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ORIGINAL ARTICLE

Exercise promotion as a strategy for preventing sarcopenia and reducing elderly abuse in Nigeria

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ABSTRACT

This study investigated exercise promotion as a strategy for preventing sarcopenia and reducing elderly abuse among older adults in the Federal Capital Territory. A quasi-experimental pretest–posttest control group design was adopted, involving 120 participants aged 60 years and above, who were assigned to experimental (n = 60) and control (n = 60) groups. The experimental group participated in a 12-week structured exercise program comprising resistance, flexibility, and balance training, while the control group maintained their usual routines. Data were collected using standardized measures of handgrip strength, gait speed, functional mobility, muscle mass, and a structured elder abuse questionnaire assessing physical, emotional, and neglect dimensions. Data were analyzed using Analysis of Covariance (ANCOVA) and Multivariate Analysis of Covariance (MANCOVA) at a .05 level of significance. The ANCOVA results showed that exercise intervention significantly improved muscle strength, $F(1,117) = 57.12$, $p < .001$, partial $\eta^2 = .328$; muscle mass, $F(1,117) = 41.58$, $p < .001$, partial $\eta^2 = .262$; and reduced elderly abuse, $F(1,117) = 50.41$, $p < .001$, partial $\eta^2 = .302$. The MANCOVA results further indicated a significant combined effect on gait speed and functional mobility, Wilks' $\Lambda = .641$, $F(2,116) = 32.48$, $p < .001$, partial $\eta^2 = .359$. The study concludes that structured exercise interventions significantly enhance physical function and reduce vulnerability to elderly abuse. It is recommended that exercise programs be integrated into geriatric and community health services to promote healthy ageing and safeguard older adults' well-being.

Keywords: sport medicine; exercise promotion; sarcopenia; elderly abuse.

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INTRODUCTION

Sarcopenia is a progressive age-related disorder characterized primarily by reduced muscle strength, accompanied by loss of muscle quantity or quality and impaired physical performance. It has become an important public health concern because of its association with frailty, functional limitation, falls, disability, loss of independence, and reduced quality of life among older adults (Cruz-Jentoft et al., 2019). The condition is particularly relevant within the context of population ageing in low- and middle-income countries, including Nigeria, where health and social-care systems must increasingly respond to the needs of older populations. The contemporary healthy-ageing framework extends the focus beyond disease prevention to the maintenance of functional ability, emphasizing the capacity of older people to remain mobile, meet their basic needs, maintain relationships, and participate meaningfully in society (WHO, 2021). Consequently, preventing or delaying functional decline associated with sarcopenia is an important component of healthy ageing.

Contemporary evidence provides strong support for exercise as a modifiable strategy for preventing and managing sarcopenia. Resistance exercise is particularly important because it provides an adaptive stimulus for maintaining muscle strength and muscle function in later life. A systematic review and network meta-analysis of 42 studies involving 3,728 older adults found that resistance exercise and combinations of resistance, aerobic, and balance exercise produced meaningful improvements in muscle strength and physical function, including handgrip strength and gait speed (Shen et al., 2023). Similarly, Ferreira et al. (2023), in a systematic review of systematic reviews involving 3,877 older adults, reported significant improvements in handgrip strength, skeletal muscle mass, and gait speed following exercise interventions, with resistance training showing particular benefits for muscle-related outcomes. More recent evidence also indicates that moderate-to-vigorous resistance training can improve muscle strength, gait speed, functional performance, and selected indicators of muscle mass among older adults with sarcopenia (Chen et al., 2023). These findings provide contemporary support for structured exercise programmes that combine resistance training with functional and balance activities.

The relevance of exercise extends beyond physiological outcomes to the broader concept of healthy ageing. The WHO Decade of Healthy Ageing 2021–2030 emphasizes the development of communities that foster the abilities of older people and the delivery of integrated, person-centred primary health services that respond to their needs (WHO, 2021). Within this framework, physical activity can be viewed not simply as an individual lifestyle behaviour but as an important component of public health and community-based healthy-ageing strategies. Evidence from Nigeria further demonstrates the relevance of physical activity to the wellbeing of community-dwelling older adults. Oyeyemi et al. (2023) found that physical activity moderated the relationship between neighbourhood environmental characteristics and quality of life among older adults in Nigeria, suggesting that both individual activity and supportive community environments are relevant to healthy ageing. This evidence supports the integration of feasible exercise opportunities into community and primary healthcare settings in Nigeria, particularly where access to specialized geriatric rehabilitation services may be limited.

Exercise promotion may also have implications for the social vulnerability of older adults. Elder abuse encompasses physical, psychological or emotional, financial, and other forms of abuse, as well as neglect and abandonment, and constitutes an important public health and human-rights concern. The WHO estimates that approximately one in six people aged 60 years and older experience some form of abuse in community settings each year, although evidence remains limited in many countries (WHO, 2024). Physical frailty, functional dependence, social isolation, and declining capacity to perform activities independently may increase vulnerability among some older adults. Therefore, interventions that preserve muscle strength, mobility, and functional independence may have relevance to the broader protection and wellbeing of older people. Exercise should not, however, be regarded as a stand-alone intervention for elder abuse. Rather, improvements in physical function and independence may complement safeguarding, social-support, healthcare, and social-protection interventions directed at preventing and responding to abuse.

