Smart Multi-Health Promotion Programs on Physical Health and Quality of Life in Older Adults

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Submitted to: Interactive Journal of Medical Research
on: August 12, 2024

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Li-Yun Lee[1] PhD; Heng-Hsin Tung[2] Prof Dr; George Liao[3] BS; Su-Ju Liu[4] BS; Zi-Yu Chen[5] MSN; Yea-Ru Yang[2] Prof Dr

[1]Dayeh university Changhua TW
[2]National Yang Ming Chiao Tung University Taipei TW
[3]YuSen Biotechnology Co., Ltd Taichung City TW
[4]Pharmacist, Keisei Pharmacy Yunlin County TW
[5]YuSen Biotechnology Co., Ltd Taichung TW

Corresponding Author:
Heng-Hsin Tung Prof Dr
National Yang Ming Chiao Tung University
155, Sec 2, Li-Nong St.,
Pei-Tao
Taipei
TW

Abstract

Background: Physical activity and appropriate nutrition are essential for older adults. Improving physical health and quality of life can lead to healthy aging.

Objective: To investigate the long-term effects of smart multi-health promotion programs on the physical and mental health of older adults in communities.

Methods: A quasi-experimental method was utilized to recruit 112 older adults voluntarily from a pharmacy in central Taiwan between April 2021 and February 2023.Participants were divided into an experimental group (n=64) receiving a multi-health promotion program and a control group (n=48) with no specific intervention. The study measured frailty, nutritional status, well-being, and quality of life using standardized tools such as the Clinical Frailty Scale (CFS), Mini-Nutritional Assessment-Short Form (MNA-SF), Well-being Scale for Elders (WSE), and the EQ-5D-3L. Data were analyzed using descriptive statistics, independent t-tests, Pearson correlation, and generalized estimating equations (GEE).

Results: The experimental group outperformed the control group in muscle mass and strength. The GEE analysis revealed that the experimental group had a significantly higher quality of life at 12 weeks and 24 weeks. The groups showed no significant variations in frailty or well-being with time.

Conclusions: The study's findings highlight the practical benefits of interventions, including physical and social activities and nutritional support, in enhancing the quality of life and general physical health of the elderly. Clinical Trial: The trial design was registered with ClinicalTrials.gov (identifier: NCT05412251)

(JMIR Preprints 12/08/2024:65213)
DOI: https://doi.org/10.2196/preprints.65213

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Introduction

All countries contend with significant challenges stemming from aging populations and must ensure their health and social systems are adequately equipped to respond. By 2050, 80% of older people will reside in low- and middle-income countries. By 2050, the proportion of the global population over 60 will increase to 22%. People aged 80 and over are expected to triple between 2020 and 2050 [1]. Aging causes several changes in body composition, characterized by decreased strength and muscle mass leading to functional decline [2]. However, successful interventions such as physical training or cognitive activities have been shown to improve muscle strength, increase physical functional performance, reduce the risk of injury, and improve the quality of life in older adults [3, 4]. In the community, older adults particularly those over 65, face a moderate to high nutritional risk (34.8% and 29.4%). This group of people often struggle with malnutrition, which may impair their health and quality of life and may even cause death [5]. Successful interventions such as community-based nutrition programs have effectively addressed this issue. While older adults may face psychological anxieties of death and despair about life and their surroundings, there is immense potential for positive well-being which empowers them to thrive and maintain their health. Historically, care for older adults has been primarily focused on the medical treatment of physical diseases, often neglecting issues related to their happiness [6].

Background

Well-being is a subjective feeling, a quality, an outcome, or a state characterized by happiness or contentment that everyone aspires to achieve. It is associated with a reduced risk of depression, minimal despair, enhanced psychological well-being, a sense of high quality of life, and living in an average family. For people over 60, this satisfaction culminates in a lifetime of achievements and victories [7]. Engaging in different types of social interactions can make the elderly feel that life is meaningful and full of hope and happiness [8]. Trudel-Fitzgerald et al. (2019) emphasized that well-being is linked to all causes of death and that interventions can result in small to moderate attainment of well-being. However, more diverse interventions are required for comparison [9]. It is crucial to promote positive mental health, including well-being, for healthy people. Increasing positive biopsychosocial resources for preventive intervention is especially important, as psychological

