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Effect of Promotive Exergaming on Elderly Performance Balance Using Deep Learning Technology as an Artificial Intelligence Tool

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Abstract

Background: Regular exercise is vital for elderly balance and mobility, and promotive exergaming with deep learning offers an innovative way to enhance and monitor performance and balance.

The aim of the study was to evaluate the effect of promotive exergaming on elderly performance balance using deep learning technology as an artificial intelligence tool.

Subjects and Methods: **Research design:** A quasi-experimental design was adopted to carry out this study.

Setting: The study was conducted at Mobasher Village, Sharkia Governorate, Egypt. **Subjects:** Purposive sample of 80 elderly who fulfilled the study inclusion criteria.

Tools for data collection: Tool I: A structured interview questionnaire was used for data collection. It was composed of three parts. (Part I) elderly demographic characteristics, (Part II) medical history and (Part III) elderly knowledge about exercise questionnaire.

Tool II: The Older Persons' Attitudes Toward Physical Activity and Exercise Questionnaire (OPAPAEQ).

Tool III: Performance balance was measured by The Balance Evaluation Systems Test (BESTest).

Results: Out of the 80 elderly, 40.4% had positive attitude toward physical exercise which improved to 73.9% post-program, besides, the total mean score of Balance Evaluation Systems was 67.50±7.65 pre-program then improved to 76.85±4.62 post-program. Statistically significant positive correlation between attitude and balance evaluation systems, the higher the attitude score, the higher balance evaluation systems score.

Conclusion: The promotive exergaming program proved to be an effective tool in enhancing elderly's positive attitude toward exercise and performance balance.

Recommendations: Inclusion of promotive exergaming modules in community-based preventive health programs for the elderly to encourage active aging and independence while reducing health care costs related to falls and mobility impairments.

Keywords: Artificial Intelligence, Deep Learning Technology, Elderly, Performance Balance and Promotive Exergaming.

Introduction:

People are living longer all around the planet. Most people nowadays can expect to live well into their sixties and beyond. Every country around the globe is seeing population growth, as well as an increase in the number of elderly people. By 2030, one out of every six people on the planet will be 60 years old or older. The number of people aged 60 and more is expected to rise from 1 billion in 2020 to 1.4 billion by 2050. By 2050, the global population of adults aged 60 and up will have doubled (2.1 billion). Between 2020 and 2050, the number of people aged 80 and more is predicted to treble, reaching 426 million (WHO, 2022).

Physical ability is the most basic motor skill necessary for an individual's daily life and labor to be maintained, and it can be classified as strength, endurance, balance, coordination, agility, and speed, according to its nature (Ju et al., 2023). Physical activity refers to any movement that increases energy expenditure, while exercise is a subset of physical activity that is planned, structured and repetitive, with a specific goal in mind. Regular exercise plays a crucial role in both the prevention and management of chronic conditions like liver disease and cardiovascular diseases by improving insulin sensitivity, enhancing anti-inflammatory and paracrine actions of myokines, supporting immune function and more (Alabdul Razzak et al., 2025).

Engaging in regular exercise is immensely beneficial for elderly individuals, contributing significantly to their physical and mental health. It also plays a critical role in mental health by alleviating symptoms of depression and anxiety, enhancing mood, and improving sleep quality. Regular exercise can also improve cognitive function, potentially delaying the progression of dementia and other age-related cognitive decline. Exercise can be seen as a preventive measure, so that, without adequate physical activity levels, the ageing process may be associated with premature development of disease and dysfunction (Wollesen et al., 2025).

Exergaming programs build confidence and improve mental health, support sustained activity and reduce fall risk. Comprehensive exercise interventions address physical strength, balance, and psychological factors, mitigating fear and promoting well-being. This holistic approach empowers older adults, fostering independence and improving their quality of life (Zhong et al., 2024).

