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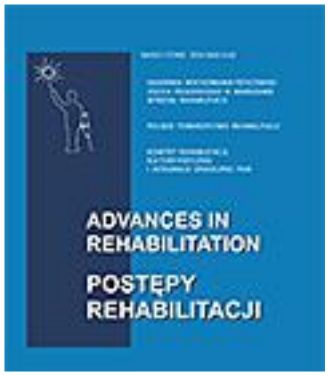

Original article

Title: Development, feasibility, and preliminary testing of a video-based exercise programme for fall prevention in older community-dwelling adults

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Development, Feasibility, and Preliminary Testing of a Video-based Exercise Programme for Fall Prevention in Older Community-dwelling Adults

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Abstract

Introduction: Falls prevention (FP) in older adults is an important area of research requiring innovative approaches. Telerehabilitation is speculated to have the potential for FP among older adults. This study aimed to develop and test the feasibility and short-term effects of a video-based exercise for FP (VbEFP) in community-dwelling older adults.
Material and methods: The Otago Exercise Programme was adapted for VbEFP following an iterative process. The feasibility of the VbEFP was carried out using Usability Satisfaction and Enjoyment Questionnaire among 10 community-dwelling older adults (mean age: 67.6± 4.86 years; 70% female) after three weeks. Also, the short-term effect of VbEFP was assessed in terms of balance (Berg Balance Scale and 4-stage Balance Test), risk of falling (Timed Up and Go Test, 30-sec Chair Stand Test, and Fall Efficacy Scale), physical activity (Physical Activity scale for the Elderly), and health-related quality of life (SF-36 Health Survey).
Results: The participants had positive responses on usefulness (3.8± 0.59), ease of use (4.60± 0.90), ease of learning (4.80± 0.36), satisfaction (4.42± 0.50), and pleasantness (4.49± 0.37) of VbEFP. There was a significant difference in physical activities aimed at improving endurance following the implementation of VbEFP after 3 weeks ($p = 0.001$).
Conclusions: A video-based telerehabilitation based on the Otago Exercise Programme had satisfactory feasibility ratings regarding ease of use, usefulness, and satisfaction among Nigerian community-dwelling older adults. Though VbEFP significantly increases physical activity to improve endurance in the short-term, longer implementation of the intervention may be necessary to obtain significant benefits in other clinical outcomes.

Keywords: Exercise, Fall, Geriatrics, Telerehabilitation, Balance

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Introduction

Global life expectancy is on the rise, with expected increase of 4.5 years from 73.6 years in 2022 to 78.1 years in 2050 [1]. This indicates that as older adults are increasing in population, also injuries associated with falls among the population [2]. Falls have implications for older adults' health status [3-5]. More than one out of every three community-dwelling elderly experienced fall episodes at least once per year, with half of these adults reporting repeated falls [6]. Evidence has shown that about 20% of older adults who fell suffer injuries, hospitalization, and/or death [4,7,8]. Specifically, recent data showed that more than one-third US older adults were treated in emergency rooms for fall-associated injuries, with about one-fifth hospitalized [9]. Thus, the economic and health costs of fall-associated injury hospitalization are huge. According to Florence et al. [10], fall has huge direct medical costs which exceed $50 billion. Research has shown that many factors, including musculoskeletal, neurologic, psychosocial, environmental, etc., are responsible for a higher frequency of falls among the elderly [4,5,11]. The combinations of these intrinsic and extrinsic factors in fall occurrence pose a challenge to its prevention [5,11].

Although not every fall lead to injury, however, older adults who have had an experience of falls develop a fear of falling, activity avoidance, and physical deconditioning, which often precipitate future fall occurrence [11,12]. Most of the rehabilitation protocols for fall prevention are delivered in person, requiring the elderly to travel to such rehabilitation centres or hospitals. This in-person rehabilitation requires more time and cost, whereas many older adults population are homebound, cannot travel, are poor, or live in rural or remote places [4,5]. These challenges emphasize the importance of developing other rehabilitation protocols for fall prevention in older adults [13].

