001$). There were also perceived social fairness and concerns about aging-related, which positively predicted Subjective Well-being using a direct effect (0.319 , $p < .001$; 0.097 , $p < .001$, respectively).

Table 3. Analysis of direct effects among overall variables, n = 1347.

Path	Estimate	S.E.	C.R.	p - Value	Label
Perceived social fairness <---physical activity participation	0.083	.016	3.059	.002	a1
Aging anxiety <---physical activity participation	0.069	.019	2.539	.011	a2
Subjective well-being <---perceived social fairness	0.319	.022	12.580	***	b1
Subjective well-being <---aging anxiety	0.097	.019	3.843	***	b2
Subjective well-being <---physical activity participation	0.134	.013	5.277	***	c

According to the model fit particularly, this research employed a bias corrected and non-parametric percentile bootstrap test to test out the mediating effects as well as to estimate confidence intervals. When the 95% interval fails to contain 0, then the indirect effect is said to be significant. Table 4 shows that perceived social fairness (95% CI: 0, 0.006) and aging anxiety (95% CI: 0.001, 0.007) were partially mediating the association between physical exercise and happiness. The two mediating effects combined three point two and four point six percent of the overall effect, respectively, and the difference between the two mediating effects of the two variables failed to give significant results ($p > .05$).

Table 4. Analysis of mediating effects, n = 1347.

Path	Mediating Effect	Proportion of Total Effect	95% Confidence Interval		
			Lower	Upper	p - Value
ind1:physical activity participation → perceived social fairness → subjective well-being	.002	3.2%	0.000	0.006	.014
ind2: physical activity participation → aging anxiety → subjective well-being	.003	4.6%	0.001	0.007	.014
Total Effect: ind1+ind2+c	.075		0.049	0.100	.001
Contrast Effect: ind1-ind2	-0.001		-0.004	0.001	.4

Multi-group path analysis of the effects of physical exercise on the elderly happiness

The result of the multi-group path analysis on demographic characteristics (gender, household registration, and the level of education) indicates that exercise is successful in improving the perceived social fairness of men but not women. Perceived social fairness and aging related issues increase happiness among rural inhabitants but this is not relevant to urban residents. Those people having junior high school education or lower will find exercising more advantageous. Perceived Social fairness affects Subjective Well-being among individuals who have a vocational or high school education. In case of people who have an associate degree or higher education, the direct and positive impact on Subjective Well-being was determined only by physical exercise. Table 5 provides the results of multigroup analysis.

Table 5. Results of multi-group analysis, n = 1347.

Category		a1	a2	b1	b2	c
Gender	Male	0.11**	0.072	0.341***	0.082*	0.157***
	Female	0.051	0.055	0.297***	0.107**	0.113**
Household Registration	Agricultural	0.064*	0.074*	0.341***	0.123***	0.085**
	Urban	0.17**	0.02	0.247***	-0.007	0.211***
Education Level	Low	0.076*	0.083**	0.335***	0.088**	0.126***
	Medium	0.113	-0.151*	0.29***	0.053	-0.037
	High	0.116	0.006	0.119	0.2	0.215*

Note: *p < .05, **p < .01, ***p < .001.

DISCUSSION

The direct impact of physical exercise on subjective well-being

Physical exercise enhanced the Subjective Well-being of middle-aged adults ($\beta = 0.134, p < .001$). This is in line with the analyses of many domestic and international scholars. Relevant studies have found a positive correlation between the subjective well-being of the elderly and their physical condition under the domain of physical function (Li et al., 2023; Patria, 2022). As the physical organs of the elderly gradually age and their self-care ability decreases, negative emotions such as helplessness and low self-esteem naturally reduce their Subjective Well-being (Baltes & Smith, 2003; Lara, Vazquez, Ogallar, & Godoy-Izquierdo, 2020). However, physical exercise can effectively improve the physical function of older adults and reduce negative emotions from both physiological and psychological perspectives. This study confirms the conclusions of previous research.

The mediating role of perceived social fairness and aging-related worries

Perceived social fairness (95% CI: 0.000, 0.006) and aging-related worries (95% CI: 0.001, 0.007) partially mediated the relationship between physical exercise and Subjective Well-being, accounting for 3.2% and 4.6% of the total effect, respectively. Physical exercise is an important means of promoting social equity (Adamson, Adamson, & Clarke, 2022). It mainly reconstructs social networks through participation in sports activities, enhances social capital, and thereby improves residents' sense of social fairness. Sui, Zhao and Liu (2023) empirically tested that participation in physical exercise significantly positively affects residents' sense of social fairness in China. Social fairness has also been shown to exert a significant positive influence on the subjective well-being of older adults (Sui, Zhao, & Liu, 2023). Physical exercise provides a platform for interaction, promoting contact and exchange among people of different sexes, occupations, and ages. This helps reduce stereotypes and prejudices, enhances social inclusiveness, and may improve the perception of fairness.