Artificial intelligence (AI) is being increasingly integrated into scientific discovery to augment and accelerate research, helping scientists to generate hypotheses, design experiments, collect and interpret large datasets, and gain insights that might not have been possible using traditional scientific methods alone (Wang et al., 2023). Overall, the integration of AI into balance monitoring and rehabilitation offers promising advancements in improving the quality of life and reducing fall risks among older adults. Artificial Intelligence (AI) is reshaping the healthcare industry by offering new ways to enhance patient care, optimize operations, and improve the work-life balance of healthcare professionals, particularly nurses (Rony et al., 2024a).

Using deep learning technology in exergaming enhances personalization, real time feedback, and rehabilitation outcomes, especially for populations like the elderly or those undergoing physical therapy. Exergaming, the fusion of exercise and interactive gaming, has evolved significantly with the integration of deep learning technologies. Deep learning enables real-time motion tracking, pattern recognition, and adaptive feedback, thereby enhancing the personalization and effectiveness of physical activity interventions (Hotiet et al., 2024). For older adults, deep learning enhanced exergaming supports balance training, reduces fall risk, and promotes functional independence by tailoring activities to individual motor abilities (Almeida et al., 2024).

Aim of the study:

The current study aimed to evaluate the effect of promotive exergaming on elderly performance balance using deep learning technology as an artificial intelligence tool.

Research Hypothesis:

The promotive exergaming program can have a positive effect on elderly performance balance.

Subjects and methods:

Research design:

A quasi-experimental design was adopted to carry out this study.

Study setting:

The current study was carried out at Mobasher Village, Sharkia governorate, Egypt.

Study subjects:

A purposive sample of 80 elderly aged 60 years or above. Able to perform the measurement and training without any aid (independent elderly), no experience in virtual reality gaming, agree to participate in the study and able to communicate was selected for the recruitment of this study.

Sample size calculation:

Brachman et al., (2021), found that Mean ±Sd of function balance test post intervention program was 64.86±16.7 and 73.87± 17.1 pre intervention, confidence level is 95% two side with power of study 90%, in addition 10% drop out. So, Sample size calculated using Open Epi, was 80 elderly. In addition, 8 elderly for pilot study were excluded from the study sample.

Tools of data collection*:*

Three tools were used to collect the necessary data as following:

***Tool I*: Structured interview questionnaire:**

It was developed by researchers based on the literature review. It consisted of three parts.

Part (1): Sociodemographic characteristics of the studied elderly modified after El-Gilany et al., (2012): this scale includes 6 domains with a total score of 84. Socioeconomic level classified into low, middle and high levels. These 6 domains are "Education and cultural domain, Occupation domain, Family domain, Economic domain, Home sanitation domain and Health care domain".

Scoring system:

- Score less than 50% was considered as low social class.
- Score from 50% to less than 75% was considered as middle social class.
- Score more than 75% was considered as a high social class.

Part (2): involved questions about the medical history of the studied elderly; it involved questions about chronic diseases and their duration, medications taken, suffering from imbalance or dizziness and its reason, physical condition and falling history.

Part (3): Elderly Knowledge about Exercise Questionnaire: This part was developed by the researcher guided by Cheng et al. (2024), Maduakolam et al. (2023) and Alali et al. (2023). It included questions that were used to test a broad range of exercise related knowledge among the elderly.

***Tool II*: The Older Persons' Attitudes Toward Physical Activity and Exercise Questionnaire (OPAPAEQ).**

It is an instrument designed and validated by Terry et al., (1997). The translated 14 items into Arabic (by the researchers) of the OPAPAEQ were employed to evaluate the older persons' attitudes toward physical activity and exercise, with 4 different subcategories tension relief, promotion of health, vigorous exercise and social benefits.

Scoring system: Responses were rated on a three-point Likert scale ranging from 1 ("strongly disagree") to, 3("strongly agree"). All but one item was positively phrased; in the case of the one item that was negatively phrased, the SPSS software used in the statistical analyses converted the negatively worded questions to positive scores. Positive attitude: ≥ 60% (≥ 25 points out of 42). Negative attitude: < 60% (< 25 points). In the current study.