Meanwhile, many rehabilitation strategies that have been developed and subjected to clinical trials over the years to combat falls in the older population show promising results [11,14-16]. These programmes have shown to decrease the frequency of falls considerably [11,14-17]. Some of these fall-prevention programmes include functional, gait, and balance training exercises, resistance exercises, physical activity, nutritional intervention, and cognitive behavioural therapy intervention [15,16]. Recently, telerehabilitation has been recommended as an effective way of delivering an evidence-based fall prevention programme [18-20]. Telerehabilitation has the potential to increase access to rehabilitation in terms of availability and regularity of intervention, and reduction in cost and travel time to the facility for care. Telerehabilitation **could improve compliance, as well as allow for personalized fall prevention programmes [13]**. Telerehabilitation is finding increasing application in many clinical conditions such as multiple sclerosis [21], stroke [17], and heart disease [22]. Falls prevention in older adults is a public health concern requiring innovative approaches. Telerehabilitation is speculated to have the potential to prevent falls among older adults [23]. This study aimed to develop and test the feasibility and short-term effects of a video-based exercise for fall prevention (VbEFP) in community-dwelling older adults.

Materials and methods

Procedure and Participants

Design Phase

The development of the VbEFP followed an iterative process. The Otago Exercise Programme (OEP) was culturally adapted for the VbEFP and was designed to run on smart phones and tablets. There is substantial literature on the effectiveness of OEP in reducing falls among community-living older adults [24,25,26]. The OEP comprises 17 exercises (warm-up, strengthening, balance) and a walking programme of at least 30minutes per week (broken down into three bouts) [24]. Using the iterative model of planning, design, development, and testing [27], the development of the VbEFP involved collaboration between clinicians (CFI & OOO), a digital technician, and a computer scientist. Following deliberation among the team, the flow and function diagram of the VbEFP app was drawn, and prototypes of the app were developed. The prototypes were subjected to analysis and critique by two experts (one in telerehabilitation and geriatric care respectively) and two older adults to obtain initial feedback on the design, relevance of the content to the context, and what could be improved.

A 65-year-old female with a positive history of a fall within one year consented as the model for the VbEFP app. The model was an independent and self-ambulant community-dwelling older adult. The model had no history of previous cerebrovascular accident, chronic neurological or severe musculoskeletal condition, and no history of cognitive impairment (Mini-Mental State Examination (MMSE) score = 30) [28]. The model rehearsed with an instructor on strengthening and balance exercises training based on the OEP. The digital technician had several takes of the exercise session for further processing and editing. Each exercise on the VbEFP was for approximately 30 seconds with a rest period of two minutes.

The video is available at -

https://drive.google.com/drive/folders/1jLbMeW0gxYcIwpKHSy1Dddz_R-74lRi8?usp=sharing (password protected)

The exercises illustrated in the VbEFP are the following:

Warm-up exercises

1. Head movement: The model sat with her back supported by the chair's backrest and slowly turned her head to the left and then to the right, keeping her shoulders still. This movement was repeated five times.

2. Neck movements: The model sat with her back supported by the chair's backrest, then gently guided her chin back until she felt a stretch in the back of her neck. This was repeated five times.

3. Back extension exercise: The model stood tall with feet hip-width apart and then placed the hands on the waist while gently arching the back. Looking at the ceiling or locking at her knees was avoided. This was repeated five times.

4. Ankle movement: The model sat in the chair with her back supported by the backrest. She straightened one leg, lifted her foot off the floor, and then alternated between pointing her toes forward and pulling them back, repeating this ten times before switching to the other leg.

Strength exercises

1. Front knee strengthening: The participant sat on a chair with her leg well-supported. She then straightened her leg and lowered it. By the second week, she progressed to using a 1kg ankle weight strapped around her ankle. This was repeated five times.

2. Back knee strengthening exercise: The participant stood upright, holding onto a chair for support with her feet hip-width apart and knees slightly bent. She moved one foot back along the floor, and then slowly raised the heel towards their bottom while keeping their knees close together. After slowly lowering the foot, she shifted her weight back onto both feet and rested briefly. This sequence was repeated three times on one leg before switching to the other leg, aiming to lift for a slow count of five. In

the second week, she progressed to using a 1kg ankle weight strapped around their ankle.

