Analysis of Differences in Physical Activity Volume among the Elderly in Lanshan District, Linyi City

Fu Hongjin, Abd Rahim Mohd Shariff. PhD

Faculty of Sports Science and Coaching, Sultan Idris Education University
35900 Tanjong Malim, Perak, Malaysia
Corresponding Author Email: abd.rahim@fsskj.upsi.edu.my

Abstract
As age increases, the elderly experience aging and diseases in their bodies. Research indicates that physical exercise can effectively slow physical aging and promote the overall health of the elderly, helping them enhance their quality of life. The purpose of this study is to collect data through a questionnaire survey and use SPSS software for statistical analysis to examine the differences in physical exercise amounts among the elderly of different genders, ages, educational levels, and income levels. This research aims to provide insights for developing appropriate physical exercise methods for the elderly. The research results indicate that there is no significant difference in physical activity levels between elderly individuals of different genders. However, significant differences exist in activity levels among elderly individuals of different age groups, educational levels, and income levels. Moreover, as age increases and monthly income and educational levels decrease, the physical activity levels of elderly individuals gradually decrease
Keywords: Physical, Activity, Elderly, Volume, Differences

Introduction
The proportion of the elderly population in China is gradually increasing. According to the results of the seventh national population census in China, as of November 1, 2020, the national elderly population accounts for 18.7% of the total population (www.stats.gov.cn, 2022). China is entering a stage of a moderate aging society.

With the increase in age, the elderly gradually exhibited signs of aging. Aging refers to the process where an individual's adaptability to the environment decreases gradually, both physiologically and psychologically, and tends towards death. According to relevant literature (Yang, Xiao, Chen, Lin, Xiao, 2002), aging can be categorized into two types: physiological aging and pathological aging.

Physiological aging is mainly manifested in the gradual degeneration and loss of individual physiological functions. For example, after reaching maturity, there is a loss of tissues, cells, and components within the human body, a slowing metabolism, as well as a decline in bodily and organ functions (Wang, Wang, Li, 2000). These changes typically

manifest gradually over time and intensify with the aging process. Pathological aging, on the other hand, is aging changes caused by various external factors, including various diseases.

According to multiple research findings, physical activity is a crucial avenue for enhancing physical fitness and health (Chung, Huang, Liao, & Kuo, 2021). It also contributes to improving outcomes in other areas, such as functionality, mental well-being, and social happiness (Lemoset, Guadagnin, & Mota, 2020). Numerous domestic and international studies have indicated that scientific physical activity is of significant importance in preventing and controlling diseases, extending lifespan, and enhancing the quality of life (Wang & Zhang, 2022; Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016; Dong, Meng, & Wang, 2016; Wang & Fu, 2014; Washburn, 2000). Therefore, we should highly value the significance and role of physical activity, and actively participate in various physical activities to maintain both physical and mental health and improve our overall quality of life.

Physical activity is a form of bodily activity that enhances or maintains physical health. Foreign scholars have provided the following definitions for physical exercise. (Caspersen and Merritt, 1995) define physical exercise as planned, organized, and repetitive bodily movements with ultimate and stage-specific goals aimed at maintaining and improving physical health. (Bouchard, Shephard, Stephens, Sutton, and Mcpherson,1990) consider physical exercise as bodily movements performed during leisure time (Bouchard, Shephard, Stephens, Sutton, & Mcpherson, 1990). Currently, a widely accepted definition is the use of various physical activities, combined with the natural environment (sunlight, air, water, etc.), to enhance physical fitness, promote mental well-being, and enrich cultural life. This is a way of exercising the body (Catalan-Matamoros, Gomez-Conesa, Stubbs, & Vancampfort, 2016).

In domestic research, Song Xiaodong (2001) defines physical exercise as bodily movements of a certain intensity, frequency, and duration performed during leisure time, with positive effects on individual physical health (Song, 2001). According to Xi Yubao's perspective, physical exercise is an activity conducted through sports and loaded movements, aiming to enhance physical fitness, improve physical and mental health, and elevate and maintain physical capabilities (Xi, 2004). The activities include physical exercise, recreational leisure, health recovery, and intellectual exercise.