Group-based and community-oriented exercise may provide additional psychosocial benefits by creating opportunities for social interaction, participation, and supportive relationships. Such approaches are consistent with the WHO healthy-ageing framework, which emphasizes the importance of environments that enable older people to maintain relationships and participate in society (WHO, 2021). In Nigeria, where community structures and family support arrangements vary considerably across socioeconomic and geographic contexts, accessible group-based physical activity programmes could provide an additional platform for social participation and health promotion. However, claims concerning a general weakening of traditional family support systems should be interpreted cautiously because the evidence is heterogeneous and context-specific. Instead, the emphasis should be placed on developing complementary community support systems that strengthen, rather than replace, existing family and social networks.

Taken together, contemporary evidence suggests that exercise promotion can be positioned as an important component of an integrated strategy for healthy ageing, sarcopenia prevention, and the preservation of functional independence. Resistance and multicomponent exercise can improve muscle strength and physical performance, while community-based programmes may simultaneously promote social participation and access to health-promoting activities (Chen et al., 2023; Ferreira et al., 2023; Shen et al., 2023). In the Nigerian context, integrating appropriately supervised exercise programmes into primary healthcare centres, community organizations, ageing services, and other accessible community settings could provide a feasible approach to supporting older adults. Such programmes should form part of a broader multidisciplinary framework encompassing exercise promotion, nutritional support, falls prevention, social protection, elder-abuse safeguarding, and age-friendly community development. This integrated approach is consistent with the WHO Decade of Healthy Ageing and provides a stronger conceptual basis for examining exercise promotion as a strategy for preventing sarcopenia while potentially reducing vulnerability to elder abuse.

This aligns with broader public health strategies that emphasize active ageing, social inclusion, and community-based interventions as means of improving overall well-being among older populations (Akinyemi et al., 2015). In light of these considerations, this study investigated exercise promotion as a strategy for preventing sarcopenia and reducing elderly abuse among older adults in the Federal Capital Territory.

Objectives of the study
The main objective of this study is to examine exercise promotion as a strategy for preventing sarcopenia and reducing elderly abuse among older adults in the Federal Capital Territory.

The specific objectives are to:

- Determine the effect of exercise intervention on muscle strength (handgrip strength) among elderly participants.
- Assess the effect of exercise intervention on gait speed and functional mobility among elderly participants.
- Evaluate the impact of exercise intervention on muscle mass status (sarcopenia indicators) among elderly participants.

- Examine the effect of exercise participation on the level of elderly abuse (physical, emotional, and neglect) among older adults.

MATERIALS AND METHODS

This study was conducted in the Abuja Municipal Area Council (AMAC) of the Federal Capital Territory (FCT), Nigeria, a cosmopolitan area comprising communities with a growing elderly population. The study employed a quasi-experimental pretest–posttest control group design to evaluate the effectiveness of exercise promotion as a strategy for preventing sarcopenia and reducing elderly abuse among older adults. After baseline assessment, eligible participants were allocated to either the experimental or control group to ensure comparable baseline characteristics before the commencement of the intervention.

The target population comprised community-dwelling men and women aged 60 years and above residing in Abuja Municipal Area Council. Participants were recruited through community leaders, primary healthcare centres, and religious organizations. A multistage sampling technique was employed. First, four communities were purposively selected based on accessibility and the availability of older adults. Eligible participants were subsequently identified through community visitation and screened according to the inclusion and exclusion criteria. A total of 166 older adults met the eligibility criteria and consented to participate in the study. Of these, 16 participants did not complete the baseline assessments, leaving 150 participants who commenced the intervention. During the 12-week intervention period, 30 participants withdrew from the study, representing an attrition rate of 20.0% among those who started the intervention. Reasons for withdrawal included illness unrelated to the intervention, relocation from the study area, personal commitments, and inconsistent attendance at exercise sessions. Consequently, 120 participants (60 in the experimental group and 60 in the control group) completed the intervention and were included in the final analyses, corresponding to an overall retention rate of 80.0% among participants who commenced the intervention.

Eligible participants were those aged 60 years and above who were medically fit to engage in light-to-moderate physical activity, able to ambulate independently with or without assistive devices, free from severe cognitive impairment, and willing to provide written informed consent. Individuals with unstable cardiovascular disease, severe musculoskeletal disorders, advanced neurological conditions, or other medical contraindications to exercise were excluded from the study.

Data were collected using standardized, validated, and culturally adapted instruments. Sarcopenia was assessed using objective measures of handgrip strength, gait speed, muscle mass, and functional mobility. Handgrip strength was measured using a Jamar® Hydraulic Hand Dynamometer (Patterson Medical, Warrenville, IL, USA), which was calibrated according to the manufacturer's specifications before data collection and periodically checked throughout the study. Participants were assessed in a standardized seated position with the shoulder adducted, elbow flexed at 90°, forearm in a neutral position, and wrist slightly extended, following the recommendations of the American Society of Hand Therapists (ASHT). Three maximal grip trials were performed on the dominant hand with one-minute rest intervals, and the highest value (kg) was recorded. Gait speed was assessed using the 4-metre walk test, in which participants walked at their usual pace over a measured distance, with the average of two trials expressed in metres per second (m/s). Functional mobility was evaluated using the Timed Up and Go (TUG) Test, which measured the time (seconds) required for participants to stand from a chair, walk three metres, turn, return, and sit down. Muscle mass was estimated using Bioelectrical Impedance Analysis (BIA) with an Omron HBF-514C Body Composition Monitor (Omron Healthcare Co., Kyoto, Japan) following standardized assessment procedures, and skeletal muscle mass index was calculated in accordance with the revised European Working Group on Sarcopenia in Older People (EWGSOP2) recommendations.