3. Side hip exercises: The participant stood tall with her feet hip-width apart while holding the chair's backrest for support. She then slowly lifts one leg out to the side and back, keeping the toes pointing forward and avoiding leaning to the side. After that, she placed her weight back over both feet, rested briefly, and repeated this three times on each leg. The goal is to lift for a slow count of three and lower for a slow count of five each time.

4. Calf raises: The participant stood with her feet hip-width apart facing a support and placed both hands on it. She slowly lifted her heels while keeping the weight over her big toes, and she avoided locking her knees. Then, slowly she lowered her heels. This sequence was repeated ten times, as she aimed to lift for a slow count of three and lower for a slow count of five each time.

5. Toe raises: The participant stood tall with her feet hip-width apart, holding onto a support. Slowly she lifted her toes while keeping the knees soft, and avoided sticking the bottom out when lowering her toes slowly. This was then repeated ten times. She aimed to lift for a slow count of three and lower for a slow count of five each time.

Balance exercises

1. Knee bends: The participant stood in front of a chair with her feet hip-width apart and toes facing forward. She held the backrest of the chair for support, then bent her knees and pushed her bottom backward as though she was going to sit down. She ensured her heels did not lift and her knees did not roll inwards. Then she came back up to the starting position and repeated this five times.

2. Backward walking: The participant stood tall, kept her back straight, and looked straight ahead whilst walking 10 steps backward. She kept her pace steady and controlled by using a toe through to heel action and repeated the activity the other way.

3. Sideways walking: The participant stood tall with both hands on the hips, keeping the hips forward and the knees soft, and then took 10 sideways steps. This sequence was repeated in the opposite direction.

4. Heel toe standing: The participant stood tall, with her side, and placed one hand on the support. She then placed one foot in front of the other, forming a straight line, looked forward, and balanced for 10 seconds. She then brought her feet back to hip-width apart before placing the other foot in front and balancing for another 10 seconds.

5. Heel-toe walking: The participant stood tall and looked ahead. She placed one foot directly in front of the other and walked 10 steps forward so that her feet formed a straight line. She focused on maintaining a steady walking action and then brought her feet back to hip-width apart before turning towards the support. She repeated the steps in the other direction.

6. Heel-toe walking backward: The participant stood up straight, placed one foot behind the other, and walked 10 steps backward to form a straight line with her feet. She maintained focus on steady walking throughout.

7. One-leg stand: The participant stood tall on one leg next to the chair's backrest and supported herself with her hand on the backrest, attempting to hold this position for 10 seconds. The participant then repeated this on the other leg and eventually progressed to standing on one leg without any support.

8. Heel walking: The participant stood tall, lifted her toes, kept her knees soft, and tucked in her bottom. She moved steadily and with control while looking ahead, and then walked 10 steps on her heels. After that, she brought her feet together before lowering her toes to the floor.

9. Sit to stand: The participant sat in the middle of a chair that was not low, leaned forward, and placed both feet on the ground behind their knees. Then, they pushed up with both hands on the armrest and stood. This action was repeated five times.

<u>Testing Phase</u>

The feasibility and preliminary testing of the VbEFP were undertaken among community-dwelling older adults after three weeks of participating in the study. The participants were members of the Association of Nigeria University Contributory Pension Retirees (ANUCOPR), Ile-Ife, Nigeria. Included in the present study were adults (65 years and older), who had controlled hypertension or no history of hypertension, and no neurological deficits. The included adults have had at least one fall during the past 12 months but were still independent and able to walk without assistance. Excluded from the study were those with a self-reported history of diabetes mellitus, hypertensive heart disease, dementia, cognitive impairment (scores < 18 or < 24, based on Mini-Mental State Examination (MMSE), low exercise efficacy (based on exercise self-efficacy score) and those who were or had participated in any fall prevention programme.

After explaining the procedure, the VbEFP was installed on the participants' Android phones or tablets. They were instructed to perform 17 exercises at home for three weeks, divided into three sessions per week. The schedule was as follows: on Monday, the first five exercises from the video plus a 10-minute walk; on Wednesday, the next six exercises plus a 10-minute walk; and on Saturday, the remaining six exercises plus a 10-minute walk. Each participant kept a diary of the completed exercises. Adherence to the programme was monitored weekly via telephone calls and by reviewing the participants' exercise diaries.