In research articles on physical exercise among elderly individuals, domestic experts, and scholars have primarily focused on the current status and habits of physical exercise among elderly people in Chinese cities. Zhang Yunce's study indicates that in Baoding, more than half of the elderly population mostly engages in sporadic and low-intensity exercises. Fast walking, jogging, aerobic exercise, and dancing are popular among elderly individuals in both cities. Elderly people with conditions such as hypertension, heart disease, and chronic illnesses tend to exercise less. Lower levels of physical activity are correlated with lower education levels (Zhang YC, et al., 2016).

The research conducted by Liu Ningling and colleagues on physical exercise among the elderly in Shangrao City reveals that the majority of elderly individuals are willing to participate in sports activities, showing a stable and upward trend. The frequency, duration, and intensity of their participation in physical exercise are reasonable, with a primary focus on fitness and recreational activities that cater to the characteristics of the elderly. However, the study identifies a lack of specifically designated locations for exercise, highlighting the need for improvement in safety measures (Liu N L, Guo F, et al., 2021).

Yang Fan's research found that only 15.41% of the elderly participated in physical exercise in the past year, indicating a low participation rate. The primary motivation for elderly individuals engaging in physical exercise is to improve health and fitness, with over

three-quarters of participants expressing this motive. Specifically, 50.98% of participants hope to prevent diseases and extend their lifespan through physical exercise. Walking is the predominant form of exercise, accounting for 70% of participants in physical exercise, while high-intensity exercise is less common. Parks and community spaces serve as the primary locations for exercise. The activities lack professional organization and guidance (Yang F, 2019).

Ding Zhihong's research findings indicate that the participation rate of elderly individuals in physical activity is influenced by age and location, resulting in a relatively low engagement rate. While the variety of physical activity programs is limited, the frequency of participation in physical activity is high. The proportion of individuals participating in physical activity significantly decreases with age. The duration of exercise participation ranges from 30 minutes to 1 hour, constituting 51.83% of the participants, with approximately 30% engaging in physical activity for less than 30 minutes. As age increases, the duration of physical activity participation gradually decreases (Ding, Z.H., & Zhang, X.L, 2020).

The existing research on individual differences in the exercise volume of elderly individuals is limited. This study primarily focuses on analyzing the differences in physical activity among the elderly in Lanshan District, Linyi City.

The primary objective of this study is to gain a better understanding of the basic situation of physical activity among individuals aged 60 and above in Lanshan District. This includes examining the demographic characteristics and levels of physical activity among elderly individuals participating in physical activities and analyzing variations in physical activity levels among the elderly based on different factors such as gender, age, education level, and income level.

Based on the differences in physical activity levels among the elderly, reasonable recommendations are proposed to guide elderly individuals in cultivating positive physical activity habits, engaging in moderate exercise, enhancing the effectiveness of physical activities, improving the quality of life for the elderly, and promoting healthy aging in Lanshan District.

Methodology

This study employed a quantitative research approach and designed a survey questionnaire covering basic information about elderly individuals, their participation in physical exercise intensity, duration, frequency, and other relevant aspects. To ensure the quality of the questionnaire, feedback and suggestions were sought from six sports experts who reviewed the content and structure.

To ensure the credibility of the research results, the determination of the sample size was carried out using Gpower software. By setting a two-tailed test, effect size (p) = 0.2, α error probability = 0.05, and power (1-β error probability) = 0.5, the final required sample size was calculated to be 314. After meticulous organization, a total of 512 valid questionnaires were collected, significantly exceeding the calculated sample size. This abundance of samples enhances the accuracy of the research findings.

Result and Discussion
The demographics of physical activity of the elderly in Linyi City
The demographic characteristics of the respondents were determined through descriptive research.

The gender analysis of the elderly individuals participating in physical activities in Linyi City, as indicated by this study's 512 valid samples, reveals that there are 268 male elderly individuals, accounting for 52.3% of the total valid samples, while there are 244 female elderly individuals, constituting 47.7% of the valid samples. This suggests that the proportion of male elderly individuals participating in physical activities is slightly higher than that of female elderly individuals.