intervention improves well-being. Thus, conducting interventional research with healthy older adults and practical research aimed at enhancing future well-being is vital. According to the literature, existing research on the impact of intervention planning on the well-being of healthy elderly individuals over 65 years old is limited, very varied, and has received little attention [10]. A systematic review underscores the importance of encouraging older adults to engage in diverse physical activities to enhance their quality of life. This review recommends incorporating multiple types of exercises. Compared to sedentary individuals and non-exercise control groups, older adults who participated in exercise programs significantly improved their physical and mental health. Typical exercise interventions involved 30-60 minute sessions, conducted 2 to 5 times per week, with a minimum of three times per week being the most common. Health-beneficial exercises include yoga, breathing, meditation, Baduanjin, 24-form Tai Chi, and aerobics [11]. A meta-analysis of ten articles examined empirical studies that implemented health promotion interventions aimed at community-dwelling older adults in the early or moderate stages of frailty. The interventions included exercise, nutrition, and remote monitoring. The findings on the impact of exercise on physical function were inconsistent: three studies reported no significant effects, while another three studies found positive effects. This inconsistency underscores the need for further research to determine the most effective health promotion measures. Consequently, it is premature to make specific recommendations for health promotion interventions for older adults with pre-frailty or moderate frailty [12]. Based on the literature review, it was found that current research on the use of artificial intelligence exercise equipment and nutritional intervention is limited. Therefore, this study aims to explore the long-term impact of using smart multi-health promotion programs on the physical and mental health of the elderly in the community.

METHODS

Design and sample

This study adopted a quasi-experimental design. Participants were recruited voluntarily from a pharmacy located in central Taiwan between April 2021 and February 2023. The trial design was registered with ClinicalTrials.gov (identifier: NCT05412251) and followed the CONSORT guidelines. The inclusion criteria for this study were: (1) aged 65 years or over; (2) fluent in Mandarin (speaking or reading). The study excluded participants who had a history of cognitive impairment, cancer, myocardial infarction, or congestive heart failure. Based on a power analysis [13] and considering high attrition rates in similar studies [14], the sample size was increased to a

minimum of 50 participants per group. Data were collected at baseline (T0) and 12 weeks, 24 weeks, and 36 weeks post-intervention (T1, T2, T3). After excluding ineligible participants and those who dropped out, a total of 112 older adults (64 in the experimental group and 48 in the control group) completed the study, with 15.8% and 18.6% attrition rates, respectively (Fig. 1).

Intervention

The intervention program design was based on previous studies [8,11,15]. For 12 weeks, participants in the experimental group engaged in social and physical activities while receiving nutritional support. (1) Social activities: This was combined with activities held at community base C, such as makeup, reading picture books, art classes, board games, and more, for at least 120 minutes, once a week. (2) Physical training: The utilization of artificial intelligence exercise equipment, suitable for middle-aged and elderly people's exercise training and approved by the Food and Drug Administration of the Ministry of Health and Welfare. This was carried out at least 60 minutes, 3 times a week, including 8–10 minutes of warm-up exercise before exercise, after exercise, aerobic exercise, muscle strengthening training, and balance training, each requiring 15-20 minutes. Before each exercise, researchers utilized the EASY tool to assess participants' exercise risks, and the AI-enabled exercise equipment will evaluate participants and provide appropriate exercise prescriptions. Throughout the exercise, the researchers observed the physical condition of the participants constantly. If there were signs of discomfort, participants were asked to stop immediately. (3) Nutritional support: Nutritionists screened participants' nutritional status based on the mini nutrition assessment tool and based on personal wishes, provided free protein nutrition products in this plan. The control group did not receive the intervention program for social activities, physical activity, or nutritional support. They only took measurements and questionnaires at monitoring time points (baseline, 12, 24, and 36 weeks). The on-site nutritionist was available for any questions from the control group.

Outcome Measures

The study measured demographic and baseline characteristics, frailty, nutrition status, well-being, and quality of life.

1. Basic information sheet:

This includes basic demographics: age, gender, body mass index, education level, lived conditions, and chronic disease.

2. The Clinical Frailty Scale (CFS)

The Clinical Frailty Scale (CFS) is used to assess frailty in the elderly and was developed by Rockwood et al. in 2005. This scale was updated to version 2.0 in 2020. The frailty scale ranges from 1 to 9, where level 1 indicates very fit and level 9 indicates terminally ill, corresponding to a survival time of less than six months [16].