Elder abuse was assessed using a structured questionnaire adapted from the Hwalek–Sengstock Elder Abuse Screening Test (H-S/EAST) and selected items from the Elder Assessment Instrument (EAI) to measure physical abuse, emotional abuse, and neglect among older adults. The adaptation involved expert review to ensure linguistic clarity and cultural appropriateness within the Nigerian context while preserving the original constructs. The final instrument comprised 18 items, with six items allocated to each abuse dimension, and responses were rated on a 4-point Likert scale ranging from Never (1) to Often (4). Higher scores indicated greater exposure to elder abuse.

The study instruments underwent rigorous psychometric evaluation before administration. Face and content validity were established by experts in exercise physiology, gerontology, public health, psychology, and measurement and evaluation, resulting in a Scale Content Validity Index (S-CVI) of 0.91. A pilot study involving older adults outside the study area was conducted to assess reliability and construct validity. Exploratory factor analysis confirmed the three-factor structure of the elder abuse questionnaire, with factor loadings ranging from 0.61 to 0.87. Internal consistency reliability was satisfactory, yielding Cronbach's alpha coefficients of 0.84 for physical abuse, 0.86 for emotional abuse, 0.81 for neglect, and an overall reliability coefficient of 0.82, indicating excellent internal consistency and supporting the suitability of the instruments for use among older adults in the Federal Capital Territory, Nigeria.

The intervention consisted of a 12-week supervised exercise programme incorporating progressive resistance training, flexibility exercises, balance training, and functional mobility activities. Exercise sessions were conducted three times per week, with each session lasting approximately 45–60 minutes under the supervision of qualified exercise specialists. Exercise intensity was progressively increased according to participants' functional capacity while adhering to established exercise safety guidelines for older adults. Attendance was monitored using standardized attendance registers throughout the intervention. Participants who attended at least 80% (29 of the 36 scheduled sessions) were regarded as adherent to the intervention protocol. The control group continued with their usual daily activities and did not receive the structured exercise intervention during the study period. Baseline (pretest) measurements were obtained before the intervention, while posttest assessments were conducted immediately after completion of the 12-week programme.

Data were analyzed using IBM SPSS Statistics Version 27.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic characteristics and outcome variables. Analysis of Covariance (ANCOVA) was used to determine the effects of the intervention on handgrip strength, muscle mass, and elderly abuse while controlling for baseline scores. Multivariate Analysis of Covariance (MANCOVA) was employed to examine the combined effects of the intervention on gait speed and functional mobility after adjusting for pretest measurements. Analyses were conducted using the 120 participants who completed the intervention (complete-case analysis). Therefore, no missing values were identified among participants who completed both the baseline and post-intervention assessments. Consequently, statistical significance was set at $p < .05$.

Ethical approval was obtained from the Institutional Research Ethics Committee before commencement of the study. Permission was also obtained from relevant community authorities within the study area. Written informed consent was obtained from all participants before enrolment. Participants were informed of their right to withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained through coded identification numbers and secure storage of all research data.

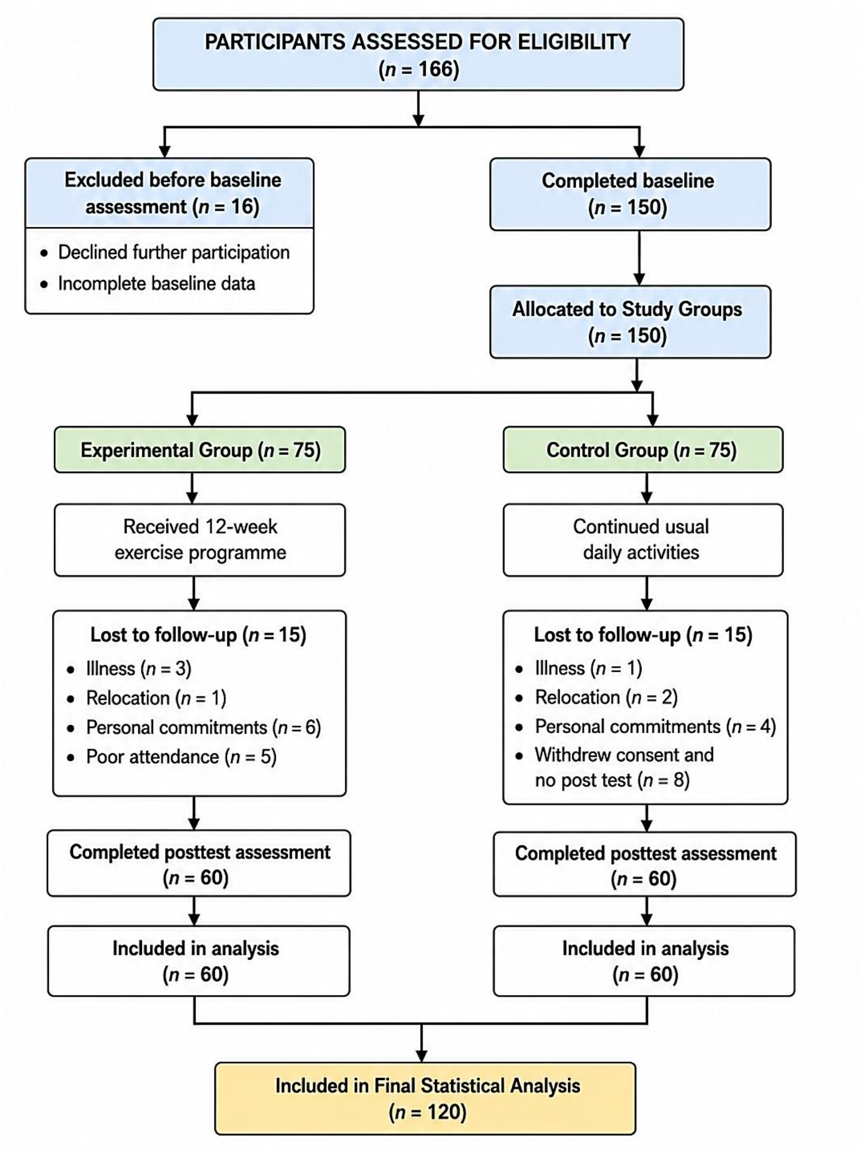

Figure 1. CONSORT-style flow diagram illustrating participant recruitment, screening, allocation, follow-up, attrition, and inclusion in the final analysis.