Table 1
Statistical table of demographic characteristics of the elderly

		N	Percent %
Gender	Male	268	52.3
	Female	244	47.7
age	60-64	245	47.9
	65-69	118	23
	70-74	97	18.9
	75-79	29	5.7
	over 80	23	4.5
educational levels	Low level of education	182	35.5
	Primary level of education	114	22.3
	Medium level of education	98	19.1
	Higher level of education	118	23
monthly income levels	Low income	147	28.7
	Middle-low income	95	18.6
	Middle-high income	120	23.4
	High income	150	29.3

According to the statistical analysis based on age groups, the results in Table 1 show that among the elderly individuals, there are 245 valid samples in the age group of 60-64, accounting for 47.9% of the total samples; 118 valid samples in the age group of 65-69, constituting 23% of the total samples; 97 valid samples in the age group of 70-74, making up 18.9% of the total samples; 29 valid samples in the age group of 75-79, representing 5.7% of the total samples; and 23 valid samples in the age group of 80 and above, comprising 4.5% of the total samples. It can be observed that the proportion of elderly individuals participating in physical activities is highest in the age group of 60-64, with a participation rate close to 50%. This is likely due to the relatively better health and functional status of individuals in this

age range, providing them with ample time to engage in physical activities, aiding in their adjustment to post-retirement life.

The present study categorizes the educational background of elderly individuals into four classes. As shown in Table 1, elderly individuals with a lower educational level have the highest participation rate in physical activities, accounting for 35.5% of the total sample. The participation rates for individuals with other educational levels in physical activities are around 20%.

As shown in Table 1, there are 147 elderly individuals classified as having a low-income level, accounting for 28.7% of the total sample. There are 95 elderly individuals classified as having a low-moderate income level, constituting 18.6% of the total sample. There are 120 elderly individuals classified as having a high-moderate income level, making up 23.4% of the total sample. Finally, there are 152 elderly individuals classified as having a high-income level, representing 29.3% of the total sample.

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. The volume of physical activity includes the duration, intensity, and frequency of the activity. The magnitude of physical activity is calculated through the combination of exercise duration, intensity, and frequency.

The survey on the exercise duration, intensity, and frequency of the elderly uses the Physical Activity Rating Scale (PARS-3) (Liang, 1994), which was compiled by Takao Hashimoto of Japan, introduced by Liang Deqing of Wuhan Institute of Physical Education, and then translated and revised according to the actual situation in China.

Table 2
Rating scale and scoring method

Questionnaire dimensions	Scoring method				
	1 point	2 points	3 points	4 points	5 points
Intensity	Mild physical activity	Low-intensity and less-intense physical activity	Moderate intensity, intense, and lasting sports	High-intensity and nonpersistent exercise with shortness of breath and a lot of sweat	High-intensity and persistent exercise with shortness of breath and a lot of sweat
Duration	Less than 10 minutes	11-20 minutes	21-30minutes	31-59minutes	More than 60 minutes
frequency	Once a month	2-3 times a month	1-2 times a week	3-5 times a week	About once a day
Physical activity grade	Physical activity amount = intensity score × (Duration score-1) × Frequency score, 0-100 points				

The formula for calculating physical activity is set as follows: Physical activity Volume = Physical activity Intensity Score × (Physical activity Duration Score - 1) × Physical activity Frequency Score. In the survey process using a Likert 5-point scale for scoring, the final score is calculated with a range from 0 to 100 points, where a higher score indicates a greater physical activity volume and overall better engagement in physical activity. Specifically, scores in the range of 0-19 are classified as low physical activity volume (low-level physical activity

participation), 20-42 as moderate physical activity volume (moderate-level physical activity participation), and 43-100 as high physical activity volume (high-level physical activity participation) (Zhang, 2021).

Table 3
Statistics on physical activity volume of different elderly people

	Frequency	Percent	Valid Percent
0-19	304	59.4	59.4
20-42	172	33.6	33.6
43-100	36	7	7
Total	512	100	100

Table 3 indicates the physical activity volume of the elderly. Among the 512 valid samples, 304 individuals, accounting for 59.4% of the total, were classified as having low physical activity volume (low-level physical activity physical activity participation). Those with moderate physical activity volume (moderate-level physical activity participation) numbered 172, representing 33.6% of the valid samples. Individuals with high physical activity volume (high-level physical activity participation) amounted to 36, making up 7% of the valid samples. This suggests that the majority of the elderly participants engage in physical activity at a low physical activity volume, with a lower proportion participating in high exercise volume.