Sample size determination

Extant literature suggests that a pilot study should have 10-30 participants [29]. This study estimated a sample of 15 individuals to provide a statistical estimate for a larger parent study and also to accommodate attrition. A total of 15 participants were invited to this study, however, only 10 participants completed the study (Figure 1).

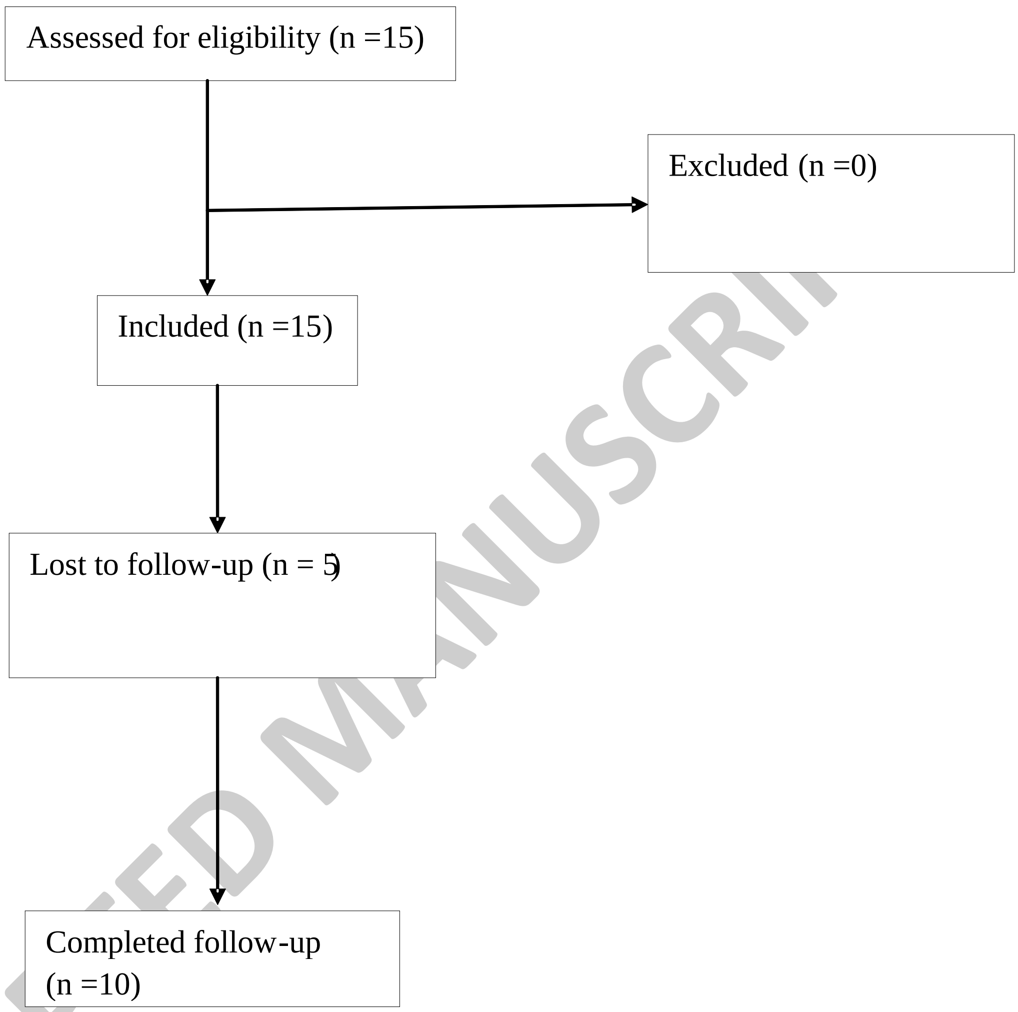

Fig. 1. Participants' flowchart

Feasibility Testing

Usability Satisfaction and Enjoyment (USE) questionnaire was used to evaluate the feasibility of the VbEFP. The USE employs 30 items to assess four usability dimensions (usefulness, ease of use, ease of learning, and satisfaction). The items on USE are scored on a 7-point Likert scale from strongly disagree to strongly agree. The validity (r = 0.60-0.81) and internal consistency (Cronbach's alpha = 0.87-0.95) of the different dimensions of USE are acceptable [30].

