Influence of Life Meaning on Subjective Well-Being of Older People: Serial Multiple Mediation of Exercise Identification and Amount of Exercise

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Objective: This study aimed to explore the relationship between life meaning and subjective well-being among older people and the mediating role of subjective exercise identification and objective amount of exercise.

Methods: A total of 352 older respondents completed four questionnaires: the Chinese life meaning scale, the University of Newfoundland Happiness Scale, the physical activity habits questionnaire, and the exercise identification questionnaire designed for this study.

Results: Gender differences existed in the respondents’ perception of life meaning, and men had a better perception of life meaning ($t = 2.28$, $SE = 0.63$, $p < 0.05$). There were age differences in the subjective well-being of older people ($F = 5.69$, partial $\eta^2 = 0.03$, $p < 0.01$); the subjective well-being of older individuals steadily declines with rising age. Life meaning not only directly affected the subjective well-being of the respondents but also indirectly influenced their subjective well-being through the following three pathways: life meaning $\rightarrow$ exercise identification $\rightarrow$ subjective well-being (mediating effect of 22%); life meaning $\rightarrow$ amount of exercise $\rightarrow$ subjective well-being (mediating effect of 22%); and life meaning $\rightarrow$ exercise identification $\rightarrow$ amount of exercise $\rightarrow$ subjective well-being (serial multiple mediation effect of 27%).

Conclusion: The more positive the life meaning perception of older people is, the higher their experience of subjective well-being. For older people to sense the meaning of life, we recommend that they realize the importance of physical activities and take the initiative to engage in physical activities to obtain higher subjective well-being.

Keywords: subjective well-being, amount of exercise, exercise identification, life meaning, older people

INTRODUCTION

According to recent data from the National Bureau of Statistics of China (1), the number of people in China has exceeded 240 million, accounting for 17.3% of the total population, and the number of people aged 65 years or above is nearly 160 million, representing 11.4% of the total population. It is generally believed that a society is aging when people aged over 60 years account for 10% of the total population in a given country (2), implying that China has become an aging society. Thus, it is important to pay attention to the quality of life and subjective well-being of older people in China.
Subjective well-being refers to individuals’ overall evaluation of their quality of life at a certain stage based on the selected cognitive and emotional standards they set (3). Specifically, the cognitive component refers to life satisfaction, and the emotional component includes both positive and negative emotions. Life meaning is also known as individual meaning, Steger et al. (4) define it as individuals’ perceptions of themselves as human beings, the essence of their existence, and the things that are the most important to them. It includes two dimensions: existential meaning and search for meaning. Existential meaning is the degree to which an individual perceives his or her life as meaningful, while the search for meaning is the degree to which an individual actively searches for the meaning of life and emphasizes the process (5). Both life meaning and subjective well-being are regarded as the most important components of a happy life (6), important qualities of an individual’s positive psychology and the cornerstone of a better life (7). Moreover, life meaning can affect subjective well-being (8). Specifically, individuals with a sense of life meaning exhibit enhanced positive emotions (9), such as happiness (10). Life meaning is closely related to subjective well-being, and they may compensate for each other in adverse circumstances (11). Furthermore, older people with a high life significance score hold optimistic and positive attitudes toward life and are less likely to feel lonely (12).

Individuals who pursue the meaning of life are aware of the value of exercise and take the initiative, especially physical exercise (13). Physical exercise refers to purposeful, planned, and regular physical activities aimed at being fit and strengthening the mind (14). The meaning of life is composed of purpose, meaning, and consistency (15), corresponding to the definition of physical exercise. Physical exercise refers to purposeful, planned, and regular physical activities. Therefore, there may be a positive association between life meaning and engagement in regular physical exercise. Individual attitudes and identification with physical exercise are highly correlated with physical exercise behavior (16), and individual identification with physical exercise is associated with subjective well-being (17). In addition, Li et al. (18) identified a significant correlation between physical exercise behavior and the happiness index in older people. Therefore, an individual’s physical exercise routine is expected to be facilitated by an enhanced understanding of life. Engagement in sports can increase older people’s happiness and positive feelings and reduce depression and anxiety (19). Thus, the influence of life meaning on subjective well-being may be mediated by the amount of exercise an individual performs and exercise identification.