RESULTS

Table 1. Demographic characteristics of the respondents.

Age group (Years)	Gender	Experimental n (%)	Control n (%)
60–64 years	Male	14 (23.3)	16 (26.7)
	Female	16 (26.7)	14 (23.3)
65–69 years	Male	16 (26.7)	14 (23.3)
	Female	14 (23.3)	16 (26.7)
Total		60 (100)	60 (100)

Hypothesis H_1: There will be no significant difference in muscle strength (handgrip strength) between elderly participants exposed to the exercise intervention and those in the control group.

Table 2. Descriptive statistics for handgrip strength by group (Kg).

Group	n	Pretest Mean ± SD	Post-test Mean ± SD	Mean change	95% CI of mean change
Experimental	60	23.41 ± 3.62	29.85 ± 3.91	6.44	5.72 – 7.16
Control	60	23.68 ± 3.57	24.10 ± 3.64	0.42	-0.18 – 1.02

Table 2 shows that both groups had comparable baseline handgrip strength before the intervention. Following the 12-week exercise programme, participants in the experimental group demonstrated a substantial increase in mean handgrip strength (Mean change = +6.44 kg), whereas only a marginal improvement was observed in the control group (Mean change = +0.42 kg). The non-overlapping confidence intervals indicate a meaningful improvement in muscle strength among participants exposed to the exercise intervention.

Table 3. Assumption tests for ANCOVA.

Assumption	Statistical test	Test statistic	*p*-value
Normality	Shapiro–Wilk	W = 0.986	.274
Homogeneity of variances	Levene's Test	F = 1.16	.283
Homogeneity of regression slopes	Group × Pretest Interaction	F = 0.81	.371

Preliminary analyses confirmed that all assumptions required for ANCOVA were met (Table 3) The Shapiro–Wilk test indicated that handgrip strength scores were normally distributed ($p > .05$). Levene's test showed equal variances between groups ($p > .05$), while the interaction between baseline handgrip strength and treatment group was not statistically significant ($p > .05$), confirming homogeneity of regression slopes.

Table 4. Analysis of Covariance (ANCOVA) of effect of exercise intervention on muscle strength.

Source	Type III Sum of squares	df	Mean square	F	Sig. (*p*-value)	Partial Eta squared	Adjusted Mean (kg)	95% Confidence Interval
Pretest (Covariate)	284.6	1	284.6	16.85	<.001	.13	24.10	28.80-30.90
Group (Intervention)	965.2	1	965.2	57.12	<.001	.33	29.85	23.05-25.15
Error	1976.4	117	16.89					
Total	3226.2	119						

The result indicates a statistically significant difference in muscle strength between elderly participants who participated in the exercise intervention and those in the control group after controlling for baseline handgrip strength. The adjusted mean value shows that the experimental group (29.85 kg) had significantly higher muscle strength compared to the control group (24.10 kg). This suggests that the structured exercise program was effective in improving upper-body muscle strength among older adults in the Federal Capital Territory.

The effect size (partial eta squared = .33) indicates a large effect, implying that a substantial proportion (33%) of the improvement in muscle strength can be attributed to the exercise intervention. This demonstrates that resistance and functional exercise training play a critical role in mitigating age-related decline in muscular strength. Since the group effect is statistically significant, $F(1,117) = 57.12$, $p < .001$, $\eta^2 = .33$, the null hypothesis is rejected.

Hypothesis H_2: There will be no significant difference in gait speed and functional mobility between elderly participants exposed to the exercise intervention and those in the control group.

Table 5. Descriptive statistics for gait speed and functional mobility.

Variable	Group	n	Pretest Mean ± SD	Post-test Mean ± SD	Mean change	95% CI of Mean change
Gait speed (m/s)	Experimental	60	0.89 ± 0.18	1.21 ± 0.21	0.32	0.27–0.37
	Control	60	0.90 ± 0.19	0.92 ± 0.18	0.02	-0.02–0.06
Functional mobility (TUG, s)	Experimental	60	13.81 ± 1.82	9.85 ± 1.51	-3.96	-4.42 – -3.50
	Control	60	13.65 ± 1.74	13.42 ± 1.68	-0.23	-0.61 – 0.15

The descriptive statistics in Table 5 revealed that participants in both groups had comparable baseline values for gait speed and functional mobility. Following the 12-week intervention, the experimental group demonstrated a marked improvement in both outcome measures. Specifically, gait speed increased by 0.32 m/s in the experimental group compared with only 0.02 m/s in the control group. Similarly, participants in the exercise group recorded a substantial reduction in Timed Up and Go (TUG) completion time (mean change = −3.96 seconds), whereas the control group showed only a slight reduction (−0.23 seconds). The corresponding 95% confidence intervals indicate that these improvements were both clinically and statistically meaningful.

Table 6. MANCOVA summary of the effect of exercise intervention on gait speed and functional mobility.