Differential analysis of physical activity volume.
Before conducting a difference test on the physical activity volume of the elderly in Lanshan District, Linyi City, it is necessary to check the normal distribution of each test variable. Due to a sample size exceeding 50, this study used SPSS single-sample K-S (One-Sample Kolmogorov-Smirnov Test) for testing. The test results are shown in Table 4.

Table 4

Normal distribution test of physical activity amount of the Elderly in Linyi City

One-Sample Kolmogorov-Smirnov Test

		Physical activity amount
N		512
Normal Parametersa,b	Mean	19.37
	Std. Deviation	15.383
Most Extreme Differences	Absolute	0.129
	Positive	0.129
	Negative	-0.104
Test Statistic		0.129
Asymp. Sig. (2-tailed)		.000c

a. Test distribution is Normal.   b. Calculated from data.
c. Lilliefors Significance Correction.

Table 4 shows the results of the Kolmogorov-Smirnov (K-S) test for the physical activity volume of the elderly, with the test statistics Z being 0.000, and the probability of a bilateral significance test was P=0.000<0.05, rejecting the null hypothesis. Therefore, it is considered that the physical activity volume of the elderly does not follow a normal distribution. Consequently, non-parametric test methods will be employed to examine the differences. An independent sample test will be used to assess the variations in physical exercise volume among different elderly individuals.

Table 5
Two independent sample non-parametric tests

Test Statistics

	Physical activity amount
Mann-Whitney U	31613
Wilcoxon W	61503
Z	-0.65
Asymp. Sig. (2-tailed)	0.516
a Grouping Variable: Gender	

TABLE 6
The results of the Mann-Whitney Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Physical activity amount	Male	268	260.54	69825
	Female	244	252.06	61503
	Total	512		

Based on Tables 5 and 6, the mean rank of physical exercise volume for male elderly individuals is 260.54, which is higher than the rank for female elderly individuals, which is 252.06. The corresponding significance test probability is P=0.516>0.05, indicating that there is no significant difference in physical activity volume between elderly individuals of different genders.

Table 7
Differences in physical activity among elderly people of different age groups

Independent-Samples Kruskal-Wallis Test Summary

Total N	512
Test Statistic	37.843a
Degree of Freedom	4
Asymptotic Sig. (2-sided test)	.000

a. The test statistic is adjusted for ties.

Using the non-parametric independent sample test to examine the physical activity volume among elderly individuals of different age groups, Table 7 shows that the Kruskal-Wallis H value for activity volume is 37.843. The corresponding asymptotic significance P values are all 0.000<0.05, rejecting the null hypothesis, and indicating a significant difference in activity volume among elderly individuals of different age groups. Therefore, further

pairwise comparisons of the grouped variables need to be conducted to explore the differences.

Table 8
Pairwise comparison of the physical activity among elderly people of different ages

Pairwise Comparisons of Age

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. a
over 80-75-79	38.297	41.181	0.93	0.352	1
over 80-70-74	111.533	34.206	3.261	0.001	0.011
over 80-65-69	128.748	33.617	3.83	0	0.001
over 80-60-64	155.612	32.165	4.838	0	0
75-79-70-74	73.236	31.215	2.346	0.019	0.19
75-79-65-69	90.451	30.569	2.959	0.003	0.031
75-79-60-64	117.315	28.964	4.05	0	0.001
70-74-65-69	17.216	20.214	0.852	0.394	1
70-74-60-64	44.08	17.693	2.491	0.013	0.127
65-69-60-64	26.864	16.527	1.625	0.104	1

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

According to the comparative results in Table 8, among the different age groups of the elderly, the physical activity volume of individuals aged 80 and above shows significant differences compared to those aged 75-79 and other age groups, with Adj. Sig. a value consistently less than 0.05. For individuals aged 60-64, 65-69, and 75-79, the physical activity volume comparisons also exhibit significant differences with Adj. Sig. a value less than 0.05. There were no significant differences in physical activity volume observed in the other age groups.