China, as the largest population on earth, has a rapidly aging population (20). Life meaning has a positive association with subjective well-being. However, few studies have explained how life meaning affects subjective well-being from the exercise psychology perspective. As physical exercise can benefit older people physically and psychologically, two exercise-related factors were considered to explain the relation between life meaning and subjective well-being. Thus, the present study explored the direct and indirect effects of life meaning, exercise identification, and amount of exercise on subjective well-being. The present study hypothesized that life meaning can positively predict subjective well-being. Moreover, according to the literature reviewed above, a serial multiple mediation model of exercise identification and amount of exercise in the association between life meaning and subjective well-being among older people is hypothesized.

**METHODS**

**Participants and Procedures**

The economy of Yueyang, Hunan Province, is at the middle level in China and is representative of most cities. The participants were recruited through advertisements posted in locations in Yueyang frequented by older people, including exercise areas (e.g., parks and bulletin boards) and informal spaces (e.g., chess and card rooms, activity centers, and universities for older people). 1 week after the advertisements were released, the principal investigator and the research assistant interviewed older people who volunteered to participate. The questionnaire was self-administered. For older people who could not complete the questionnaire independently due to eyesight problems, the data were collected by interview. The principal investigator or research assistant read the questionnaire verbatim to the participants with poor vision and entered the participants’ answers into the questionnaire. The participants who were not visually impaired filled out the questionnaire in person and returned it. Data from the self-administered and investigator-administered questionnaires were statistically compared, and no difference between the two groups was detected. Participants with cognitive impairment or speech problems were excluded. Non-Chinese individuals were excluded. And invalid responses were removed.

The present study received ethics approval from the Kinetic Science Experiment Ethics Committee of Beijing Sport University. Participation was totally voluntary, and responses were anonymous. All the information collected was stored securely. A participant information sheet was provided at the start of the data collection. Completion of the questionnaire indicated consent.

**Measures**

Chinese life meaning scale. The meaning of life questionnaire created by Steger et al. (4) was translated into Chinese and adapted by Wang and Dai et al. It measures two factors: life meaning experience and life meaning pursuit. When administered to Chinese college students, the questionnaire showed excellent internal consistency; the alpha coefficients of the two factors of life meaning experience and life meaning pursuit were 0.85 and 0.82, respectively, and the retest reliability 1 week later was 0.71.

University of Newfoundland Happiness Scale. Liu and Gong (21) revised the University of the Newfoundland Happiness Scale developed by Kozma and Stones and applied it to older people. The internal consistency coefficient of the whole scale was 0.87, and the internal consistency coefficient of each subscale was >0.80 with good reliability; thus, this scale can be used to assess the subjective well-being of older people in China. Among the 24 items in the scale, five items reflect positive emotions (PA) and five items reflect negative emotions (NA).
Seven items reflect positive experiences (PE), and seven items reflect negative experiences (NE). The total score was obtained using the following formula: total happiness = PA-NA-NE+24, and the possible score ranges from 0 to 48.

Physical Activity Habits Questionnaire. This questionnaire was revised by Song based on the Physical Exercise Rating Questionnaire revised by Liang (22); the retest reliability of the scale was 0.82. The questionnaire assesses exercise habits in terms of participation in physical exercise programs, exercise intensity, exercise frequency, duration of participation in regular exercise, organizational form of participation in physical exercise, and whether participation in physical exercise is voluntary. The amount of exercise is calculated in three dimensions, namely, exercise time, exercise intensity, and exercise frequency, and the score is calculated as follows: amount of exercise = physical exercise intensity × (time-1) × frequency. Each aspect is divided into five levels, with a score of 1–5, and the possible score ranges from 0 to 100.