3. The Mini-Nutritional Assessment-Short Form (MNA-SF)

The MNA-SF consists of six questions that assess key areas of nutritional assessment: decline in food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems, and body mass index. The total score classifies individuals into three categories: normal nutritional status (12–14 points), at-risk of malnutrition (8–11 points), and malnourished (0–7 points). The MNA-SF has been validated in various studies and settings, demonstrating high sensitivity and specificity [17].

4. The Exercise Assessment and Screening for You (EASY)

The Easy For You Tool is an exercise screening and assessment tool designed to help the elderly choose safe and effective exercise modalities and physical activity programs. There are six questions, each of which can be answered with "yes" or "no." If the answer to one of the questions is "yes," the participant must find a healthcare provider to discuss an appropriate exercise plan before exercising [18].

5. Well-being Scale for Elders (WSE):

The Well-being Scale for Elders is a 9-item self-report questionnaire, including emotional, psychological, and social well-being. It has good reliability and construct validity, and can be effectively used to measure the happiness of older adults. The Chronbach α is 0.91, and the factor analysis results explain 59.67% of the variation [6]. In this study, Chronbach α is 0.82.

6. The EuroQoL five-dimensional instrument (EQ-5D 3L)

EQ-5D-3L is a standardized instrument developed by the EuroQol Group to measure general health status. It is widely used in both clinical and economic evaluations to assess health-related quality of life. The EQ-5D index comprises of five dimensions: mobility, self-care, daily activities, pain/discomfort, and anxiety/depression. Each dimension has three levels of severity (no problems, moderate problems, and extreme problems). Higher scores on this index indicate a poorer health-related quality of life. EQ-VAS is a visual analog scale ranging from 0 to 100, with higher scores indicating a better-perceived quality of life. Respondents evaluate their overall health on a scale from 0, indicating the worst possible health, to 100, indicating the best possible health [19]. The EQ-5D-3L has demonstrated good reliability, validity, and sensitivity for measuring health-related quality of life [20]. In this study, the Cronbach's alpha is 0.80.

Statistical Analysis

All data were analyzed using the SPSS software program (IBM, SPSS version 24, Chicago, IL, USA). This research uses descriptive statistics to analyze frequencies, means, and standard deviations (SD). Differences in outcome variables at baseline between the two groups are analyzed using the chi-square test and an independent t-test. GEE analyzes changes over time, group differences, and group-by-time interactions, including body composition, frailty, well-being, and quality of life.

Ethical considerations

This study was conducted with the utmost ethical considerations and approved by the National University Institutional Review Board (YM110168EF). All participants were respected, and their autonomy was upheld, as they provided written informed consent before enrollment. Participants were fully informed by a research assistant about the study’s purpose, procedure, benefits, and potential risks, ensuring transparency and respect for their rights and welfare.

Results

1. Baseline Characteristics

This study is quasi-experimental. 112 elderly people were recruited and assigned to this group based on their wishes and consent. There were 64 people in the experimental group and 48 in the control group. The experimental group received a multi-health promotion program, while the control group received no specific intervention. The majority of participants were female (67.0%), with an average body mass index of 24.51 (SD 3.6) (kg/□). Only 23.2% of the elderly live alone; the average frailty

score is 2.20 points. A difference analysis of the essential characteristics of the two groups was conducted, and the results indicated high homogeneity (Table 1).

Table1 Baseline characteristics (N=112)

Variable	Total n=112	EG n=64	Control group n=48	X^2/t	*P*
		n(%)/M(SD)	n(%)/M(SD)		
Age	75.10(6.2)	75.81(5.1)	74.16(1.1)	–1.32	.19
Gender				4.36	.04
Female	75(67.0)	48(75.0)	27(56.3)		
Male	37(33.0)	16(25.0)	21(43.8)		
BMI(kg/□)	24.51(3.6)	24.79(3.3)	24.13(3.9)	–0.96	.34
Education level				4.82	.19
None	13(11.6)	7(10.9)	6(12.5)		
Elementary	56(50.0)	36(56.3)	20(41.7)		
Junior high	10(8.9)	7(10.9)	3(6.3)		
Senior high and above	33(29.5)	14(21.9)	19(39.6)		
Lived conditions				1.19	.28
alone	26(23.2)	13(20.3)	6(12.5)		
With family	86(76.8)	51(79.7)	42(87.5)		
Chronic disease				3.04	.08
No	86(76.8)	53(82.8)	33(68.8)		
Yes	26(23.2)	11(17.2)	15(31.3)		
Frailty (CFS) [a]	2.20(0.9)	2.11(0.9)	2.31(0.9)	1.18	.24
Well-being (WSE) [b]	38.00(5.7)	37.86(6.0)	38.20(5.4)	0.32	.75
EQ5D index [c]	5.74(1.3)	5.92(1.4)	5.50(1.1)	–1.72	.09
EQ VAS[c]	80.57(9.7)	81.23(8.2)	79.7(11.3)	–0.84	.40