***Tool III:* The Balance Evaluation Systems Test (BESTest):**

The Balance Evaluation Systems Test (BESTest) developed by Horak et al. (2009). The BESTest consists of 27 tasks, with some items consisting of 2 of 4 subitems (e.g., for left and right sides), for a total of 36 items. Each item is scored on a 4-level ordinal scale from 0 (worst performance) to 3 (best performance). Scores for the total test, as well as for each section, were provided as a percentage of total points. The BESTest developed to assess balance impairments across six contexts of postural control.

Scoring system: The test consists of 36 items grouped into 6 sections, each addressing a different aspect of balance: Biomechanical Constraints (e.g., base of support, postural alignment). Stability Limits/Verticality (e.g., learning and reaching). Anticipatory Postural Adjustments (e.g., sit-to-stand, step initiation). Postural Responses (e.g., reaction to external perturbations). Sensory Orientation (e.g., balance with eyes closed, surface changes). Stability in Gait (e.g., walking, stepping over obstacles). Each item is scored from 0 to 3, based on performance:

- 0 = Severe impairment (unable to perform)
- 1 = Moderate impairment
- 2 = Mild impairment
- 3 = Normal performance.

Total Score Calculation

- Maximum score: 108 (indicating no balance impairment). ≥ 60% (65 to 108).
- Lower scores indicate greater balance dysfunction < 60% (< 65).

Content validity & Reliability:

Once prepared, the tool was presented to a panel of three experts in the field of Community Health Nursing, Faculty of Nursing, Zagazig University and Community medicine, Faculty of Medicine, Zagazig University. The panel reviewed the tool content for relevance, clarity, comprehensiveness and understandability. This constituted the content validation of tools. All recommended modifications were applied. The reliability of this tool was tested by measuring its internal consistency. In the current study, Cronbach α of The Older Persons' Attitudes Toward Physical Activity and Exercise Questionnaire (OPAPAEQ) was 0.75 and The Balance Evaluation Systems Test (BESTest) was 0.74.

Fieldwork

Once permission was granted to proceed with the study, the researcher started to prepare a schedule for collecting the data. The fieldwork was carried out within nine months, starting from the beginning of November 2023 up to the end of July 2024. Each elderly participant was interviewed individually at the elderly's home. Following the safety precautions strategies from Corona virus by the researcher. The researcher allocated three days weekly from 9 am to 7 pm.

Pilot study:

Before performing the main study, a pilot study was carried out on 8 elderly from the study setting, constituting about 10% of the calculated sample for the main study. They were selected randomly from the selected village and were later excluded from the main study sample of research work to assure stability of the answers. The purposes of the pilot were to test the questions for any obscurity and to assess the practicability and feasibility of using the structured interview questionnaire sheet for the elderly. It also helped the researcher to determine the time needed for filling out the forms, which turned out to be 30 to 45 minutes. The tools were finalized after doing necessary modifications according to the pilot study results.

Statistical analysis:

Data entry and statistical analysis were done using SPSS 23.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables and means and standard deviations and medians for quantitative variables. Cronbach alpha coefficient was calculated to assess the reliability of the developed scales through their internal consistency. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal-Wallis tests and paired t-test. The McNemar test was used to determine if there are differences on a dichotomous dependent variable. Qualitative categorical variables were compared using the chi-square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. The Spearman rank correlation was used for the assessment of the interrelationships among quantitative variables and ranked ones. In order to identify the independent predictors of the knowledge, attitude and the balance evaluation systems test scores multiple linear regression analysis was used after testing for normality, and homoscedasticity, and an analysis of variance for the full regression models were done. Statistical significance was considered at p-value <0.05.

Results:

Concerning socio- demographic characteristics of the studied subjects, the current study revealed that, among 80 elderly, the mean age was 67.41±5.12 years, 60% were males, 70% of the participants were married, 23.8% had secondary education, the lowest percentage (16.3%) were employees, monthly income was not enough as reported by 73.7% of elderly, ultimately, 47.5 depend on retirement salary as a source of monthly income.

Regarding medical history, 80% of the elderly suffer from chronic diseases, since 25.75±8.28 years. The most reported diseases are GIT diseases (53.1%), diabetes (32.8%) and hypertension (28.1%). Furthermore, dizziness affects 10%, mainly due to chronic diseases (100%) and sleep problems (37.5%). Moreover, reduced mobility in the last year was reported by 55% of participants, while 7.5% experienced falls that occur totally at home with frequency of one to two times.