Exercise Identification Questionnaire. Three questions were designed in this survey to assess older people's attitudes toward exercise, their willingness to participate in physical exercise, and their judgment of the benefits of physical exercise, all scoring four points. The results revealed a moderate correlation among the three questions (r > 0.48, p < 0.01). Principal component analysis showed that the three questions could be combined into one factor with a total explanatory power of up to 71.5% and an internal consistency coefficient of 0.79; this factor was eventually named “exercise identification.”

Statistical Analysis
The SPSS 18.0 software and Amos 21.0 software were used to analyze the data. The data were inspected for common method bias using the Harman’s single-factor test. Analysis was conducted focusing on differences in life meaning and subjective well-being among older people in different groups. The correlation between continuous variables was examined. Hierarchical regression analysis was then conducted to determine the factors influencing life meaning and subjective well-being. The mediating effects of exercise identification and amount of exercise were evaluated using Amos 21.0, including serial multiple mediation pathway analysis.

RESULTS
Three hundred and fifty-two completed questionnaires were obtained. Of the 352 respondents, 143 were men (40.63%). Regarding age, 134 people were aged 61–65 years (38.00%), 109 were aged 66–70 years (31.00%), and 109 were aged over 70 years (31.00%).

Common Method Deviation Control and Inspection
Data collection by survey questionnaires may produce a common method bias effect. Thus, a Harman single-factor test was adopted to check this bias. The results showed that nine factors had eigenvalues >1, while the variation explained by the first factor was 27.38%, which was less than the critical standard of 40%, indicating that there was no serious common method variance (23).

Analysis of Differences in Life Meaning and Subjective Well-Being Among Older People in Different Groups
Analysis of gender differences in life meaning and subjective well-being among older people
An independent-samples t-test found significant gender differences among older people in terms of their perception of the meaning of life [t(1,350) = 2.19, SE = 0.63, p < 0.05], suggesting that men had better perceptions of life meaning than women. There was no significant difference in the experience of subjective well-being among older people of different genders [t(1,350) = 1.70, SE = 0.95, p > 0.05] (Figure 1).
### TABLE 1 | Correlation analysis of the variables.

|                          | M ± SD   | Life meaning | Exercise identification | Amount of exercise | Subjective well-being |
|--------------------------|----------|--------------|-------------------------|--------------------|-----------------------|
| Life meaning             | 32.76 ± 5.81 | 1.00         | 0.48**                  | 0.33**             | 1.00                  |
| Exercise identification  | 8.35 ± 1.36  | 0.48**       | 0.50**                  | 0.49**             | 1.00                  |
| Amount of exercise       | 10.90 ± 8.21 | 0.33**       | 0.27**                  | 0.49**             | 1.00                  |
| Subjective well-being    | 36.14 ± 8.76 | 0.33**       | 0.27**                  | 0.49**             | 1.00                  |

*p < 0.05, **p < 0.01, ***p < 0.001, the same below.

### TABLE 2 | Hierarchical regression analysis of life meaning and subjective well-being.

| Level    | DV                  | IV        | R   | Adjust R² | t    | β    |
|----------|---------------------|-----------|-----|-----------|------|------|
| First    | Subjective well-being | Gender   | 0.17 | 0.03      | 0.43 | 0.03 |
|          |                     | Age      |     |           |      |      |
| Second   | Subjective well-being | Life meaning | 0.36 | 0.12      | 6.38*** | 0.33 |

**p < 0.01, ***p < 0.001.

### Analysis of the Age Difference in Life Meaning and Subjective Well-Being Among Older People

Using ANOVA, we found that older people of different ages exhibited no significant difference in life meaning perception ($F_{(2,349)} = 2.63, partial \eta^2 = 0.02, p > 0.05$). However, older people of different ages significantly differed in their experience of subjective well-being ($F_{(2,349)} = 5.69, partial \eta^2 = 0.03, p < 0.01$). The post hoc analysis revealed a significant difference among the 61- to 65-year-old participants, 66- to 70-year-old participants, and over-70-year-old participants ($p < 0.01$), but there was no significant difference among the age groups (Figure 2). Specifically, as age increased, the experience of subjective well-being gradually decreased.