Baseline =before the intervention program; [a] CFS: The Clinical Frailty Scale;[b] WSE: Well-being scale for Elders;[c] EQ–5D–3L:European quality of life–5 dimensional, 3 level version. BMI, Body mass index; M, mean; SD, standard deviation.

2. Changes at different periods between the experimental group and the control group

The baseline BMI of the control group was 24.13 kg/m² (SD 3.89), with a slight decrement to 24.06 kg/m² (SD 3.63) at week 36. Frailty scores increased from 2.31 to 2.46, while well-being increased from 38.21 (SD 5.42) to 38.59 (SD 5.45). Quality of life improved, with scores decreasing from 5.50 (SD 1.07) to 5.35 (SD 0.90). The baseline BMI in the experimental group was 24.79 kg/m² (SD 3.34), which was reduced to 24.43 kg/m² (SD 3.42) by the 36 weeks. Frailty score increased from 2.11 to 2.16, well-being increased slightly from 37.86 (SD 5.99) to 38.91 (SD 4.97), and quality of life improved from 5.98 (SD 1.46) to 5.42 (SD 0.79). The above results indicate a slight decrease in the body mass index and clinical frailty scores of the control and experimental groups, with an improved quality of life (Table 2).

Table 2 Changes at different periods between the EG and the Control group (N=112)

Variable	Group	T0 M(SD)	T1 M(SD)	T2 M(SD)	T3 M(SD)
BMI(kg/□)	EG	24.79(3.34)	24.49(3.46)	24.39(3.40)	24.43(3.42)
	CG	24.13(3.89)	23.91(3.77)	23.93(3.73)	24.06(3.63)
Frailty (CSF) [a]	EG	2.11(0.88)	2.06(0.81)	2.12(0.85)	2.16(0.84)
	CG	2.31(0.93)	2.46(0.80)	2.46(1.01)	2.45(1.02)
Well-being (WSE) [b]	EG	37.86(5.99)	37.53(4.92)	38.92(4.92)	38.91(4.97)
	CG	38.21(5.42)	37.65(5.70)	38.33(4.82)	38.59(5.45)
EQ–5D index [c]	EG	5.98(1.46)	5.50(0.81)	5.42(0.85)	5.42(0.79)
	CG	5.50(1.07)	5.60(1.14)	5.38(0.96)	5.35(0.90)
EQ VAS [c]	EG	81.23(8.24)	80.63(8.30)	82.42(10.11)	83.20(9.16)
	CG	79.69(11.30)	80.35(10.68)	81.33(10.14)	81.74(10.04)

T0 =baseline, before the intervention program; T1= 12 weeks; T2=24weeks; T3= 36weeks;[a] CSF: The Clinical Frailty Scale;[b] WSE: Well-being scale for Elders;[c] EQ–5D–3L:European quality of life–5 dimensional, 3 level version. EG, Experimental Group; CG, Control group; BMI, Body mass index; M, mean; SD, standard deviation.

3. Generalized Estimating Equations (GEE) analysis of BMI, Frailty, Well-being, and Quality of life

The result of the study indicates that all participants experienced significant BMI reductions over 12 weeks. The BMI of the experimental group at 36 weeks was significantly lower than those of the control group. The experimental group had significantly better quality of life than the control group at 12 weeks (B– .589, p= .002) and 24 weeks (B– .438, p= .036). Time and group factors did not affect the experimental and control groups' frailty, well-being, and visual quality of life (Table 3).