Table 1 displays the attitude of elderly toward physical exercise. As the table reveals, the elderly held positive attitude in term of "physical activity relieves stress, role in emotional tension relief, physical activity as an effective treatment for anxiety and mental relaxation," (26.2%, 28.8%, 31.2% &32.5%respectively). The marked improvement was observed post-test as reported by elderly (48.8%, 42.5%, 48.8% & 57.5% respectively). Considering the elderly attitude towards health promotive role of physical exercise, pretest elderly people agreed with the importance of physical exercise, benefits to body, essential to good health, and its regularity make person feel better (41.3%, 45%, 38.7%, & 43.7% respectively). Albeit post-test marked improvement was obviously posttest in all the above-mentioned items (52.5%, 53.8%, 51.3%, & 57.5% respectively).

Table 2 displays the attitude of elderly toward physical exercise. As the table reveals, the elderly held positive attitude in term of "Regular vigorous exercise is necessary for good health and maintain general health, Vigorous exercise is not necessary to maintain general health (16.3%, 18.8% & 20% respectively). The marked improvement was observed post-test as reported by elderly (57.5%, 60% & 61.3% respectively). Considering the elderly attitude towards social benefits of physical exercise, pretest elderly people agreed with exercising with other people of the same age is socially beneficial, participating with others in some physical activities is fun, and participating in physical recreation is a satisfying and enriching use of free time. (17.5%, 23.8% &22.5% respectively). Albeit, post-test marked improvement was obviously posttest in all the above-mentioned items (50%, 57.5% & 60% respectively).

Table 3 shows a significant improvement in the elderly's attitude toward physical exercise after the program. The highest percentage of elderly had negative attitude pre-program toward the role of physical exercise in relieving stress, health promotion, vigorous exercise, and social benefits (52%, 46.6%, 62.7% and 59.6% respectively). Meanwhile, post-program marked improvement is observed where negative attitude was reduced to 29.8%, 25%, 22.7% and 26% respectively. With a statistically significant difference ($p < 0.05$).

Table 4 presents the distribution of elderly participants based on their mean percentage scores in the Balance Evaluation Systems before and after the program. The post-test scores showed significant improvement across all balance evaluation components, including biomechanical constraints, stability limits/verticality, anticipatory postural adjustment, reactive postural response, sensory orientation, and stability in gait. The total balance score increased from 67.50±7.65 in the pre-test to 76.85±4.62 in the post-test, showing a statistically significant improvement ($p = .001^{**}$).

Figure 2 sketches the percentage distribution of the studied elderly based on their total knowledge about physical exercise before and after the program. The results show a substantial improvement in knowledge levels from 45.9% pre-program to 89.1% post-program with a statistically significant difference ($p < 0.05$).

Table 5 Simplifies the correlation between the elderly's total mean score of knowledge, attitude, and balance evaluation systems pre- test and post-test. The table indicates a statistically significant positive correlation between knowledge and attitude {the higher the knowledge score, the more positive attitude (r= .717), knowledge and balance evaluation systems {the higher the knowledge score, the higher balance evaluation systems score (r= .499). Also, there is a statistically significant positive correlation between attitude and balance evaluation systems, the higher the attitude score, the higher balance evaluation systems score (r= .676).

Table 6 demonstrates that age, male, education level, and total knowledge score are statistically significant independent positive predictors of total elderly attitude score. The regression model explains 47% variation in change of this level as indicated by r- square value. This means that with advancing age, increased educational level and total knowledge, elderly attitude becomes more positive.

Table 7 presents that total knowledge is statistically significant independent positive predictors of total elderly Balance Evaluation Systems score. The regression model explains 49% variation in change of this level as indicated by r- square value.