### Correlation Analysis of Each Variable

Table 1 shows significant correlations among life meaning, exercise identification, and subjective well-being ($r = 0.48, r = 0.33, p < 0.01$); among life meaning, amount of exercise and subjective well-being ($r = 0.33, r = 0.33, p < 0.01$); and between life meaning and subjective well-being ($r = 0.33, p < 0.01$). Life meaning, exercise identification, and subjective well-being are significantly correlated, and life meaning, amount of exercise, and subjective well-being are significantly correlated. Therefore, the relationship among the above variables can be further explored.

### Hierarchical Regression Analysis of Life Meaning and Subjective Well-Being

With subjective well-being as the dependent variable, gender and age were entered into the first layer, and life meaning was entered into the second layer. A hierarchical regression analysis was adopted to analyze the individual contribution of life meaning to subjective well-being. The results showed that life meaning had a significant positive impact on subjective well-being ($\beta = 0.33, t_{(3,348)} = 6.38, p < 0.001$); thus, life meaning can positively predict subjective well-being, corresponding to our hypothesis. Excluding the influence of gender and age, the difference in subjective well-being explained by life meaning alone was 10%, which was statistically significant (Table 2).

### Mediating Effect Test of Exercise Identification

Exercise identification (W) was assumed to be the mediating variable between life meaning (X) and subjective well-being (Y). The mediating effect of exercise identification on life meaning and subjective well-being was tested according to the testing procedure for mediating variables (24).

The results (Table 3) showed that exercise and life meaning were still significant predictors of subjective well-being after the mediating variable of exercise identification was added, implying a partial mediating effect. The proportion of the mediating effect was 22% of the total effect.

### Mediating Effect Test of Amount of Exercise

The amount of exercise (W) was assumed to be the mediating variable between life meaning (X) and subjective well-being (Y).
The mediating effect of the amount of exercise on life meaning and subjective well-being was tested following the procedure for testing mediating variables (24).

The results (Table 4) showed that amount of exercise and life meaning were still significant predictors of subjective well-being after the mediating variable of amount of exercise was added, implying a partial mediating effect. The proportion of the mediating effect was 43% of the total effect.

Serial Multiple Mediation Pathway Analysis of Exercise Identification and Amount of Exercise

Based on the above analysis, a pathway analysis chart of the saturation model of life meaning, exercise identification, amount of exercise, and subjective well-being was established. Since the regression coefficient between exercise identification and subjective well-being was not significant ($p = 0.33 > 0.05$), the path from exercise identification to subjective well-being was removed, and the path analysis chart was reestablished (Figure 3). The fitting results showed that the model had a good chi-square effect ($\chi^2/df = 0.94$, $GFI = 0.99$, $AGFI = 0.98$, $NFI = 0.99$, $IFI = 1.00$, $CFI = 1.00$, $RMSEA = 0.00$), and the overall fit was satisfactory.

The bootstrap method was used to test the serial multiple mediation effect of "exercise identification—amount of exercise" to determine the influence of life meaning on subjective well-being over 5,000 iterations. The serial multiple mediation effect was 0.09, and the 95% confidence interval was [0.14, 0.29], excluding 0, indicating that the serial multiple mediation effect was significant and the effect amount was 27%. These results verified our hypothesis. In addition, the direct effect of meaning of life on subjective well-being was 58%, and the effect of the amount of exercise was 15% (Table 5).

To test whether the serial multiple mediation pathway diagrams were universally applicable, we conducted a multigroup analysis of the above model according to gender (Table 6). The results showed that the unconstrained model was equal to the model of the structural weight; thus, there was no significant difference in the factor load values of the older person's model for different genders. Comparison of the structural covariance model and the structural weight model found no significant difference; thus, gender played a moderate role in the model. Regarding the above model explaining older women, each pathway coefficient in the model was significant ($p < 0.001$). Among older men, the path coefficients from life meaning to amount of exercise and from life meaning to subjective well-being were not significant ($p > 0.05$). A moderate effect appeared in the two pathways from life meaning to amount of exercise and from life meaning to subjective well-being, and this model was more effective in explaining older women.