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta squared
Intercept	Wilks' Lambda	.215	211.84	2.00	116.00	<.001	.785
	Pillai's Trace	.785		2.00	116.00	.00	.785
	Hotelling's Trace	3.653		2.00	116.00	.00	.785
	Roy's Largest Root	3.653		2.00	116.00	.00	.785
Pretest (Covariates)	Wilks' Lambda	.812	12.94	2.00	116.00	.00	.182
	Pillai's Trace	.188		2.00	116.00	.00	.182
	Hotelling's Trace	.231		2.00	116.00	.00	.182
	Roy's Largest Root	.231		2.00	116.00	.00	.182
Group	Wilks' Lambda	.641	32.48	2.00	116.00	.00	.359
	Pillai's Trace	.359		2.00	116.00	.00	.359
	Hotelling's Trace	.560		2.00	116.00	.00	.359
	Roy's Largest Root	.560		2.00	116.00	.00	.359

The MANCOVA results indicate that the exercise intervention had a statistically significant combined effect on gait speed and functional mobility after controlling for pretest scores. The experimental group demonstrated higher gait speed and better functional mobility (lower time in seconds) compared to the control group.

Table 7. Tests of between-subjects effects dependent variable: Gait speed (m/s).

Source	Type III Sum of squares	df	Mean square	F	Sig.	Partial Eta squared	Adjusted mean
Corrected model	5.807	2	2.903	34.32	.00	.37	
Intercept	112.64	1	112.64	1331.05	.00	.92	
Pretest	1.842	1	1.842	21.76	.00	.16	0.92
Group	3.965	1	3.965	46.82	<.001	.29	1.21
Error	9.902	117	0.085				
Total	128.35	120					
Corrected total	15.709	119					

The partial eta squared value (.36) indicates a large multivariate effect size, suggesting that the intervention substantially improved overall physical performance i.e. 35.9% of the variance in the combined measures of gait speed and functional mobility was explained by the exercise intervention after controlling for baseline differences. The univariate results further confirm that both gait speed and functional mobility were independently and significantly improved by the exercise program. Since the multivariate test is statistically significant (Wilks' Λ = 0.641, F(2,116) = 32.48, *p* < .001), the null hypothesis is rejected. The present intervention produced an approximately 0.32-m/s increase in gait speed and a 3.96-second reduction in TUG time in the experimental group. The comparatively larger changes may reflect differences in programme composition, supervision, baseline functional status, and participant characteristics.

Table 8. Tests of between-subjects effects dependent variable: Functional mobility (Timed up and go – seconds).

Source	Type III Sum of squares	df	Mean square	F	Sig.	Partial Eta squared	Adjusted mean
Corrected model	138.85	2	69.43	32.73	.00	.36	
Intercept	2450.62	1	2450.62	1155.95	.00	.91	
Pretest	42.15	1	42.15	19.88	.00	.14	13.42
Group	96.7	1	96.7	45.62	<.001	.28	9.85
Error	247.8	117	2.12				
Total	2865.47	120					
Corrected total	386.65	119					

The univariate follow-up analyses further showed that the intervention significantly improved both outcome measures independently. For gait speed (Table 7), participants in the experimental group achieved a significantly higher adjusted mean (1.21 m/s) than those in the control group (0.92 m/s), F(1,117) = 46.82, *p* < .001, partial η^2 = .286. Likewise, functional mobility improved significantly (Table 8), with the experimental group recording a significantly lower adjusted Timed Up and Go score (9.85 seconds) compared with the control group (13.42 seconds), F(1,117) = 45.62, *p* < .001, partial η^2 = .281. These effect sizes indicate large practical effects of the intervention on both gait speed and functional mobility.

Hypothesis H_3: There will be no significant difference in muscle mass status between elderly participants in the experimental and control groups following the intervention.

Table 9. Descriptive statistics for muscle mass status (kg).

Group	n	Pretest Mean ± SD	Post-test Mean ± SD	Mean change	95% CI of Mean change
Experimental	60	22.18 ± 1.62	24.75 ± 1.58	2.57	2.19–2.95
Control	60	22.05 ± 1.59	22.10 ± 1.56	0.05	-0.21–0.31

Table 9 shows that both the experimental and control groups had comparable baseline muscle mass prior to the intervention. Following the 12-week structured exercise programme, participants in the experimental group recorded a substantial increase in muscle mass (mean change = +2.57 kg), whereas the control group exhibited virtually no improvement (mean change = +0.05 kg). The 95% confidence intervals indicate that the increase observed in the experimental group was both statistically and clinically meaningful.

Table 10 presents the results of the Analysis of Covariance (ANCOVA) examining the effect of the structured exercise intervention on muscle mass status after controlling for baseline muscle mass. Prior to conducting the analysis, the assumptions underlying ANCOVA were evaluated. The results confirmed that the assumptions of normality, homogeneity of variances, and homogeneity of regression slopes were satisfied, indicating that the ANCOVA model was appropriate for the data. The result revealed a statistically significant effect of group on post-test muscle mass, F(1,117) = 41.58, p < .001, partial η^2 = .262. Participants in the experimental group (M = 24.75, SE = 0.16) had significantly higher muscle mass compared to those in the control group (M = 22.10, SE = 0.16), after adjusting for baseline differences. The findings indicate that the exercise intervention significantly improved muscle mass among older adults. The effect size (η² = .262) suggests a large practical effect, confirming that structured exercise is effective in reducing sarcopenia indicators. Since the group effect is statistically significant, the null hypothesis is rejected.

Table 10. Analysis of covariance (ANCOVA) on muscle mass status.