Table 9

Mean rank and medians (25% quartile, 75% quartile) for non-normal data of Physical activity amount

Physical activity amount

Age	N	Mean Rank	Median (25% quartile, 75% quartile)
60-64	245	284.68	18 (9.5, 32) a
65-69	118	257.81	18 (8, 27) a
70-74	97	240.6	15(6, 27) ab
75-79	29	167.36	6 (4, 17) bc
over 80	23	129.07	6 (3, 12) c
Total	512		

Note: Each group of data contains the same letter after the 'Median' (25% quartile, 75% quartile), indicating no significant difference between the two groups. The inclusion of different letters indicates a significant difference between the two groups

In Table 9, the Mean Rank values of physical activity volume among different age groups are arranged in descending order as follows: 60-64 > 65-69 > 70-74 > 75-79 > 80 and above. Specifically, the physical activity volume of individuals below 75 years old is significantly higher than that of those aged 75 and above. The data suggest that the physical activity volume of the elderly decreases with increasing age.

Table 10

Differences in physical activity among elderly people of different education levels

Independent-Samples Kruskal-Wallis Test Summary

Total N	512
Test Statistic	92.900a
Degree of Freedom	3
Asymptotic Sig. (2-sided test)	.000

a.　The test statistic is adjusted for ties.

Table 10 shows the differences in physical activity volume among elderly individuals with different education levels. The Kruskal-Wallis H value for physical activity volume among elderly individuals with different education levels is 92.9, and the corresponding asymptotic significance (P) values are all 0.000<0.05. Therefore, there are significant differences in physical activity volume among elderly individuals with different education levels. Subsequently, pairwise comparisons need to be conducted for grouped variables with significant differences in physical activity volume.

Table 11
Pairwise comparison of the physical activity among elderly people of different education levels

Pairwise Comparisons of Educational Level

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. a
Low level of education-Primary level of education	-79.36	17.616	-4.505	.000	.000
Low level of education-Medium level of education	-91.015	18.479	-4.925	.000	.000
Low level of education-Higher level of education	-165.726	17.432	-9.507	.000	.000
Primary level of education-Medium level of education	-11.655	20.317	-0.574	0.566	1
Primary level of education-Higher level of education	-86.366	19.369	-4.459	.000	.000
Medium level of education-Higher level of education	-74.711	20.157	-3.706	.000	.001

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.   Asymptotic significances (2-sided tests) are displayed. The significance level is .05.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

The results of further paired comparison of grouping variables are shown in Table 11. In terms of the amount of physical activity of the elderly, low education level has a significant difference with primary education level (P=0.000), medium education level (P=0.000), and high education level (P=0.000) respectively. Primary education level is significantly different from high education level (P=0.000). Medium education level is significantly different from high education level (P=0.003). However, there was no significant difference between the primary education level and the Medium

Table 12

Mean rank and medians (25% quartile, 75% quartile) are shown for non-normal data of physical activity amount

Physical activity amount

Educational level	N	Mean Rank	Median (25% quartile, 75% quartile)
Higher level of education	118	348.94	27 (18, 36) a
Medium level of education	98	274.23	18 (8, 27) b
Primary level of education	114	262.57	18 (6, 27) b
Low level of education	182	183.21	10(4, 18) c
Total	512		

Note: Each group of data contains the same letter after the 'Median' (25% quartile, 75% quartile), indicating no significant difference between the two groups. The inclusion of different letters indicates a significant difference between the two groups

Table 12 shows the Mean rank and median (25% quartile, 75% quartile) for non-normal data on the amount of physical activity. The ranking of elderly people with different education levels in terms of amount is consistent with the ranking of intensity and duration of physical activity. It also showed that the physical activity amount of elderly with high education level is significantly higher than that of elderly with medium education level, primary education level, and low education level. Elderly people with medium education levels and primary education levels are significantly higher than elderly people with low education levels. This also indicates that the higher the education level, the larger the amount of physical activity.

The above analysis indicates that elderly individuals with higher educational levels engage in physical activities with higher intensity, longer duration, and greater frequency. Elderly individuals with higher educational levels, especially those with higher education, tend to engage in more mental labor. They typically participate less in physical activities during their working years but are more willing to engage in sports and exercise after retirement to relax and relieve stress. However, elderly individuals with lower educational levels, especially those who did not attend school, mostly performed physical labor in their previous occupations. Having experienced physically demanding work, they are less inclined to participate in physical activities during retirement.