DISCUSSION

Gender and Age Differences in Life Meaning and Subjective Well-Being Among Older People

There were significant differences in the perception of life meaning among older people of different genders, with men having a better perception of life meaning than women. However, this conclusion is controversial. A previous study has found that women had higher life meaning scores than men (25). This difference may be related to differences in the lifestyles and cultures of people in different regions. As in this study only older persons in Yueyang, Hunan Province, were investigated, further studies should be conducted in different regions of China.

There are significant differences in the experience of subjective well-being among older people of different ages, which are manifested in the gradual decrease in the experience of subjective well-being with increasing age. With increasing age, the living ability and living conditions of older people gradually decline, and their subjective well-being decreases accordingly. He (26) studied the subjective well-being of older people of different ages of the Naxi nationality (an ethnic minority in China), and the results were consistent with those reported in this paper.

Positive Predictive Effect of Life Meaning on the Subjective Well-Being of Older People

A significant positive correlation exists between life meaning and subjective well-being, and life meaning can positively predict the subjective well-being of older people, which is consistent with the research conclusions reported by Jin et al. (27) concerning the relationship between life meaning and subjective well-being. Chen (28) noted that the influence of life meaning on subjective well-being can be divided into direct and indirect ways. (1) Older people with a higher perception of life meaning still search for worthy goals and strive to achieve these goals in their later years (29). Older people with a higher perception of life significance still search for valuable goals and strive to achieve them. The process of striving to achieve goals is valuable and pleasing. When they reach these goals, older people experience satisfaction and subjective happiness. (2) The meaning of life indirectly affects subjective well-being through other mediating factors.
adopted a cross-sectional design, causality cannot be established. However, as this study only examined whether it is possible to enhance life meaning through interventions that influence exercise identification and the amount of exercise (36), which may explain why older people who have a good understanding of life meaning participate in more physical exercise. Therefore, life meaning can be changed not only at the cognitive level to improve the subjective well-being of older people but also at the practical level; the pursuit of life meaning can lead to an increase in the amount of exercise and improve the subjective well-being of older people.

Xu and Wang (37) noted that exercise identification plays an important role in predicting exercise behavior. Simultaneously, physical exercise can promote the subjective well-being of older people and improve their quality of life (38). Therefore, the perception and pursuit of life meaning lead to valuing physical exercise, recognizing the significance of physical exercise, improving the amount of exercise, and ultimately increasing the subjective well-being of older people.

In the serial multiple mediation model, gender played a moderating role in the influence of life meaning on the amount of exercise and subjective well-being. Specifically, among older women, life meaning has a significant effect on the amount of exercise and subjective well-being. Future studies should examine whether it is possible to enhance life meaning through interventions that influence exercise identification and the amount of exercise.

**DATA AVAILABILITY STATEMENT**

All datasets generated for this study are included in the article/Supplementary Material.

**ETHICS STATEMENT**

The studies involving human participants were reviewed and approved by the Kinetic Science Experiment Ethics Committee of Beijing Sport University. Participation was totally voluntary, and
responses were anonymous. All the information collected was stored securely. A participant information sheet was provided at the start of the data collection. Completion of the questionnaire indicated consent. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

**AUTHOR CONTRIBUTIONS**

YY conducted data collection. QZ performed data analysis, carried out the bulk of the literature review, and manuscript writing. G-LZ participated in checking methods, results, guiding QZ during the data analysis, and played an editorial role when it came to writing up the research study. All authors contributed to the article and approved the submitted version.

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**SUPPLEMENTARY MATERIAL**

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.515484/full#supplementary-material