As age increases, social interaction decreases, and physical function declines, middle-aged adults gradually face the negative impacts of aging. However, physical exercise can enhance self-control over physical function and eliminate the interference of negative emotions, thereby effectively improving the Subjective Well-being of middle-aged adults. Asmundson, G. J, et al (2013) found that the elderly can promote communication and interaction with others by participating in various activities, reducing the likelihood of experiencing negative emotions such as loneliness, and thus having a higher level of Subjective Well-being (Asmundson et al., 2013). Older adults with higher levels of physical exercise can better enjoy life, improve their positive emotions, and reduce the generation of negative emotions (Powell, 2018). They can overcome age-related worries about future physical decline through a positive mindset and have a more positive evaluation of reality. Relevant research supports the existence of this mediating effect.

Heterogeneous analysis of the impact of physical exercise

Previous studies have noted that demographic and social characteristics, such as marital status, education level, occupation, and age, lead to differences in participation in physical exercise and its effects. This study further uses gender, household registration, and income as the basis for the multi-group analysis. Physical exercise can effectively enhance the sense of social fairness among males ($\beta = 0.11, p < .01$), but its impact on females' sense of social fairness is not significant ($\beta = 0.051, p > .05$), which is consistent with the findings of Sui et al.(2023). In terms of household registration, perceived social fairness ($\beta = 0.074, p < .05$) and aging-related worries ($\beta = 0.123, p < .001$) can effectively improve the Subjective Well-being of rural residents, while their impact on urban residents is not significant ($\beta = 0.02, p > .05; \beta = -0.007, p > .05$). The results also confirmed significant urban-rural differences in the impact of sports participation on residents' Subjective

Well-being in China. In terms of education level, physical exercise can effectively enhance the sense of social fairness among people with lower education levels and reduce aging-related worries, thereby increasing the Subjective Well-being of middle-aged adults. However, the effects were not significant for people with medium and higher education levels. Domestic and international research suggests that education level moderates sports participation, with higher education levels being associated with higher participation frequency and levels. This study divided educational levels into low, medium, and high groups to further analyse the differences in the mechanisms of sports participation among middle-aged adults. Fang et al (2024) conducted an empirical study based on CGSS (2010–2021) mixed cross-sectional data and found that sports participation has a more significant positive impact on the class identity of elderly people with lower education levels, while its positive impact on the class identity of elderly people with higher education levels is less obvious (Fang & An, 2024). This resonates with the findings of this study, indicating that the level of education is an important moderator of sports participation. Groups with higher education levels have relatively richer social resources; therefore, sports participation is not the only factor that enhances their sense of social fairness and Subjective Well-being. In contrast, groups with lower education levels have weaker risk resistance and higher demands for physical health; therefore, the promoting effects of sports are more significant.

CONCLUSIONS

As a reaction to the new global aging crisis, the subjective well-being of middle-aged adults has become the focus of the greatest pleasure of the society. This paper examined how physical exercise affects the subjective well-being of this group attribute based on the data of the China General Social Survey (CGSS). The relationship between physical exercise, perceived social fairness, aging-related concerns and happiness were empirically studied by the analysis. The main conclusions are as follows: First, there is a strong positive correlation between the frequency of physical exercise and subjective well-being among the middle-aged adults with higher levels of perceived well-being being associated with increased frequency of exercise. Second, physical exercise produces a direct influence on the subjective well-being as well as an indirect influence by increasing the sense of social fairness and reducing aging-related concerns. Third, it is interesting to note that the mechanisms by which physical exercise has an effect on subjective well-being differ significantly according to demographic characteristics, such as gender, degree of education, or status of household registration.

Implications

Theoretical implications

This paper extends the conceptual knowledge on the impact of physical exercise on the Subjective Well-being of middle-aged adults by affirming the concomitant mediation functions of perceived social fairness and age related concerns. This paper offers new findings to the research on health behaviours and social psychology.