Source	Type III Sum of squares	Df	Mean square	F	Sig.	Partial Eta squared	Adjusted mean (kg)
Corrected model	112.86	2	56.43	36.58	.00	.38	
Intercept	1456.2	1	1456.2	944.19	.00	.89	
Pretest (covariate)	48.72	1	48.72	31.59	.00	.21	22.10
Group (intervention)	64.14	1	64.14	41.58	<.001	.26	24.75
Error	180.56	117	1.54				
Total	1750	120					
Corrected total	293.42	119					

Hypothesis H_4: There will be no significant difference in the level of elderly abuse (physical, emotional, and neglect) between participants who engage in the exercise program and those who do not.

Table 11. Analysis of covariance (ANCOVA) of effect of exercise intervention on elderly abuse (Physical, emotional, and neglect combined).

Source	Type III Sum of squares	df	Mean square	F	Sig.	Partial Eta squared	Adjusted mean score
Corrected model	1157.75	2	578.88	34.38	.00	.37	
Intercept	2685.4	1	2685.4	159.56	.00	.58	
Pretest (covariate)	312.45	1	312.45	18.62	.00	.14	31.88
Group (intervention)	845.3	1	845.3	50.41	<.001	.30	22.45
Error	1968.8	117	16.83				
Total	5812	120					
Corrected total	3126.55	119					

An analysis of covariance (ANCOVA) was conducted to examine the effect of exercise intervention on elderly abuse while controlling for pretest scores. The result revealed a statistically significant effect of group on post-test elderly abuse scores, $F(1,117) = 50.41$, $p < .001$, partial $\eta^2 = .302$. Participants in the exercise group (M = 22.45, SE = 0.74) reported significantly lower levels of abuse compared to those in the control group (M = 31.88, SE = 0.74), after adjusting for baseline differences. The findings indicate that participation in the exercise program significantly reduced experiences of physical, emotional, and neglect-related abuse among older adults. The effect size ($\eta^2 = .302$) suggests a large practical impact, highlighting exercise as an effective psychosocial and protective intervention. Since the group effect is statistically significant, the null hypothesis is rejected.

DISCUSSION

Findings on strength

The present study found a statistically significant improvement in handgrip strength among older adults who participated in the 12-week structured exercise intervention compared with those in the control group. After adjustment for baseline handgrip strength, the experimental group recorded a higher estimated marginal mean of 29.85 kg compared with 24.10 kg in the control group. The intervention effect was statistically significant, $F(1,117) = 57.12$, $p < .001$, with a partial eta squared of .328. This represents a large effect according to conventional effect-size benchmarks and indicates that the between-group difference in post-intervention handgrip strength was substantial after accounting for baseline differences. The finding is consistent with contemporary evidence demonstrating that resistance-based exercise is effective in improving muscle strength among older adults with sarcopenia.

The magnitude of the present finding is broadly comparable with, although not directly equivalent to, effects reported in recent systematic reviews. Liu et al. (2022), in a meta-analysis of 14 randomized controlled trials involving 561 older adults with sarcopenia, reported a significant positive effect of resistance training on handgrip strength (SMD = 0.81, 95% CI, 0.35–1.27). Their interventions varied in duration, intensity, and training modality, demonstrating that the strength response to exercise is influenced by programme characteristics. Similarly, Shen et al. (2023) synthesized 42 randomized controlled trials involving 3,728 older adults with sarcopenia and found that resistance and balance exercise combined with nutrition produced an approximately 4.19-kg improvement in handgrip strength, while resistance exercise was among the most effective approaches for improving physical function. The present study involved 120 participants who completed a 12-week programme, with exercise sessions conducted three times weekly. The relatively large partial eta squared observed in the present study should therefore be interpreted in relation to its supervised, multicomponent programme and ANCOVA-based adjustment for baseline strength rather than assumed to be directly comparable with standardized mean differences from meta-analyses.

The present result also extends the earlier literature by providing evidence from a Nigerian community context. Much of the contemporary sarcopenia intervention literature is derived from high-income or Asian settings, whereas evidence from sub-Saharan Africa remains comparatively limited. The finding that older adults in the Federal Capital Territory responded positively to a structured exercise programme is therefore relevant to the transferability of exercise-based sarcopenia prevention strategies to low- and middle-income settings. It also supports the broader healthy-ageing framework of the World Health Organization (WHO), which emphasizes maintaining functional ability through supportive communities and integrated, person-centred primary health services (WHO, 2021). The finding should not, however, be interpreted as evidence that exercise alone explains all changes in muscle strength, since nutritional status, habitual activity, health conditions, and other individual characteristics may also influence strength outcomes.

The physiological explanation for the observed improvement is consistent with established mechanisms of resistance exercise. Progressive loading can promote neuromuscular adaptation, improve motor-unit recruitment and coordination, and stimulate muscle protein synthesis. Contemporary evidence further suggests that resistance-training intensity, frequency, and programme structure can modify the magnitude of improvement in strength and physical performance (Chen et al., 2023). Thus, the present findings provide empirical support for incorporating appropriately supervised resistance and functional exercises into community-based healthy-ageing programmes in Nigeria.

Findings on gait speed and functional mobility

The present study demonstrated a statistically significant multivariate effect of the exercise intervention on the combined outcomes of gait speed and functional mobility after controlling for baseline scores. The MANCOVA produced Wilks' $\Lambda = .641$, $F(2,116) = 32.48$, $p < .001$, partial $\eta^2 = .359$, indicating a large multivariate effect. Follow-up analyses showed that the experimental group achieved an adjusted gait speed of 1.21 m/s compared with 0.92 m/s in the control group, $F(1,117) = 46.82$, $p < .001$, partial $\eta^2 = .286$. Functional mobility also improved, with the experimental group recording an adjusted Timed Up and Go (TUG) score of 9.85 seconds compared with 13.42 seconds in the control group, $F(1,117) = 45.62$, $p < .001$, partial $\eta^2 = .281$. These results suggest that the intervention produced a broad improvement in physical performance rather than an isolated improvement in one mobility measure.