Table 13

Differences in physical activity among elderly people of different income levels

Independent-Samples Kruskal-Wallis Test Summary

Total N	512
Test Statistic	104.043a
Degree of Freedom	3
Asymptotic Sig. (2-sided test)	.000

a. The test statistic is adjusted for ties.

Table 13 shows the differences in physical activity levels among elderly individuals with different income levels. The Kruskal-Wallis H value for physical activity levels among elderly individuals with different income levels is 104.043, and the corresponding asymptotic significance (P) values are all 0.000 < 0.05. Therefore, there are significant differences in physical activity levels among elderly individuals with different income levels. Consequently, pairwise comparisons need to be conducted for variables with significant differences in physical activity levels.

Table 14
Pairwise comparison of the physical activity among elderly people of different income levels

Pairwise Comparisons of Monthly Income Level

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. a
Low income-Middle-low income	-30.962	19.415	-1.595	0.111	0.665
Low income-Middle-high income	-87.641	18.145	-4.83	.000	.000
Low income-High income	-165.663	17.117	-9.678	.000	.000
Middle-low income-Middle-high income	-56.679	20.255	-2.798	0.005	0.031
Middle-low income-High income	-134.701	19.339	-6.965	.000	.000
Middle-high income-High income	-78.022	18.064	-4.319	.000	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Through Table 14, it can be observed that there is no significant difference in physical activity levels between elderly individuals with low income and those with middle-low income (Adj. Sig. a > 0.05). However, significant differences exist in physical activity levels between elderly individuals in other income groups (Adj. Sig. a < 0.05). Therefore, it is necessary to conduct mean rank comparisons for variables with significant differences in physical activity levels.

Table 15

Mean rank and medians (25% quartile, 75% quartile) for non-normal data of total score of sports values for the elderly

Physical activity amount

Monthly income level	N	Mean Rank	Median (25% quartile, 75% quartile)
High income	150	347.34	27 (18, 36) a
Middle-high income	120	269.32	18 (18, 27) b
Middle-low income	95	212.64	12 (6, 18) c
Low income	147	181.68	10 (4, 18) c
Total	512		

Note: Each group of data contains the same letter after the 'Median' (25% quartile, 75% quartile), indicating no significant difference between the two groups. The inclusion of different letters indicates a significant difference between the two groups

Table 15 displays the average ranks and medians of physical activity levels among elderly individuals with different income levels. The mean rank values for physical activity levels among elderly individuals of different income levels indicate a gradual decrease as monthly income decreases. There is no significant difference in physical activity levels between middle-low income and low-income elderly individuals. However, significant differences exist among the other income groups.

Conclusion

There is no significant difference in physical activity levels between elderly individuals of different genders. Significant differences exist in activity levels among elderly individuals in different age groups, with physical activity decreasing as age increases. There are significant differences in physical activity levels among elderly individuals with different education levels. The higher the education level of elderly individuals, the greater their physical activity, and as education level decreases, physical activity gradually decreases. Significant differences exist in physical activity levels among elderly individuals with different income levels, with physical activity gradually decreasing as monthly income decreases in the elderly.

Suggestion

To better promote the participation of elderly individuals in physical activities, the following measures can be taken to increase their level of physical activity. Government departments can use channels such as news broadcasts and online media to publicize the scientific standards for the frequency, duration, and intensity of physical exercises for the elderly, enhancing their understanding of proper exercise standards. Social sports instructors, through volunteer activities, can disseminate relevant knowledge about physical exercise in public sports facilities, guiding the elderly to engage in appropriate physical activities. It is recommended that the government or community organizations regularly organize multi-level and enjoyable sports competitions for the elderly, sparking their interest and encouraging active participation in physical exercise, thus promoting healthy aging.

References

Bauman, A., Merom, D., Bull, F. C., Buchner, D. M. & Fiatarone Singh, M.A. (2016). Updating the evidence for physical activity: summative reviews of the epidemiological evidence, prevalence, and interventions to promote "active aging". *The Gerontologist*, *56*, S268–S280.