Preliminary Testing

The short-term effect of the VbEFP was assessed in terms of static and dynamic balance (using Berg Balance Scale, and the 4-stage Balance Test), lower extremity strength and endurance (The 30-sec Chair Stand Test), risk of falling (using the Timed Up and Go Test, and Fall Efficacy Scale), physical activity (using the Physical Activity Scale for the Elderly), and health-related quality of life (using SF-36 Health Survey).

Outcome Measures

The Berg Balance Scale (BBS)

The BBS uses 14 items to assess both the static and dynamic balance of an individual. The participants were asked to complete the 14 items on BBS, which is then scored from 0 (inability to complete the task) and 4 (independent completion of the task). The maximum score when summed up is 56 (functional balance). A BBS score of less than 45 indicates individuals with a higher propensity for falling [31]. The BBS showed good to excellent validity and reliability in identifying fall status of older adults [32].

The 4-stage Balance Test

The 4-stage balance test includes four distinct and progressively difficult positions. These positions include “standing with feet side-by-side”, “placing the instep of one foot to touch the big toe of other foot”, “placing one foot in front of other foot while heel touching toes”, and “standing on one foot” [33]. Participants who were able to hold each position for 10 seconds or more were considered to have no risk of falling, while those who could not be considered to be at risk of falling [24, 33]. The 4-stage balance test is validated and has excellent inter- and intra-rater reliability among older population [34].

Timed Up and Go test (TUG)

In this test, participants were asked to stand from a chair, walk in their comfortable speed for 3m, turn, walk back, and sit on the chair. Participants who took more than12secs to complete this test were considered to be at risk for falling [35]. The application of TUG in this study followed the protocols of Podsiadlo and Richardson [36]. The consenting participants performed TUG at their comfortable speed, with participants performing one practice and test trial. The use of TUG is valid and reliable in assessing fall risk and mobility in geriatric population [37].

The 30-sec Chair Stand test

The 30-second Chair Stand Test was used to assess lower limbs' strength and endurance. Participants were asked to sit on a chair, crossing their arms on the chest, stand and sit as quickly as possible [38]. In this test, the number of stands a participant can complete in 30secs was counted and recorded. A below-average number of stands for the participant's age group indicated a high risk of falls [39]. The 30-second chair stand test has good test-retest reliability (ICC = 0.84 for men; ICC = 0.92 for women) and validity (r = 0.78 for men; r = 0.71 for women) as a measure of lower body strength in older people [40].

Fall Efficacy Scale (FES)

The FES is an instrument developed to assess the confidence level of a participant while performing some basic activities of self-care (e.g., bathing, reaching, walking, etc.) without falling [41]. The FES has 10 items which is scored on a 10-point from not confident at all to completely confident. A score of 70 or higher indicates a fear of falling [41]. The FES has good psychometric properties in assessing fear of falling [41].

Physical Activity Scale for the Elderly (PASE)

The PASE measures the physical activity levels of older adults. The tool consists of 10 items that focus on three different activity domains over a 7-day period: leisure (5 components), household (4 components), and work-related (1 component) activities. For leisure activities, frequency (e.g., never, seldom, sometimes, and often) and duration (e.g., less than an hour, 2–4 hours, or more than 4 hours) are recorded. Paid or unpaid work is recorded by total hours of work per week, and housework, lawn work, home repair, outdoor gardening, and care giving are recorded with yes or no answers. The overall PASE score is calculated by multiplying the time spent in each activity (in hours per week) or participation (yes/no) in an activity by empirically derived item weights, and then summarizing all activities. PASE showed good validity with actigraph (r = 0.43) [42] and good test-retest reliability (ICC = 0.75) [43].