Discussion:

Concerning socio- demographic characteristics, it is clear from the results of the current study that the mean age of the studied elderly was 67.41±5.12 years and their age ranged between 60-80 yrs.; this might be due to increase life expectancy and increased the number of this age group sector in Egypt as confirmed by the central agency for public mobilization and statistics (CAPMAS, 2022) which estimated the number of elderly in Egypt reached 6.9 million according to population estimates on July 1st, 2022. This result is in agreement with Tawfik et al. (2024) in Egypt, who found that the average age of the studied elderly was 66.3±5.6.

Also, Moreover, the current study findings revealed that the majority of the study sample were males. This might be attributed to that first, in certain rural communities, the participation of women in scientific research is often hindered by prevailing cultural norms and traditional beliefs that discourage and restrict their involvement in such activities. Also, the idea of women engaging in physical exercise is often considered unacceptable, particularly among older generations. This finding goes in the same line with Sayed et al. (2022) study which was conducted in rural areas in Beni Suef Governorate and mentioned that more than half of their study subjects were males. This is also in harmony with Eid et al., (2024) in Cairo, who found that more than two thirds of the study subjects were male.

One of the objectives of the present program was to determine the level of performance balance among community-dwelling elderly pre and post the program. As for using the Balance Evaluation Systems Test (BESTest), Before the program, the studied elderly exhibited varying degrees of balance impairments across multiple components of the test. Following the program, there was a significant improvement in all components—namely biomechanical constraints, stability limits/verticality, anticipatory postural adjustment, reactive postural response, sensory orientation, and stability in gait. Such improvement can be attributed to the structured balance-enhancing activities included in the program, which likely improved muscular strength, neuromuscular coordination, and sensory integration. Age-related declines in these areas often contribute to increased fall risk among older adults. Additionally, regular physical activity has been shown to enhance motor control and gait stability, both of which are crucial for maintaining balance in aging populations.

Similar findings were observed in previous studies as a systematic review and meta-analysis by Kong et al. (2023) who reported significant postural balance improvements in older adults following the exercise program, highlighting its effectiveness in reducing fall risk and improving mobility. As well, a randomized controlled trial by de Campos Junior et al. (2024) cited that exercises significantly enhanced balance and gait performance among elderly. As well, study by Tarkhasi et al. (2025) in Iran, reported that exercise improved static and dynamic balance, performance, gait, and quality of life in the experimental group compared to the control group ($P \leq 0.05$).

Congruently, study in Slovakia, by Varjan et al. (2024) concluded that sensorimotor training was equally effective as resistance-endurance training in improving postural stability and functional ability in older adults, further supporting the benefits of such interventions on balance control. Similarly, study findings of Putri et al. (2025) in Indonesia, indicated that several exercise-based interventions, such as the Balance-Enhancing Exercise Program (BEEP), Walking Meditation, and Multi-system Physical Exercise (MPE) are effective in increasing balance and reducing the likelihood of falls in the elderly. Similarly, study in Chile by Concha-Cisternas et al. (2024) concluded that neuromuscular training is a promising intervention to mitigate the decline in balance and physical function associated with aging, offering a targeted approach to improve the quality of life in the elderly.

A second objective of the present study was to assess the elderly's attitude toward exercise. Before the program, there were significant differences between studied elderly attitude; slightly less than one half of them had positive attitude regarding exercise, while about two thirds of them had negative attitude. It might be due to some factors as not receiving counseling about exercise, wrong inherited cultures, exercise illiteracy, low educational level and limitations of educational resources in rural areas.

After implementation of the current study exergaming program, there were statistically significant improvements in elderly attitude toward exercise. This demonstrates the program's effectiveness in equipping them with knowledge and in turn leading to positive changes in their attitude toward exercise. Also, this result was expected because the exergaming program provided an enjoyable, interactive, and engaging way for the elderly to participate in physical activity, which helped reduce fear and misconceptions about exercise. The gamified format likely increased motivation and participation, making physical activity look more accessible and less intimidating. Moreover, the structured sessions offered consistent encouragement and social interaction, which further reinforced positive perceptions and attitudes toward the benefits of regular exercise.