To start with, it disrupts the one way health improvement pathway of the traditional theory of health promotion. This demonstrates that physical exercise has the capacity to enhance Subjective Well-being perception through rebuilding the social networks (e.g., increasing the perceived social fairness and mitigating aging-related concerns). This indicates that, the incorporation of a social-ecological approach along with the incorporation of structural social determinants (resource distribution as well as cultural values) should be incorporated in the health behaviour analysis model in future. Second, the assessment of the mediating role of aging-related concerns provided that physical exercise may improve the feeling of control over functions deterioration in individuals, diminish the presence of negative psychological expectancies, and transform the

positive aging theory into the paradigm of active intervention rather than passive adaptation. Third, the analysis of the moderating effect of gender, household registration, and the educational level according to the social stratification theory presents their differences in terms of their effects. This verifies the structural limits of disparate access to resources opportunities to health behavioural outcomes and offers a theoretical foundation of the so-called social empowerment role of sports sociation and its compensation processes on the vulnerable populations. Lastly, the interdisciplinary validation of the physical exercise to perceived social fairness to Subjective Well-being is a favourable direction to combine the sociology of sports and positive psychology. It also takes into its accounts the social justice theory in health behaviour study by how institutional influences may determine health through individual perceptions and it presents a comprehensive explanation of how the Subjective Well-being generation processes in an aging society take place.

Practical implications

The multidimensional intervention approach can be used to effectively promote the Subjective Well-being of middle-aged adults with the help of physical exercise. Integrative sports engagement conditions are supposed to be applauded in an endeavour to fortify the incidence of fairness. The allocation of sports resources in the public should be optimized, the activities of interaction between the groups should also be designed, the policy of protection of the rights should be publicized. The measures may help to allow equal participation of various genders and household registration groups and increase the mediating effect of perceived social fairness. Aging-related concerns require specific interventions in order to increase psychological strength. Mental health services should be incorporated with the exercise prescriptions, and mutual-aid groups and intergenerational support networks developed in the community. Such programs may assist the middle-aged adults to overcome their anxiety about the decline of their functions via change mechanisms of science and psychology. Differentiation support measures will be applied in order to address the needs of the vulnerable groups of workers. As an illustration, the programs of low-intensity, social-oriented exercise interventions may be created in women, the plans of exercise simplification offered to rural and low-education populations, and adaptive courses offered to people having sub-health problems to address the psychological and physical barriers. The system of institutions should be enhanced to a sustainable level. Government performances should also provide the coverage level of community sports centres and the level of participation of middle aged and old citizens. The piloting of the policy of the sports-health integration should be provided and a dynamic database should be created to monitor the changes in the Subjective Well-being and perceived social fairness to guarantee the long-term efficiency of intervention measures. Lastly, cultural perceptions that are related to age ought to be transformed to promote the values. Stereotype of aging as decline can be dispersed by the media campaigns, and national senior sports competition brands could be developed in order to enhance group self-efficacy and social value recognition. This will eventually cause a system of happiness promotion which is an interaction between an individual, society and the institutions

AUTHOR CONTRIBUTIONS

Conceptualization, D.P., N.Z., and J.L.; methodology, D.P., N.Z.; software, D.P.,; validation, D.P., N.Z., T.C., and Z.M.; formal analysis, N.Z., Y.T., and T.C.; investigation, D.P., N.Z., Y.T.; resources, T.C., X.L., and Z.M.; data curation, T.C., and D.P.; writing — original draft preparation, D.P. and Z.M.; writing — review and editing, N.Z., and J.L.; visualization, Y.T., and T.C.; supervision, X.L. and J.L.; project administration, X.L.; funding acquisition, X.L. All authors have read and agreed to the published version of the manuscript.