Short Form Health Survey 36 (SF-36)

The SF-36 is a tool used to evaluate the health status and quality of life of specific populations. It consists of 36 questions that cover eight domains of health: limitations in physical activities due to health problems, limitations in social activities due to physical or emotional issues, limitations in usual role activities due to physical health problems, bodily pain, general mental health (psychological distress and well-being), limitations in usual role activities due to emotional problems, vitality (energy and fatigue), and general health perceptions. Scores for the SF-36 are calculated using the methods outlined by Ware et al. [44]. Each scale is transformed into a 0-100 scale, assuming that each question carries equal weight. Higher scores indicate a better health state, while lower scores indicate disability. The psychometric features of SF-36 have been tested adequate among older adults [45].

Ethical approval for this study was obtained from the Health Review and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Nigeria (IPHOAU/12/1911). All participants provided signed consent after being fully informed of the study's purpose. Confidentiality, data anonymity, and the right to withdraw from the study anytime were assured.

Data Analysis

Descriptive statistics of mean and standard deviation were used to summarise data. Paired t-test was used to compare the effect of VbEFP at baseline and the third week. The alpha level was set at $p < 0.05$. The data analysis was carried out using SPSS version 22.0 (IBM Corp, NY, USA).

Results

The participants' mean age was 67.6 ± 4.86 years with the range of 60 to 77 years. The socio-demographics of the participants are shown in Table 1. Table 2 shows the level of risk and frequency of fear of falling among the participants. The result indicates that the TUG (80%), 30 seconds Chair Stand Test (40%), and 4-Stage Balance Test 4 (20%) showed a higher risk of falling amongst the participants with a mean value of 9.6 ± 2.26, 11.8 ± 2.44, and 9.6 ± 0.84, respectively. While Berg's balance (10%), 4-stage Balance Test 1 (0%), 4-stage Balance Test 2 (0%), 4-stage Balance Test 3 (0%), and the Fall Efficacy Scale (0%) did not show the participants were at any significant risk of falling. With mean values of 48.6 ± 2.55, 10.0 ± 0.00, 10.0 ± 0.00, 10.0 ± 0.00, and 10.0 ± 0.00, respectively. Table 3 presents the responses of the participants on the ease of use, ease of learning, usefulness, satisfaction, and pleasantness of the fall prevention video-based programme. The results show the mean responses of the participants for usefulness (3.8 ± 0.59 out of 7), ease of use (4.60 ± 0.90 out of 7), ease of learning (4.80 ± 0.36 out of 7), satisfaction (4.42 ± 0.50 out of 7), and pleasantness (4.49 ± 0.37 out of 7).

Table 4 provides the findings regarding the effectiveness of the fall prevention video programme after three weeks. The results indicated that there were no significant differences in the 30-second Chair Stand test ($t = 0.983$; $p = 0.339$), Berg Balance test ($t = 0.558$; $p = 0.584$), 4-stage balance test ($t = 1.500$; $p = 0.168$), and the time up and go test ($t = 0.073$; $p = 0.943$), as well as in all scales/domains of SF-36 and PASE ($p > 0.05$) respectively. However, there was a significant increase in physical activities to improve endurance ($t = 4.027$; $p = 0.001$).

Tab. 1. **Socio-demographic data of the participants (N = 10)**

Variable	Frequency	Percentage	Mean ± SD
Age			67.6 ± 4.86
Sex			
Male	3	30	
Female	7	70	

SD- Standard Deviation

Tab. 2. **Fall risk levels and frequency among the participants (N = 10)**

Variable	Mean ± SD	Maximum score obtainable	At risk n (%)	No risk n (%)
Berg's balance score	48.6 ± 2.55	56	10	90
Time up and Go	9.6 ± 2.26	14	80	20
30 sec Chair Stand Test	11.8 ± 2.44	15	40	60
4 Stage Balance Test 1	10.0 ± 0.00	10	0	100
4 Stage Balance Test 2	10.0 ± 0.00	10	0	100
4 Stage Balance Test 3	10.0 ± 0.00	10	0	100
4 Stage Balance Test 4	9.6 ± 0.84	10	20	80
Fall Efficacy Scale	10.0 ± 0.00	10	0	100