**REFERENCES**

1. National Bureau of Statistics of China. China's Elderly Population Aged 60 and Above 240 Million People, was 17.3%, and the Aging Degree Deepen. (2018). Available online at: https://www.sohu.com/a/21932736_99906413 (accessed January 18, 2018).
2. Jingwei Network. Over 60 Percentage Exceeds 10%, China has Entered the Aging Society in Advance. (2003). Available online at: http://www.huxia.com/xw/dlwx/2003/07/221469.html. (accessed July 11, 2003).
3. Diener E, Ryan K. Subjective well-being: a general overview. *S Afr J Psychol.* (2009) 39:391–406. doi: 10.1017/S0812146409003842
4. Steger MF, Frazier P, Oishi S, Kaler M. The meaning in life questionnaire: assessing the presence of and search for meaning in life. *J Couns Psychol.* (2006) 53:80–93. doi: 10.1037/0022-0167.53.1.80
5. Cheng MM, Fan FM. Theoretical orientation and measurement of the meaning of life. *Psychol Dev Educ.* (2010) 26:431–7. doi: 10.16178/cnki.ssc.2010.04.009
6. Kashdan TB, Biswas-Diener R, King LA. Reconsidering happiness: the costs of distinguishing between hedonics and eudaimonia. *J Posit Psychol.* (2008) 3:219–33. doi: 10.1080/17439760802303044
7. Steger MF, Shim Y, Rush BR, Brusces LA, Shim JY, Merriman LA. The mind's eye: a photographic method for understanding meaning in people's lives. *J Posit Psychol.* (2013) 8:530–42. doi: 10.1080/17439760.2013.830760
8. Cohen K, Cairns D. Is searching for meaning in life associated with reduced subjective well-being? Confirmation and possible moderators. *J Happiness Stud.* (2012) 13:313–31. doi: 10.1007/s10902-011-9265-7
9. King LA, Hicks JA, Krull JL, Del Gaiso AK. Positive affect and the experience of meaning in life. *J Pers Soc Psychol.* (2006) 90:179–96. doi: 10.1037/0022-3514.90.1.179
10. Vötte B, Schnell T. Cross-legged analyses between life meaning, self-compassion, and subjective well-being among gifted adults. *Mindfulness* (2019) 10:1294–303. doi: 10.1007/s12671-018-9747-6
11. Evers A, Baan M, Ros MA, van Marwijk HW, Kempen GJ. Experience of meaning in life among physically ill patients. *J Gerontol.* (2013) 68:934–42. doi: 10.1093/geronb/gbt015
12. Evers A, Baan M, Ros MA, van Marwijk HW, Kempen GJ. Experience of meaning in life among physically ill patients. *J Gerontol.* (2013) 68:934–42. doi: 10.1093/geronb/gbt015
31. Zhou CL, Ren H, Li HJ, Zhang LW. The correlation between physical fitness and life quality of older person in some communities of Beijing. Chin J Sports Med. (2018) 37:237–40. doi: 10.3969/j.issn.1000-6710.2018.03.010
32. Georgian B, Lorand B. The meaning of physical health in the improvement of the quality of life index. Proc Soc Behav Sci. (2015) 180:1221–8. doi: 10.1016/j.sbspro.2015.02.251
33. Liu YM. Significance, and expression of the existence of sports. J Wuhan Inst Phys Educ. (2015) 49:12–6. doi: 10.15930/j.cnki.wtxb.2015.04.003
34. Chen AG, Yin HC, Yan J. Relationship between physical exercise and happiness of the elderly: the mediating role of loneliness. China Sport Sci Technol. (2010) 46:135–9. doi: 10.16470/j.csst.2010.01.006
35. Wang Y, Gao J, Shi XM, Wang Y, Wang HY, Wang Y. Effects of daily exercise on mental health and subjective well-being of older person. J Nurs. (2010) 25:18–20. doi: 10.3870/hlxzz.2010.01.018
36. Ju, Haewon. The relationship between physical activity, meaning in life, and subjective vitality in community-dwelling older adults. Arch Gerontol Geriatr. (2017) 73:120–4. doi: 10.1016/j.archger.2017.08.001
37. Xu C, Wang S. Exercise identification: concept, measurement, formation process and behavior model. J Wuhan Inst Phys Educ. (2014) 48:65–70. doi: 10.3969/j.issn.1000-520X.2014.12.012
38. Wang J, Yu C, Gao HY, Liu X. Effects of sports on happiness of the elderly. Chin J Gerontol. (2011) 31:4644–5. doi: 10.3969/j.issn.1005-9202.2011.23.064

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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