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REFERENCES

- Adams, J. S. (1963). Towards an understanding of inequity. *The journal of abnormal and social psychology*, 67(5), 422. <https://doi.org/10.1037/h0040968>
- Adamson, B., Adamson, M., & Clarke, C. (2022). Social justice through sport and exercise studies: A manifesto. *Journal of Sport and Social Issues*, 46(5), 407-444. <https://doi.org/10.1177/01937235221099150>
- An, H. Y., Chen, W., Wang, C. W., Yang, H. F., Huang, W. T., & Fan, S. Y. (2020). The Relationships between Physical Activity and Life Satisfaction and Happiness among Young, Middle-Aged, and Older Adults. *Int J Environ Res Public Health*, 17(13). <https://doi.org/10.3390/ijerph17134817>
- Asmundson, G. J., Fetzner, M. G., Deboer, L. B., Powers, M. B., Otto, M. W., & Smits, J. A. (2013). Let's get physical: a contemporary review of the anxiolytic effects of exercise for anxiety and its disorders. *Depress Anxiety*, 30(4), 362-373. <https://doi.org/10.1002/da.22043>
- Bae, M. H. (2022). Happiness Levels and Leisure Life Satisfaction for Sports Leisure Activities Participation: Implication for Physical Education in Korea. *Iran J Public Health*, 51(9), 2007-2016. <https://doi.org/10.18502/ijph.v51i9.10555>
- Balish, S. M., Conacher, D., & Dithurbide, L. (2016). Sport and Recreation Are Associated With Happiness Across Countries. *Res Q Exerc Sport*, 87(4), 382-388. <https://doi.org/10.1080/02701367.2016.1229863>
- Baltes, P. B., & Smith, J. (2003). New frontiers in the future of aging: from successful aging of the young old to the dilemmas of the fourth age. *Gerontology*, 49(2), 123-135. <https://doi.org/10.1159/000067946>
- Biernat, E., Nalecz, H., Skrok, L., & Majcherek, D. (2020). Do Sports Clubs Contribute to the Accumulation of Regional Social Capital? *Int J Environ Res Public Health*, 17(14). <https://doi.org/10.3390/ijerph17145257>
- Chen, C., Tsai, L. T., Lin, C. F., Huang, C. C., Chang, Y. T., Chen, R. Y., & Lyu, S. Y. (2017). Factors influencing interest in recreational sports participation and its rural-urban disparity. *PLoS One*, 12(5), e0178052. <https://doi.org/10.1371/journal.pone.0178052>
- Cho, J., Martin, P., Poon, L. W., & Georgia Centenarian, S. (2015). Successful aging and subjective well-being among oldest-old adults. *Gerontologist*, 55(1), 132-143. <https://doi.org/10.1093/geront/gnu074>
- Danner, D. D., Snowdon, D. A., & Friesen, W. V. (2001). Positive emotions in early life and longevity: findings from the nun study. *J Pers Soc Psychol*, 80(5), 804-813. <https://doi.org/10.1037/0022-3514.80.5.804>
- de Oliveira, L., Souza, E. C., Rodrigues, R. A. S., Fett, C. A., & Piva, A. B. (2019). The effects of physical activity on anxiety, depression, and quality of life in elderly people living in the community. *Trends Psychiatry Psychother*, 41(1), 36-42. <https://doi.org/10.1590/2237-6089-2017-0129>
- De Souza, L. N. N., De Carvalho, P. H. B., & Ferreira, M. E. C. (2018). Quality of life and subjective well-being of physically active elderly people: a systematic review. *Journal of Physical Education and Sport*, 2018(03). <https://doi.org/10.7752/jpes.2018.03237>