The finding aligns with recent research highlighting the positive impact of exergaming on older adults' attitudes toward physical activity. A study by Li et al. (2025) in Shanxi, North China demonstrated that an exergame-based training program significantly enhanced physical flexibility, motor coordination, and cognitive function among older adults, suggesting increased engagement and a more favorable attitude toward exercise. Similarly, a systematic review by Rytterström et al. (2024) found that older adults perceived exergaming as enjoyable and beneficial, particularly valuing the social interactions it facilitated, which contributed to improved attitudes toward physical activity. Additionally, a study by Yoong et al. (2024) reported that exergames positively influenced older adults' perceptions of exercise, enhancing their motivation and willingness to engage in regular physical activity. Collectively, these studies support the effectiveness of exergaming interventions in fostering positive changes in exercise attitudes among the elderly.

Concerning the correlation between elderly's attitude and their balance evaluation systems, the findings of the current study demonstrated a statistically significant positive correlation between attitude and balance evaluation systems, the higher the attitude score, the higher the balance evaluation systems score. In agreement with present study finding, a study in Aveiro, Portugal, by Almeida et al. (2020) showed significant correlations between the BESTest and its short versions, with functional ability, gait speed, self-reported physical activity, in community dwelling older people. Similarly, a study in Malaysia by Manirajan et al. (2024) reported that educational intervention significantly improved the knowledge, attitude, perception of falls and balance among older adults. In the same line, a study in Huzhou, China by Ni et al. (2024) revealed that Sensory-based balance training significantly improved balance ability and attitudes among older adults in the community.

Evaluation the effect of promotive exergaming on elderly performance balance was the aim of the present study. The positive effect of the program on the elderly was both direct and indirect through the mediation of improved attitude and balance (score) findings. In support of this, the scores of attitude and balance were shown to be significantly and positively correlated. Thus, the better acquired skills in practices good exercise habits lead to better balance level. According to (Mohamed et al., 2022b). There is a positive correlation between attitude, and practice about exercise and their exergames experiences.

In congruence with this, He et al. (2024) in Baishan, China observed that the sequence exercise program exhibited better balance performance and improved older adults' skeletal muscle area. Some positive correlation has been reported between exercise attitude and balance. Additionally, Brachman et al. (2021) in Poland, emphasized that the effects of exergaming on balance in healthy elderly demonstrated significant improvements in balance performance following a 12-session exergaming intervention. The study concluded that exergaming could be an effective tool for enhancing balance in older adults. In agreement with this, a study conducted by Kim et al. (2022) in United States indicated that balance exercise could be the optimal intervention for improving reactive balance in older adults.

Conclusion:

Based upon the findings of the present study and answer of research hypothesis, it can be concluded that: the promotive exergaming program proved to be an effective tool in improving elderly's knowledge related to physical activity and exercises, enhancing elderly's positive attitude toward exercise and performance balance. Therefore, the promotive exergaming program can be a widely accepted approach in decreasing imbalance and risk of falling among elderly.

Recommendations

Based on the current study findings, the following recommendation is suggested that: Inclusion of promotive exergaming modules in community-based preventive health programs for the elderly to encourage active aging and independence while reducing health care costs related to falls and mobility impairments.

Table 1: Comparison between the studied elderly pre and post intervention regarding their physical exercise attitude (relieve stress and health promotion) (n=80).

Items	Pre- test						Post- test						Chi-square p-value
	Agree		Neutral		Disagree		Agree		Neutral		Disagree		
	N	%	N	%	N	%	N	%	N	%	N	%	
Relieve stress													
Physical activity relieves stress.	21	26.2	29	36.3	30	37.5	39	48.8	34	42.5	7	8.7	16.34 .000**
Exercising helps relieve emotional tensions and anxiety.	23	28.8	28	35.0	29	36.2	34	42.5	38	47.5	8	10.0	14.65 .000*
Physical activity in some form is an excellent treatment for a tense, nervous and anxious person	25	31.2	32	40.0	23	28.8	39	48.8	31	38.7	10	12.5	12.34 .002*
Developing physical skills leads to mental relaxation and stress relief.	26	32.5	28	35.0	26	32.5	46	57.5	30	37.5	4	5.0	15.25 .000*
Health promotion													
Physical exercise is important in helping a person gain and maintain health.	33	41.3	16	20.0	31	38.7	42	52.5	38	47.5	0	0.0	21.58 .000**
Exercising is beneficial to the human body.	36	45.0	19	23.8	25	31.2	43	53.8	34	42.5	3	3.7	14.58