SD- Standard Deviation

Tab. 3. **Feasibility testing of the video-based exercise for fall prevention**

Domain	Mean ± SD	Total score obtainable
Satisfaction	4.49 ± 0.37	7.0
Usefulness score	3.8 ± 0.59	7.0
Ease of Use score	4.60 ± 0.90	7.0
Ease of Learning score	4.80 ± 0.36	7.0
Satisfaction score	4.42 ± 0.50	7.0

SD- Standard Deviation

Tab. 4. Effect of a fall prevention video-based programme after three weeks (N = 10)

Variable	Baseline mean ± SD	Third week mean ± SD	t	p-value
30-sec Chair Stand Test	11.8 ± 2.44	12.8 ± 2.10	0.983	0.339
Berg's Balance	48.6 ± 2.55	49.2 ± 2.25	0.558	0.584
4-stage balance test 1	10.0 ± 0.00	10.0 ± 0.00	____	____
4-stage balance test 2	10.0 ± 0.00	10.0 ± 0.00	____	____
4-stage balance test 3	10.0 ± 0.00	10.0 ± 0.00	____	____
4-stage balance test 4	9.6 ± 0.84	10.0 ± 0.00	1.500	0.168
Time Up and Go	9.7 ± 2.26	9.59 ± 1.82	0.073	0.943
SF-36 Health Survey				
HP	66.5 ± 11.63	68.6 ± 10.84	0.411	0.686
PF	67.5 ± 17.20	67.5 ± 15.32	0.000	1.000
RL-Physical	35.0 ± 42.82	42.5 ± 31.29	0.447	0.661
RL-Emotional	80.0 ± 32.20	90.0 ± 16.10	0.878	0.395
SF	71.3 ± 18.68	68.1 ± 16.67	0.394	0.699
MH	82.4 ± 9.08	80.4 ± 7.88	0.526	0.605
BP	76.8 ± 35.63	75.5 ± 35.04	0.079	0.938
EV	49.5 ± 13.01	52.0 ± 10.85	0.467	0.646
PH Domain	61.4 ± 22.97	65.7 ± 20.23	0.430	0.673
MH Domain	70.8 ± 15.95	72.8 ± 10.12	0.335	0.742
PASE endurance	9.0 ± 28.46	69.0 ± 37.55	4.027	0.001*
PASE strenuous sport	16.1 ± 43.44	27.6 ± 48.25	0.560	0.582
PASE moderate sport	0.0 ± 0.00	0.0 ± 0.00	____	____
PASE light sport	18.9 ± 27.02	14.7 ± 24.35	0.365	0.719
PASE walking	62.0 ± 47.56	58.0 ± 27.41	0.230	0.821
PASE lawn-walk	3.6 ± 11.38	3.6 ± 11.38	0.000	1.000
PASE caring another	24.5 ± 16.91	21.0 ± 18.07	0.447	0.660
PASE home repairs	0.0 ± 0.00	0.0 ± 0.00	____	____
PASE heavy house works	12.5 ± 13.18	15.0 ± 12.91	0.429	0.673
PASE light house works	17.5 ± 12.08	22.5 ± 7.91	1.095	0.290
PASE outdoor gardening	4.0 ± 8.43	4.0 ± 8.43	0.000	1.000

BP- Bodily Pain, EV- Energy and Vitality, HP- Health Perception, MH- Mental Health, PASE- Physical Activity Scale for the Elderly, PF- Physical Functioning, R - Role Limitation, SF- Social Functioning, *- indicates significant difference

Discussion

This study aimed to develop and test the feasibility and short-term effects of a VbEFP in community-dwelling older adults. To the best of our knowledge, VbEFP is one of the first telerehabilitation apps developed specifically for Nigerian older adults, designed to promote physical activity and other health benefits. The potential of VbEFP is particularly promising in a digitally-deprived context. The development of VbEFP followed an iterative process. The video-based app provides detailed information on the intervention, including the mode of delivery, features, and functionalities.