- Di Bartolomeo, G., & Papa, S. (2019). The effects of physical activity on social interactions: The case of trust and trustworthiness. *Journal of Sports Economics*, 20(1), 50-71. <https://doi.org/10.1177/1527002517717299>
- Diener, E. (2012). New findings and future directions for subjective well-being research. *Am Psychol*, 67(8), 590-597. <https://doi.org/10.1037/a0029541>
- Dings, A., & Spinath, F. M. (2024). Sports club participation impacts life satisfaction in adolescence: A twin study. *Psychol Sport Exerc*, 73, 102639. <https://doi.org/10.1016/j.psychsport.2024.102639>
- Ewuzie, Z., Ezeano, C., & Aderinto, N. (2024). A review of exercise interventions for reducing anxiety symptoms: Insights and implications. *Medicine (Baltimore)*, 103(41), e40084. <https://doi.org/10.1097/MD.00000000000040084>
- Fang, C., & An, Z. (2024). Mechanism and micro-evidence of the impact of physical exercise participation on household consumption carbon emissions. *Journal of Xi'an Physical Education University*, 41(2), 205-216+280.
- Ferrer-Uris, B., Ramos, M. A., Busquets, A., & Angulo-Barroso, R. (2022). Can exercise shape your brain? A review of aerobic exercise effects on cognitive function and neuro-physiological underpinning mechanisms. *AIMS Neurosci*, 9(2), 150-174. <https://doi.org/10.3934/Neuroscience.2022009>
- Foster, L., & Walker, A. (2021). Active Ageing across the Life Course: Towards a Comprehensive Approach to Prevention. *Biomed Res Int*, 2021, 6650414. <https://doi.org/10.1155/2021/6650414>
- Gao, S., & Zhao, J. (2021). The Influence of Perception of Social Equality and Social Trust on Subjective Well-Being Among Rural Chinese People: The Moderator Role of Education. *Front Psychol*, 12, 731982. <https://doi.org/10.3389/fpsyg.2021.731982>
- Gill, D. L., Hammond, C. C., Reifsteck, E. J., Jehu, C. M., Williams, R. A., Adams, M. M., . . . Shang, Y. T. (2013). Physical activity and quality of life. *J Prev Med Public Health*, 46 Suppl 1(Suppl 1), S28-34. <https://doi.org/10.3961/jpmp.2013.46.S.S28>
- Goodwin, G. M., & Stein, D. J. (2021). Generalised Anxiety Disorder and Depression: Contemporary Treatment Approaches. *Adv Ther*, 38(Suppl 2), 45-51. <https://doi.org/10.1007/s12325-021-01859-8>
- Hallmann, K., Breuer, C., & Beermann, S. (2023). Facilitating sporting and non-sporting career goals of elite athletes through mentoring programmes. *European Sport Management Quarterly*, 23, 1200-1220. <https://doi.org/10.1080/16184742.2021.1967420>
- Huang, H., & Humphreys, B. R. (2010). Sports Participation and Happiness: Evidence from U.S. Micro Data. <https://doi.org/10.4337/9780857930149.00013>
- Hunte, H. E., & Williams, D. R. (2009). The association between perceived discrimination and obesity in a population-based multiracial and multiethnic adult sample. *Am J Public Health*, 99(7), 1285-1292. <https://doi.org/10.2105/AJPH.2007.128090>
- Kim, A. C. H., Ryu, J., Lee, C., Kim, K. M., & Heo, J. (2021). Sport participation and happiness among older adults: A mediating role of social capital. *Journal of Happiness Studies*, 22, 1623-1641. <https://doi.org/10.1007/s10902-020-00288-8>
- Lara, R., Vazquez, M. L., Ogallar, A., & Godoy-Izquierdo, D. (2020). Psychosocial Resources for Hedonic Balance, Life Satisfaction and Happiness in the Elderly: A Path Analysis. *Int J Environ Res Public Health*, 17(16). <https://doi.org/10.3390/ijerph17165684>
- Li, C., Ning, G., & Xia, Y. (2023). Does exercise participation promote happiness?: Mediations and heterogeneities. *Front Public Health*, 11, 1033157. <https://doi.org/10.3389/fpubh.2023.1033157>
- Liu, Y., Li, L., Miao, G., Yang, X., Wu, Y., Xu, Y., & Yang, S. (2021). Relationship between children's intergenerational emotional support and subjective well-being among middle-aged and elderly people in China: The mediation role of the sense of social fairness. *International Journal of Environmental Research and Public Health*, 19(1), 389. <https://doi.org/10.3390/ijerph19010389>