													.001**
Physical exercise, done with good sense and judgment, is essential to good health.	31	38.7	20	25.0	29	36.3	41	51.3	35	43.7	4	5.0	18.29 .000**
Regular physical activity makes a person feel better.	35	43.7	18	22.5	27	33.8	46	57.5	29	36.2	5	6.3	14.39 .000**

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

Table 2: Comparison between the studied elderly pre and post intervention regarding their physical exercise attitude (Vigorous exercise and social benefits) (n=80).

Items	Pre- test						Post- test						Chi-square p-value
	Agree		Neutral		Disagree		Agree		Neutral		Disagree		
	N	%	N	%	N	%	N	%	N	%	N	%	
Vigorous exercise													
Regular vigorous exercise is necessary for good health.	13	16.3	31	38.8	36	45.0	46	57.5	31	38.7	3	3.8	22.45 .000**
Vigorous exercise is necessary to maintain general health.	15	18.8	34	42.5	31	38.7	48	60.0	27	33.7	5	6.3	17.56 .000**
Vigorous exercise is not necessary to maintain general health.	16	20.0	26	32.5	38	47.5	49	61.3	27	33.7	4	5.0	24.13 .000**
Social benefits													
Exercising with other people of the same age is socially beneficial.	14	17.5	29	36.3	37	46.2	40	50.0	29	36.3	11	13.7	16.98 .000**
Participating with others in some physical activities is fun.	19	23.8	31	38.7	30	37.5	46	57.5	28	35.0	6	7.5	14.68 .001**
Participating in physical recreation is a satisfying and enriching use of free time.	18	22.5	32	40.0	30	37.5	48	60.0	30	37.5	2	2.5	17.98 .000**

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

Table 3: Percentage distribution of the studied elderly according to total physical exercise attitude (n=80).

Total physical exercise's attitude domains	Pre test				Post test				Chi-square p-value
	Positive		Negative		Positive		Negative		
	N	%	N	%	N	%	N	%	
Relieve stress	38	48	42	52	56	70.2	24	29.8	12.84 .000**
Health promotion	43	53.6	37	46.4	60	75	20	25	16.38 .000**
Vigorous exercise	30	37.3	50	62.7	62	77.3	18	22.7	11.27 .000**
Social benefits	32	40.4	48	59.6	59	74	21	26	10.98 .000**
Total	**32**	**40.4**	**48**	**59.6**	**59**	**73.9**	**21**	**26.1**	**16.49 .000****

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

Table 4: Distribution of the studied elderly according to their mean percent of total Balance Evaluation Systems (n=80).

Total Balance Evaluation Systems	Pre-test	Post-test	Chi-square p-value
Biomechanical constraints	63.48±8.95	72.47±5.23	11.35 .000**
Stability limits /Verticality	67.36±5.27	79.21±3.34	15.38 .000**
Transitions- anticipatory postural adjustment	68.49±5.64	80.15±2.59	14.87 .000**
Reactive postural response	59.89±9.16	67±5.85	10.45 .000**
Sensory orientation	74.41±6.12	78.74±3.25	7.56

			.05*
Stability in gait	71.39±6.25	78.45±4.23	10.26 .000**
Total score	**67.50**±7.65	**76.85**±4.62	9.78 .001**