The findings are supported by recent evidence, although the magnitude of effects varies across studies. Shen et al. (2023), in a network meta-analysis of 42 randomized controlled trials involving 3,728 older adults with sarcopenia, reported that resistance and balance exercise produced an improvement in usual gait speed of approximately 0.16 m/s and an improvement in TUG performance of approximately 1.85 seconds. In comparison, the present experimental group demonstrated a 0.32-m/s increase in gait speed and a 3.96-second reduction in TUG time from pretest to post-test. These changes appear larger than the average effects reported in that meta-analysis. However, direct comparison should be undertaken cautiously because the studies differed in participant characteristics, baseline functional status, exercise dosage, intervention supervision, measurement procedures, and statistical approaches. The present study's 12-week, three-sessions-per-week programme may have provided a relatively concentrated exercise exposure that contributed to the observed functional improvements.

The present findings are also consistent with Zhao et al. (2022), who synthesized 13 randomized controlled trials and found that resistance training significantly improved grip strength, gait speed, and skeletal muscle index among older adults with sarcopenia. More recent evidence further indicates that resistance exercise improves TUG performance, while combined or multicomponent exercise can produce broader functional benefits (Shen et al., 2023). Nevertheless, the literature is not entirely uniform. A network meta-analysis by Wang et al. (2023) found significant improvements in handgrip strength and TUG with resistance training but did not find statistically significant improvements in gait speed across all exercise modalities. This variation suggests that the effectiveness of exercise for gait speed may depend on the specific exercise prescription and whether programmes incorporate functional and balance components in addition to resistance training.

The present study's findings are particularly important within the framework of healthy ageing because gait speed and TUG performance represent practical indicators of mobility and functional independence. WHO (2021) emphasizes the importance of maintaining functional ability and developing communities that enable older people to remain active and independent. Thus, the observed improvements in gait speed and functional mobility have implications beyond statistical significance. Nevertheless, because the present study was quasi-experimental, the findings should be interpreted as evidence of a strong intervention-associated effect rather than definitive proof that exercise alone caused all observed improvements.

Findings on muscle mass status

The present study found a statistically significant difference in muscle mass status between the experimental and control groups following the intervention, after controlling for baseline muscle mass. The ANCOVA produced $F(1,117) = 41.58$, $p < .001$, with a partial eta squared of .262. The adjusted mean muscle mass was 24.75 kg in the experimental group compared with 22.10 kg in the control group. The magnitude of the group effect represents a large effect by conventional benchmarks and indicates a substantial difference between the groups after adjustment for baseline status.

The finding is broadly consistent with contemporary evidence that resistance exercise can improve selected muscle-related outcomes in older adults, although the literature on muscle mass is less consistent than that on muscle strength and physical performance. Liu et al. (2022), for example, found significant improvements in handgrip strength and physical performance following resistance training but did not find statistically significant effects on appendicular skeletal muscle mass or skeletal muscle mass in their pooled analysis. In contrast, Zhao et al. (2022) reported that resistance training significantly improved skeletal muscle index, together with grip strength and gait speed. More recently, Chen et al. (2023) reported that moderate-to-vigorous resistance training improved selected muscle-mass and physical-performance outcomes, although the magnitude of benefit varied according to exercise intensity and programme characteristics. These differences demonstrate that muscle mass may respond differently from muscle strength and functional performance and that exercise dose and measurement methods are important considerations.

The present study therefore makes an important contribution by demonstrating a significant muscle-mass response following a relatively short, 12-week structured exercise intervention among older adults in the Federal Capital Territory. The observed adjusted difference of 2.65 kg between the experimental and control groups is noteworthy; however, it should not be interpreted as evidence that all older adults would achieve an equivalent increase. Differences in baseline nutritional status, habitual physical activity, sex, age, disease burden, adherence, exercise intensity, and the technique used to estimate muscle mass can influence the magnitude of change. Moreover, the current study assessed muscle mass as a sarcopenia indicator rather than establishing sarcopenia diagnosis solely on the basis of muscle mass.

The finding nevertheless has important implications for sarcopenia prevention. Contemporary evidence increasingly supports resistance exercise as a cornerstone of sarcopenia management, while also indicating that exercise combined with adequate nutrition may produce greater improvements in muscle-related outcomes than exercise alone (Shen et al., 2023). This suggests that community-based sarcopenia prevention programmes in Nigeria should ideally integrate exercise promotion with nutritional assessment and counselling. Such an integrated approach would be consistent with the WHO healthy-ageing framework, which emphasizes maintaining functional ability through coordinated health and social interventions (WHO, 2021).

Findings on elder abuse

The present study also found a statistically significant reduction in the level of elderly abuse across the assessed dimensions of physical abuse, emotional abuse, and neglect among participants who received the exercise intervention compared with those in the control group. The observed partial eta squared of .302 indicates a large group effect within the ANCOVA model. This finding is potentially important because it extends the discussion of exercise beyond physiological outcomes to the social and psychosocial dimensions of ageing.

However, the relationship between exercise and elder abuse requires more cautious interpretation than the physiological outcomes. Elder abuse is a complex phenomenon influenced by individual, relational, community, socioeconomic, cultural, and health-system factors. WHO identifies older people's physical or cognitive impairment, dependence, social isolation, and other vulnerabilities among factors associated with increased risk of abuse (WHO, 2024). Exercise may therefore contribute indirectly to reducing vulnerability by improving physical functioning and independence, but it should not be presented as a direct or stand-alone treatment for elder abuse.