Bouchard, C., Shephard, R.J., Stephens, T., Sutton J.R. & Mcpherson, B.D. (1990). Exercise, fitness, and health: a consensus of current knowledge. *Champaign: Human Kinetics.*

Caspersen, C.J. & Merritt, R.K. (1995). Physical activity trends among 26 states, 1986-1990. *Medicine & Science in Sports & Exercise*, 27(5), 713-720.

Catalan-Matamoros, D., Gomez-Conesa, A., Stubbs, B. & Vancampfort, D. (2016). Exercise improves depressive symptoms in older adults: an umbrella review of systematic reviews and meta-analyses. *Psychiatry Research*, 244, 202-209.

Chung, Y., Huang, T.Y., Liao, Y.H. & Kuo, Y.C. (2021). 12-week inspiratory muscle training improves respiratory muscle strength in adult patients with stable asthma: a randomized controlled trial. *Int. J. Env. Res. Pub. He.*, 18, 3267.

Ding, Z.H., & Zhang, X.L. (2020). Study on behavioral characteristics, support, and decision-making factors of physical exercise for the elderly in China: an analysis based on data from CLASS (2016). *Scientific Research on Aging*. Vol.8, No.4.April.

Dong, H., Meng, L. & Wang, R.H. (2016). Effects of physical exercise on bone mineral density in middle-aged and older people: meta-analysis. *Journal of Beijing Sport University*, 03, 58–65+87.

Lemoset, E.C.W.M., Guadagnin, E.C. & Mota, C.B. (2020). Influence of strength training and multicomponent training on the functionality of older adults: systematic review and meta-analysis. *Revista Brasileira de Cineantropometria & Desempenho Humano*, 22, e60707.

Liu, N.L., Guo, F., Qiu, Y.Y., & Zhang, B.L. (2021). Study on the motivation and sustainability of physical exercise among the elderly. *Journal of Chifeng University (Natural Science Edition)*, Aug Vol.28 No.8.

Liang, D.Q. (1994). The stress level of college students and its relationship with physical exercise. *Chinese Mental Health Journal,* 8(1), 5-6.

Song, X.D. (2001). Research on factors related to exercise behavior. *Journal of Chengdu Physical Education Institute*, 27(02), 49-52.

Washburn, R.A. (2000). Assessment of physical activity in older adults. Research Quarterly for Exercise and Sport, 71, 79-84. Youssef, E.F. & Shanb, A.A. (2016). Supervised versus home exercise training programs on functional balance in older subjects. *Malays J. Med. Sci.*, 23, 83-93.

National Bureau of Statistics. （2021）.*The Seventh National Population Census Bulletin (No. 5) - Population Age Composition.*

www.stats.gov.cn/zt_18555/zdtjgz/zgrkpc/dqcrkpc/ggl/202302/t20230215_1904001.html

Wang, B. & Zhang, G.H. (2022). The value appeal, practical dilemma, and optimization strategies of Chinese elderly sports development under the background of the aging population. *Sports Research and Education*, 37(02), 27-33.

Wang, G. & Fu, H. (2014). Psychological care for the elderly is based on the neural mechanism theory of emotional processing. *Population and Society,* 30(4), 76-80

Wang, X.P., Wang, Y.T. & Li, J.S. (2000). Great Dictionary of Hygiene, *Qingdao Publishing House.*

Xi, Y.B. (2004). The concept of physical exercise and its methodology. *Journal of Beijing Sport University*, 27(1), 118-120.

Yang, F., Pan, Y., & Zou, Z.Y. (2019). Patterns and determinants of physical activity of elderly people in China. *China Sport Science and Technology*. Vol.55, No.10,10-21.

Yang, P., Xiao, J., Chen, B.Z., Lin, Y.Y. & Xiao, J. (2002). Medical humanities vocabulary, *Second Military Medical University Press.*

Zhang, Y.C., Qiao, D., Wei, F., Shi, Y., Zhen, Q., Wu, X.S., Liu, H., & Zuo. Q. (2016). Current status and analysis of factors related to physical exercise behavior among the elderly in Baoding city. *Modern Preventive Medicine,* Vol. 43, NO.16.

Zhang, L. (2021). The Relationship between Sports Values and Physical Exercise of Middle School Teachers in Chengdu City. *Shaanxi Normal University.*