Table 3 GEE Analysis of BMI, Frailty, Happiness, and QOL in Elderly Participants (N =112)

			95% Wald Confidence Interval		
Parameter	B	SE	Lower	Upper	*P*
BMI					
(Intercept)	24.13	0.56	23.04	25.22	.000
EG	0.66	0.69	–0.69	2.02	.340
[reference group=CG]	0[a]				
T3	0.15	0.12	–0.10	0.39	.230
T2	–0.20	0.10	–0.40	0.01	.062
T1	–0.22	0.09	–0.41	–0.03	.022
Baseline (T0)	0[a]				
EG*T3	–0.51	0.15	–0.81	–0.21	.001
EG*T2	–0.21	0.14	–0.48	0.07	.139
EG*T1	–0.08	0.13	–0.33	0.17	.528
EG*T0	0[a]				
Frailty (CFS)					
(Intercept)	2.31	0.13	2.05	2.57	.001
EG	–0.20	0.17	–0.54	0.13	.24
[reference group=CG]	0[a]	.	.	.	.
T3	0.15	0.09	–0.04	0.33	.13
T2	0.15	0.09	–0.03	0.32	.10
T1	0.15	0.10	–0.05	0.34	.14

Baseline (T0)	0[a]				
EG*T3	–0.10	0.12	–0.34	0.15	.43
EG*T2	–0.07	0.11	–0.29	0.15	.54
EG*T1	–0.19	0.12	–0.43	0.04	.11
EG*T0	0[a]				
Well-being (WSE)					
(Intercept)	38.21	0.77	36.69	39.73	.000
EG	–0.35	1.07	–2.45	1.76	.745
[reference group=CG]	0[a]				
T3	0.30	0.81	–1.28	1.88	.711
T2	0.13	0.87	–1.58	1.83	.886
T1	–0.56	0.82	–2.18	1.05	.494
Baseline (T0)	0[a]				
EG*T3	0.75	1.12	–1.44	2.94	.503
EG*T2	0.94	1.20	–1.41	3.28	.433
EG*T1	0.23	1.03	–1.79	2.26	.821
EG*T0	0[a]				
EQ5D index					
(Intercept)	5.55	0.15	5.20	5.80	.001
EG	0.48	0.24	0.02	0.95	.041
[reference group=CG]	0[a]				
T3	–0.16	0.16	–0.47	0.14	.300
T2	–0.13	0.15	–0.42	0.17	.411
T1	0.10	0.11	–0.11	0.32	.349
Baseline (T0)	0[a]				
EG*T3	–0.40	0.23	–0.84	0.04	.076
EG*T2	–0.44	0.21	–0.85	–0.03	.036
EG*T1	–0.59	0.19	–0.96	–0.21	.002
EG*T0	0[a]				
EQ VAS					
(Intercept)	79.69	1.61	76.52	82.85	.001
EG	1.55	1.91	–2.19	5.29	.418
[reference group=CG]	0[a]				
T3	1.74	1.46	–1.11	4.60	.231
T2	1.64	1.04	–0.39	3.68	.113
T1	0.66	0.71	–0.73	2.06	.350
Baseline (T0)	0[a]				
EG*T3	0.22	1.96	–3.62	4.07	.909

EG*T2	–0.46	1.81	–4.00	3.08	.800
EG*T1	–1.28	1.23	–3.68	1.13	.298
EG*T0					

T0 =baseline, before the intervention program; T1= 12 weeks; T2=24weeks; T3= 36week; CSF: The Clinical Frailty Scale; WSE: Well-being scale for Elders; EQ5D–3L: European quality of life–5 dimensional, 3–level version; BMI, body mass index; QOL, quality of life. SE, Standard error; GEE, a generalized estimating equation, was based on an AR1 working correlation matrix.

4. Body Composition in the Experimental Group Analyzed by Generalized Estimating Equations (GEE)

The results of this study found that there was no significant difference in the body fat percentage and visceral fat of the experimental group at different time points. Significant increases in muscle mass were seen at 24 and 36 weeks. Upper limb and core muscle strength significantly improved at 12 and 36 weeks. Lower limb muscle strength improved significantly only after 12 weeks. Muscular endurance, motor coordination, and stability improved significantly at 12, 24, and 36 weeks. These results indicate that the intervention positively impacted muscle mass and strength in the experimental group, with notably significant effects at 12 and 36 weeks (Table 4).