- Lukaschek, K., Vanajan, A., Johar, H., Weiland, N., & Ladwig, K. H. (2017). "In the mood for ageing": determinants of subjective well-being in older men and women of the population-based KORA-Age study. *BMC Geriatr*, 17(1), 126. <https://doi.org/10.1186/s12877-017-0513-5>
- Lynch, S. M. (2000). Measurement and prediction of aging anxiety. *Research on Aging*, 22(5), 533-558. <https://doi.org/10.1177/0164027500225004>
- McHale, I., & Forrest, D. (2009). Public policy, sport and happiness: an empirical study working paper.
- Meier, L. L., Semmer, N. K., & Hupfeld, J. (2009). The impact of unfair treatment on depressive mood: the moderating role of self-esteem level and self-esteem instability. *Pers Soc Psychol Bull*, 35(5), 643-655. <https://doi.org/10.1177/0146167208331337>
- Moreno-Llamas, A., & García-Mayor, J. D. L. C.-S., E. (2022). Gender inequality is associated with gender differences and women participation in physical activity. *Journal of Public Health*, 44, e519-e526. <https://doi.org/10.1093/pubmed/fdab354>
- Okely, J. A., & Gale, C. R. (2016). Well-Being and Chronic Disease Incidence: The English Longitudinal Study of Ageing. *Psychosom Med*, 78(3), 335-344. <https://doi.org/10.1097/PSY.0000000000000279>
- Patria, B. (2022). Modeling the effects of physical activity, education, health, and subjective wealth on happiness based on Indonesian national survey data. *BMC Public Health*, 22(1), 959. <https://doi.org/10.1186/s12889-022-13371-x>
- Peng, L., Yang, Z., Chang, D., & Liu, C. (2025). Disparities in sports participation behavior among Chinese residents. *Scientific Reports*, 15, 8788. <https://doi.org/10.1038/s41598-025-92865-1>
- Powell, P. A. (2018). Individual differences in emotion regulation moderate the associations between empathy and affective distress. *Motiv Emot*, 42(4), 602-613. <https://doi.org/10.1007/s11031-018-9684-4>
- Ramírez, L., & Palacios-Espinosa, X. (2016). Stereotypes about old age, social support, aging anxiety and evaluations of one's own health. *Journal of Social Issues*, 72(1), 47-68. <https://doi.org/10.1111/josi.12155>
- Ravari, A., Mirzaei, T., Bahremand, R., Raeisi, M., & Kamiab, Z. (2021). The effect of Pilates exercise on the happiness and depression of elderly women: a clinical trial study. *J Sports Med Phys Fitness*, 61(1), 131-139. <https://doi.org/10.23736/S0022-4707.20.10730-8>
- Ruseski, J. E., Humphreys, B. R., & Hallmann, K. (2014). Sport participation and subjective well-being: Instrumental variable results from German survey data. *Journal of Physical Activity and Health*, 11(2), 396-403. <https://doi.org/10.1123/jpah.2012-0001>
- Scarpa, M. P., Di Martino, S., & Prilleltensky, I. (2021). Mattering Mediates Between Fairness and Well-being. *Front Psychol*, 12, 744201. <https://doi.org/10.3389/fpsyg.2021.744201>
- Stellar, J. E., John-Henderson, N., Anderson, C. L., Gordon, A. M., McNeil, G. D., & Keltner, D. (2015). Positive affect and markers of inflammation: discrete positive emotions predict lower levels of inflammatory cytokines. *Emotion*, 15(2), 129-133. <https://doi.org/10.1037/emo0000033>
- Sui, X., Zhao, B., & Liu, J. (2023). The impact of physical exercise participation on Chinese residents' sense of social equity: An empirical analysis based on CGSS2021 data. *China Sport Science and Technology*, 59(12), 18-24.
- Sui, X., Zhao, B., Na, D., Liu, J., & Zhang, Q. (2024). The relationship between physical exercise and sense of social fairness among college students: the chain-mediated role of perceived social support and life satisfaction. *Frontiers in Psychology*, 15, 1430492. <https://doi.org/10.3389/fpsyg.2024.1430492>
- Talebpour, A., Nazari Azad, M., & Kashani, M. (2019). Sociological analysis of gender inequality in sport (The perspective of female National Hero Athlete). *Quarterly Journal of Woman and Society*, 10, 289-316.
- Ustundag, A., Haydaroglu, S., Sayan, D., & Gungor, M. (2025). The relationship between social anxiety levels and effective communication skills of adolescents participating in sports. *Sci Rep*, 15(1), 15724. <https://doi.org/10.1038/s41598-025-00800-1>

- Woodman, T., Davis, P. A., Hardy, L., Callow, N., Glasscock, I., & Yuill-Proctor, J. (2009). Emotions and sport performance: an exploration of happiness, hope, and anger. *J Sport Exerc Psychol*, 31(2), 169-188. <https://doi.org/10.1123/jsep.31.2.169>
- Yawar, R., Khan, S., Rafiq, M., Fawad, N., Shams, S., Navid, S., & Butt, T. A. (2024). Aging is inevitable: Understanding aging anxiety related to physical symptomology and quality of life with the mediating role of self-esteem in adults. *International Journal of Human Rights in Healthcare*, 17(2), 170-185. <https://doi.org/10.1108/IJHRH-05-2022-0047>
- Yi, E. S., & Hwang, H. J. (2015). A study on the social behavior and social isolation of the elderly Korea. *J Exerc Rehabil*, 11(3), 125-132. <https://doi.org/10.12965/jer.150215>
- Zhi, K., Tan, Q., Chen, S., Chen, Y., Wu, X., Xue, C., & Song, A. (2022). How does social security fairness predict trust in government? The serial mediation effects of social security satisfaction and life satisfaction. *International Journal of Environmental Research and Public Health*, 19(11), 6867. <https://doi.org/10.3390/ijerph19116867>