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

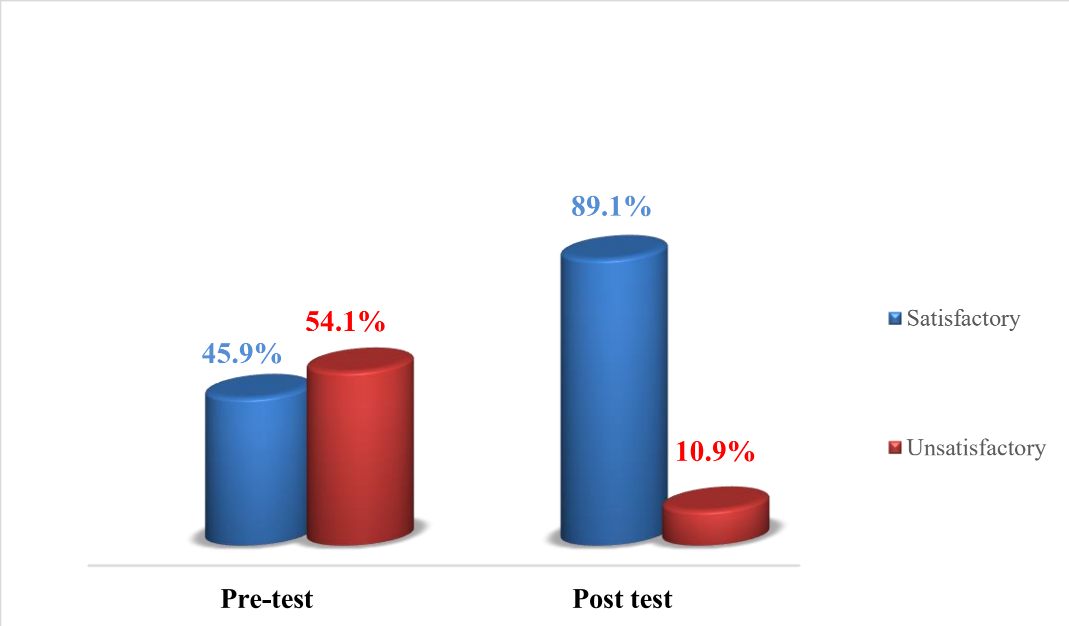

Figure 1: Percentage distribution of the studied elderly according to their total physical exercise knowledge (n=80).

Table 5: Correlation between elderly' total mean score of knowledge, attitude, and balance evaluation systems pre-test and post- test.

Scores		**Total mean score**					
		knowledge		attitude		Balance Evaluation Systems	
		pre	post	pre	post	pre	post
1. Total knowledge	**r** **p**						
2. Total attitude	**r** **p**	.853 .000**	.717 .000**				
3. Total Balance Evaluation Systems	**r** **p**	.524 .02*	.499 .03*	.498 .03*	.676 .001**		

(**) Statistically significant at p<0.01. r Pearson correlation

Table 6: Multiple Linear regression model for the studied elderly` total physical exercise attitude post-test.

	Unstandardized Coefficients		Standardized Coefficients	T-test	P-value	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower	Upper
(Constant)	4.12	.340		6.990	.000	3.40	9.03
Age	2.765	.028	.239	3.712	.000	2.89	4.87
Gender (Male)	1.987	.013	.216	2.270	.005	2.14	5.90
Educational level	2.405	.024	.390	4.110	.000	4.2	6.98
Total knowledge	3.009	.036	.416	5.778	.000	4.9	7.3
Social class	1.288	0.207	.170	1.998	.003	1.04	2.77

R Square = .47 Model ANOVA: F=10.222, p=0.000

Variable entered and removed: marital status, job before retirement, monthly income, living with.

Table 7: Multiple Linear regression model for the studied elderly` total Balance Evaluation Systems, post test

	Unstandardized Coefficients		Standardized Coefficients	T-test	P-value	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower	Upper
(Constant)	4.558	0.576		6.889	.000	2.145	7.884
Age	2.765	0.301	.298	3.987	.001	1.009	2.765
Gender (Male)	2.460	0.315	.314	3.146	.002	1.256	3.765
Total knowledge	2.978	0.450	.265	4.983	.000	1.456	4.780
Total attitude	1.340	0.240	.199	2.977	.003	0.978	3.245
Marital status (Married)	1.200	0.213	.178	2.314	.009	0.654	2.180
Social class	0.983	0.102	.061	1.872	.033	0.412	1.289

R Square = .492 Model ANOVA: F=13.400, p=0.000

Variable entered and removed: educational level, job before retirement, living with, monthly income.

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