Table 4 Body Composition in the EG Analyzed by GEE (N=64)

Outcome			95% CI			
	B	SE	Lower	Upper	Wald *X*	*P*
Body fat percentage						
intercept	3.77	0.269	3.24	4.29	196.56	.000
T3 [a]	–0.31	0.280	–0.86	0.24	1.24	.265
T2 [a]	–0.42	0.280	–0.97	0.13	2.27	.132
T1 [a]	–0.03	0.080	–0.19	0.13	0.15	.695
Muscle content						
Intercept	33.06	1.20	30.70	35.42	753.74	.000
T3 [a]	3.03	1.24	0.61	5.47	6.00	.014
T2 [a]	4.29	1.21	1.92	6.66	12.58	.000

T1 [a]	–0.67	0.733	–2.10	0.77	0.83	.363
Upper Limb score						
Intercept	65.91	1.36	63.25	68.57	2363.36	.000
T3 [a]	5.00	1.98	1.13	8.86	6.43	.011
T2 [a]	2.42	1.93	–1.37	6.20	1.57	.211
T1 [a]	3.40	1.67	0.12	6.68	4.13	.042
Core score						
Intercept	65.05	1.10	62.90	67.20	3520.30	.000
T3 [a]	6.99	2.00	3.07	10.91	12.20	.000
T2 [a]	1.02	1.80	–2.50	4.54	0.33	.569
T1 [a]	4.43	1.44	1.60	7.25	9.45	.002
Lower limb score						
Intercept	67.48	1.35	64.84	70.12	2508.61	.000
T3 [a]	3.23	2.00	–0.70	7.15	2.60	.107
T2 [a]	0.91	1.96	–2.94	4.76	0.22	.642
T1 [a]	4.15	1.40	1.42	6.88	8.85	.003
Comprehensive Sports Score						
Intercept	62.38	1.05	60.32	64.43	3553.19	.000
T3 [a]	8.79	1.36	6.12	11.46	41.58	.000
T2 [a]	5.17	1.21	2.79	7.55	18.10	.000
T1 [a]	5.47	1.37	2.78	8.16	15.83	.000

T0 =baseline before the intervention program; T1= 12 weeks; T2=24weeks; T3= 36 weeks; SE, Standard error; GEE, a generalized estimating equation, was based on an AR1 working correlation matrix.

[a] reference group is the baseline (T0).

Discussion

The findings of this study show that the intervention of an integrated multidisciplinary healthcare program substantially enhanced muscle mass, muscle strength, and quality of life in the experimental group compared to the control group. Physical exercise programs have been demonstrated to improve bodily function, body composition, quality of life, and muscle strength in older individuals [21-23], which support the findings of this study. In a randomized trial by P.J. Marcos-Pardo et al.

(2024), the experimental group performed weight training twice a week with outdoor fitness equipment for eight weeks. The findings revealed significant increases in body composition (increased lean body mass, decreased fat mass), muscle strength (arms and legs), functional mobility, and quality of life. In contrast, the control group experienced significant losses in muscle strength, mobility, dynamic balance, and a significant decrease in quality of life [23]. A randomized trial by P.J. Marcos-Pardo et al. (2019) revealed that older adults in the experimental group who used professional fitness equipment for medium-to-high-intensity resistance circuit training for 12 weeks exhibited significant decreases in body weight, fat mass, and BMI. Concurrently, lean body mass, functional independence, and muscle strength in the upper and lower limbs exhibited notable improvements. The control group, which received no intervention, experienced significant increases in weight and BMI. However, the experimental group's body fat and visceral fat levels did not change significantly during the duration of the study [22]. Chittrakul et al. (2020) conducted a randomized study of pre-frail older adults that included a 12-week exercise intervention followed by a two-year follow-up. Significant increases in muscle strength in the 12th week were discovered, as well as improvements in knee extension, balance, and reaction speed that persisted until the 24th week. The experimental group had a considerably higher health-related quality of life than the control group by the 12th week. However, no significant differences appeared between the two groups by the 24th week, despite the control group undergoing three-weekly stretching exercises. This result contrasts with the continuous 24-week quality of life acquired in the study's experimental group [21]. Furthermore, unlike earlier research [22], the experimental group noted a substantial decrease in BMI after 36

weeks, highlighting the need for future follow-up studies on BMI alterations in older adults.