The feasibility of the VbEFP was tested in terms of ease of use, ease of learning, usefulness, and satisfaction among community-dwelling older adults. The mean age of the participants was 67.6 ± 4.86 years. The participants recruited for this study represent a subset of frail adults, and had a higher risk of falling or injuries associated with falls. Based on the assessment of the baseline features, the participants showed no significant risk of falling based on the BBS, the 4-stage balance test, and the FES. However, their risk for falls based on the TUG test and the 30-second chair stand test was elevated, indicating that these tools proved to be more sensitive for predicting the probability of falls among this population. Falls are common among older adults with over 33% of them in the community having experienced at least a fall in a year [46]. Fall is the most common type of accident and also majorly contributes to injury-related hospitalization among older adults [47]. However, older adults tend to overlook or underrate their higher propensity to fall and thus do not see themselves as 'fallers', as such they are not often receptive to 'falls prevention' [48].

Regarding the feasibility of VbEFP, the results indicate that older adults had a positive response towards the VbEFP as they found it useful, easy to use, easy to learn, and satisfying. More than 50% of the participants responded positively to all five feasibility domains, indicating the potential use of VbEFP in preventing falls among older adults. These findings are promising since previous research has shown that older adults are more likely to participate in and remain motivated to engage in physical activity when digital applications are easy to use and satisfactory [49, 50]. In this study, the reported satisfaction attributed to VbEFP can be ascribed to convenience. Participants having access to such intervention on their phones at any time and being able to perform them when convenient; could give them a sense of satisfaction, thereby making them adhere and expectant of a good outcome. Their good expectation and keenness to participate can be from their perception that their fall risk is modifiable and therefore not permanent [51]. Also participants were eager to participate because the intervention employed in this study was different from their previous experience (which is a clinic visit) and they could relate to the exercises as they were easy to learn. The participants did not need to buy data to access the videos, nor transport themselves to the clinic rather they could do it at home. This makes VbEFP pocket-friendly. Thus, VbEFP can be used at a primary health care level to prevent falls at the community level as it is pocket-friendly and easy to use.

This study's findings also demonstrated that implementing the VbEFP within three weeks significantly increased physical activity to enhance endurance. The finding was consistent with a systematic review conducted by Ambrens et al. [52], which utilized digital health interventions to improve physical activity and physical functioning among the older population. The positive aspect of VbEFP observed in the present study was further corroborated in the study of Dadgari et al. [25] in which Otago Exercise programme (OEP); an evidence-based fall prevention programme was found to reduce risk of falling at least by 35% among high-risk older adults prone to fall-related injuries. The findings of this study seem to support that a longer implementation of VbEFP may be necessary to achieve significant benefits in other clinical outcomes that did not show a significant effect in this study. This is because systematic reviews indicate that effective exercise-based interventions to enhance physical activity in older adults can range from 8 weeks to 24 months [53].

Clinical implication, Limitation and future research

The implementation of clinic-based exercise interventions for fall prevention among the elderly may be hampered by demand for personnel, time, and the need for constant visit of the participants. Mobile health is gaining ground as a feasible means of providing health care to individuals beyond clinic visit. The findings of this study show that VbEFP is feasible for fall prevention strategies among the elderly and can be incorporated at the primary care level. Furthermore, since VbEFP is cheap and easy to use, this may spur elderly population to readily participate in fall prevention programme and thus reducing the fall-associated morbidity and mortality in this population. However, this study has few limitations. The use of small sample size may limit the generalizability of the findings. The feasibility of VbEFP among older people was tested for just three weeks limiting us from infer about its long-term feasibility and effectiveness. Furthermore, this study recruited only apparently health older adults and without any cognitive impairment. Thus, the results of feasibility and preliminary testing of VbEFP cannot be extended to individuals with cognitive decline and patient population. Future research should therefore increase the intervention period and include more samples of different clinical conditions to consolidate the feasibility and effectiveness of VbEFP among older adults.

Conclusion

A video-based telerehabilitation based on the Otago Exercise Programme had satisfactory feasibility ratings in terms of ease of use, usefulness, and satisfaction among Nigerian community-dwelling older adults. Though VbEFP significantly increases physical activity to improve endurance in the short term, longer implementation of the intervention may be necessary to obtain significant benefits in other clinical outcomes.

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