One plausible pathway is through functional independence. In the present study, the same intervention that improved handgrip strength, muscle mass, gait speed, and functional mobility may also have reduced participants' dependence on others for some routine activities. Greater functional capacity can potentially increase autonomy and reduce some circumstances in which dependency may create vulnerability. This interpretation is consistent with the WHO healthy-ageing framework, which conceptualizes healthy ageing in terms of developing and maintaining functional ability that enables well-being in older age (WHO, 2021). However, because caregiver burden and dependency were not directly measured in the present study, the proposed pathway should be regarded as a plausible explanation rather than a demonstrated mediation mechanism.

The social component of the intervention may also be relevant. Structured group exercise can provide opportunities for social interaction, peer support, routine contact with programme personnel, and greater community participation. These mechanisms may be relevant to elder-abuse prevention because socially isolated older people may have fewer opportunities to disclose abuse or access assistance. Importantly, contemporary Nigerian evidence demonstrates that elder abuse is influenced by relational and community factors. Ojifinni et al. (2023), examining caregivers' perspectives in rural and urban communities in Oyo State, identified verbal abuse, physical abuse, and neglect and highlighted relationship, cultural, moral, and community factors as relevant to elder-abuse prevention. This Nigerian evidence strengthens the contextual interpretation of the present finding, while also demonstrating why exercise should be incorporated into a broader community safeguarding framework rather than viewed as a single solution.

The present finding therefore contributes a novel dimension to the exercise-and-ageing literature by suggesting a possible association between structured exercise participation and reduced reported elder abuse. Nevertheless, causal interpretation should remain conservative because the quasi-experimental design cannot completely exclude unmeasured social, family, economic, or psychological factors that may have influenced abuse outcomes. Future studies should examine whether improvements in functional independence, social connectedness, caregiver burden, psychological wellbeing, or quality of life mediate the relationship between exercise participation and elder-abuse outcomes.

CONCLUSION

This study found that participation in a structured 12-week exercise programme was associated with significant improvements in muscle strength, gait speed, functional mobility, and muscle mass status, alongside reduced reported physical, emotional, and neglect-related elderly abuse among older adults in the FCT, Nigeria. The findings support structured resistance, functional, balance, and flexibility exercises as important components of sarcopenia prevention and healthy ageing, particularly for maintaining physical function, independence, and quality of life.

The practical implication is that exercise promotion should be integrated into existing Nigerian primary healthcare and community-based healthy-ageing systems rather than implemented as an isolated fitness programme. Primary healthcare centres can support screening and referral, while community and faith-based organizations, ageing services, local governments, and trained health and exercise professionals can facilitate accessible group exercise, social participation, nutrition education, falls prevention, and safeguarding activities. At the policy level, structured exercise should be incorporated into healthy-ageing, noncommunicable-disease prevention, rehabilitation, and social-protection initiatives.

Moreso, the study positions exercise promotion as a multidimensional public health and healthy-ageing strategy with relevance to exercise science, gerontology, primary healthcare, rehabilitation, social protection, community development, and ageing policy. However, given the quasi-experimental design and 12-week intervention period, the findings should be interpreted as intervention-associated effects rather than definitive evidence that exercise alone caused all observed improvements, particularly the reduction in elderly abuse. Future studies should use larger multisite samples, longer follow-up, randomized allocation where feasible, and economic and implementation evaluations to establish sustainability, scalability, and long-term effectiveness.

AUTHOR CONTRIBUTIONS

All authors meet the criteria for authorship in accordance with established ethical guidelines. Contributions are specified according to the CRediT (Contributor Roles Taxonomy) as follows:

Conceptualisation: Dr. Oluwasogo Ruth Ogunleye and Dr. Oluwayemisi Makinde developed the research concept and formulated the study focus on exercise promotion, sarcopenia prevention, and elderly abuse. Methodology: Both authors contributed to the development of the quasi-experimental research design, sampling procedures, intervention framework, measurement procedures, and data-collection protocols. Formal analysis: Dr. Oluwasogo Ruth Ogunleye contributed to the statistical analysis and interpretation of the findings, including ANCOVA and MANCOVA procedures. Investigation: Both authors contributed to participant recruitment, implementation of the exercise intervention, administration of research instruments, and collection of study data. Data curation: Both authors contributed to the organization, verification, management, and preparation of the study data for statistical analysis. Writing – original draft: Both authors contributed to the preparation and development of the original manuscript. Writing – review & editing: Both Authors critically reviewed, revised, and edited the manuscript for intellectual content, clarity, coherence, and scholarly presentation. Supervision: Both authors contributed to the overall supervision and coordination of the research process, including methodological implementation, data analysis, interpretation, and manuscript development.

All authors have critically reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

AI USE DISCLOSURE

In accordance with current publishing ethics and transparency recommendations, artificial intelligence (AI) tools were used solely to assist with translation and language editing, with the aim of improving clarity and readability. No AI tools were used in the generation of scientific content, including the study design, data collection, analysis, interpretation of results, or the formulation of conclusions. The authors retain full responsibility for the content of the manuscript and confirm its originality, integrity, and accuracy.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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The authors confirm that all procedures performed in this study complied with the ethical standards and applicable laws and regulations of the Federal Republic of Nigeria governing research involving human participants.

Each author certifies that this manuscript is original, has not been published previously, and is not under consideration for publication elsewhere in any language. Each author further confirms that they have the authority to enter into this publication agreement and accept responsibility for the content of the manuscript. The authors understand that the *Scientific Journal of Sport and Performance* (SJSP) shall not be held legally responsible for any claims for compensation arising from the publication of this work.

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