Physical activity and nutritional remedies positively impact body weight and muscle strength, and nutritional support improves older adult's physical performance. In the research by Liao et al. (2024), older adults with sarcopenia were randomly assigned to one of four groups. For 16 weeks, the nutrition group received individualized nutrition education and oral oligopeptide nutrition preparation. Handgrip strength increased significantly in all groups (nutrition, exercise, and combination). The nutrition group also exhibited significant increases in walking speed. Furthermore, the nutrition, activity, and combined groups showed substantial body weight and BMI increases. However, no increases in soft lean or skeletal muscular mass were detected in any groups, supporting the study's conclusion[15]. Liao et al. (2024) discovered that nutritional and exercise remedies can improve muscle strength and function in older sarcopenic individuals but do not muscle mass in short-term periods. Although body fat and visceral fat levels did not change considerably in the experimental group, muscle mass increased significantly by the 24th week and remained stable until the 36th week. Upper-limb muscle strength increased substantially for up to 36 weeks. However, lower-limb muscle strength improved for just 12 weeks. These findings demonstrate that the intervention has long-term benefits for older people's physical function. Notably, the experimental group's BMI remained similar to the control group until the 36th week, underscoring the necessity for longer-term investigations. This study revealed no significant difference in happiness levels between the experimental and control groups of older people. However, a quasi-experimental study by Lai et al. (2022) discovered that an outdoor physical activity program (including six days of outdoor activities such as

kayaking, rafting, hiking, and camping) significantly improved the happiness, self-image, and mental health of older adults [24], opposing the findings of this study. Another quasi-experimental study by Jung et al. (2022) utilized an integrative cognitive function improvement program over six weeks. It showed significant improvements in cognitive function and happiness in the experimental group, with no significant changes in the control group, differing from this study's results [25]. Previous research has shown that interventions can positively impact older adults' happiness, improving health and longevity. However, the happiness of older adults is influenced by many factors, including depression risk, psychological health, family functioning, social and economic relationships, biological risk factors, leisure and time use, health behaviors and habits, and quality of life. For older adults, subjective well-being, life satisfaction, optimism, and positive emotions are associated with happiness [7]. The combined findings of these studies reveal that the design of intervention programs for older adults varies, and exercise training improves muscle strength, physical function, and body composition. Further research is needed to determine the depth of these effects, recommended types of exercise, and various forms of nutritional support. Previous research discovered that multidisciplinary intervention programs increase the understanding of community-dwelling older individuals on healthy living, mental health, social participation, and positive aging [26].

Improving muscle strength in older people requires increasing muscle mass since muscle mass and body fat percentage are predictors of muscle strength. Furthermore, aging is linked to decreased physical strength and changes in body composition, such as lower muscle mass, and increased obesity [27]. Enhanced muscle strength in older adults improves stability, coordination, flexibility, and balance, lowering the risk of

injury [4]. Given the global trend of increasing life expectancy and the proportion of the senior population, promoting active and healthy aging is crucial, rather than simply a slogan. Physical inactivity and malnutrition are prevalent among older adults [28]. Nutritional issues experienced by older individuals are strongly linked to their health and quality of life [5]. Although this study did not aim at the factors that impact quality of life, the results suggest that nutritional issues and happiness in older adults are important areas for further research. Our study confirms that the intervention program positively impacts the physical function and quality of life of the elderly. However, further research is required to verify the impact on long-term nutritional status and well-being. This study has several limitations that must be noted. First, sampling bias could not be avoided as random sampling was not adopted. Second, the intervention location was not in the participants' homes, making it impossible to promote the habit of exercising at home. Third, this study is a short-term intervention that only provides limited nutritional prescriptions, which may limit the influence of the results. It is recommended that future research strengthen the design of nutritional interventions for the elderly and track their long-term benefits. Fourth, the small sample size of participants limits the generalizability of the results of this study. Future research should address all these issues.

Conclusion

This study's findings emphasize the practical benefits of physical and social activities, and nutritional support in improving the quality of life and overall physical health of the elderly.

Acknowledgments

Thanks for YuSen Biotechnology Co., Ltd. and Keisei Pharmacy, which led to the successful completion of this research project. This study was funded by YuSen Biotechnology Co., Ltd. and Keisei Pharmacy.

Conflict of Interest

This study is an original article presenting unique findings that contribute to the geriatric health field.

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Supplementary Files

CONSORT (or other) checklists

CONSORT 2010 checklist of information.
URL: http://asset.jmir.pub/assets/f8fd6204d2d2408865a581458c5643a9.pdf