Arnis-based Exercise Program for Balance Control in Community-Dwelling Older Adults: Study Protocol for a Pilot Randomized Controlled Trial

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Abstract

Introduction: Aging causes balance impairments and increases falls in older adults. Martial arts interventions incorporated into exercise programs have been shown to improve balance. Further investigation is needed on the effectiveness of Arnis, a Filipino Martial Art, in improving balance control of older adults.

Objectives: This study primarily aims to determine the effects of an Arnis-based exercise program on balance control systems of healthy community-dwelling older adults. This study also aims to describe its effect on older adults’ concerns about falling and lower extremity strength.

Methods: This will be a single-blind, pilot randomized controlled trial. Participants will be randomly allocated to either the intervention or control group. The intervention group will perform an Arnis-based exercise program for 40-60 minutes per session three times a week for 12 weeks. The control group will continue to do their usual activities for the duration of the study. These daily activities may include home gardening, physical exercises, watching television, reading a newspaper, listening to the radio, and engaging in social activities. Participants will be measured at baseline and 12 weeks after for (1) balance using the Berg Balance Scale and Timed-Up and Go Test; (2) concern for falling through the Falls Efficacy Scale International Filipino; and (3) lower limb strength through the 30-second Chair Sit-to-stand Test. Data will be analyzed through independent and paired t-tests. A p-value < 0.05 is considered significant.

Expected Results: Significant improvements in the balance scores in the intervention group are expected after 12 weeks of the Arnis-based exercise program, along with its effects on concerns for falling and lower extremity strength. The pilot study will provide data on the effectiveness of Arnis as a reference for future larger experimental studies.

Keywords: older adults, balance control, Arnis, exercise program, protocol
Introduction

Compromised balance constitutes a health concern among older adults due to the increased risk of falling (Shupert & Horak, 2016). According to Deger et al. (2019), the prevalence of balance disorders among community-dwelling older adults in Aydın, Turkey is 34.3%. Even if older adults have high self-perceived confidence in performing activities of daily living (ADLs), their risk for falling is still high if they have poor postural balance (Pua et al., 2017). Falls are the most common mechanism of injury affecting older adults (Montacar et al., 2020). Globally, falls account for 38 million disability-adjusted life years lost yearly and older adults with fall-related disabilities have high risks for hospitalization and long-term care (WHO, 2021). In the Philippines, 53.6% of older adults experienced falls, and 2.4% sustained fractures caused by the falls (Romli et al., 2017).

Balance control is achieved by integrating visual, vestibular, and somatosensory inputs with central processing and muscular strength (Hsu et al., 2014). Good static and dynamic balance are necessary to perform ADLs and recreational activities (Lipardo, Manlapaz, et al., 2021). Physiologic aging is associated with gradually decreasing muscle strength, mass, and power. It is also associated with compromised visual acuity (Norheim et al., 2017). There is an age-related deterioration of the peripheral vestibular system function by measuring the VOR. There is a decline in the response amplitude and less of a compensatory response phase in the rotational test. Patients may complain of dizziness, vertigo, or unsteadiness (Iwasaki & Yamasoba, 2015; Agrawal et al., 2012). There is also decreased sensitivity of somatosensory inputs, specifically of limb position, due to changes in the muscle spindle function, especially of the lower extremity, and progressive loss of the dendrite system in the motor cortex connected with age (Ferlinc et al., 2019). Incongruences between the sensory cues and decreased musculoskeletal function cause difficulty in balance control in older adults that may lead to decreased functionality (Hsu et al., 2014; Ma et al., 2019; Pluchino et al., 2012; Deger et al., 2019; Lipardo, Manlapaz, et al., 2021). Therefore, rehabilitation interventions are implemented to improve balance (Cameron et al., 2018; Penn et al., 2019; Howe et al., 2011).

A systematic review found that only 22% of rehabilitation interventions could be classified as high quality (Arienti et al., 2019). Interventions such as martial arts and multi-component exercises composed of resistance, endurance, and coordination training are beneficial for improving the balance of older adults (Cameron et al., 2018; Penn et al., 2019; Howe et al., 2011, Halvarsson et al., 2015; Ngamsangiam & Suttanon, 2020; Mittaz et al., 2019). These interventions help enhance the strength, coordination, and mobility of the lower extremities, improve quality of life and fall self-efficacy, and reduce the risk of falling. Martial arts as an intervention has shown promise in addressing physical inactivity in recent years (Arienti et al., 2019). It is practiced for physical fitness, competitive purposes, and motor and emotional development (Origua Rios et al., 2018). Some martial arts emphasize leg techniques, while others focus on throws and armed skills. These techniques may be divided into ‘hard,’ which uses fast and dynamic movements, and ‘soft,’ which uses smooth and relaxed movements.

Arnis, the Philippine National Martial Art and Sport is a blend of the ‘soft’ and ‘hard’ martial art styles. Also known as Kali or Eskrima, Arnis uses ‘swinging and twirling movements along with striking, thrusting, and parrying techniques, done with one or two sticks’ (National Commission for Culture and the Arts, 2021). Although scarce literature on Arnis and balance exists, published studies have shown the effectiveness of martial arts such as Judo, Taekwondo, Tai Chi, and Wai Khru in balance improvement among geriatrics (Arkkukangas et al., 2020; Valdez-Badilla et al., 2021; Phanpeng et al., 2020; Pon van Dijk et al., 2013; Chen, 2019; Li et al., 2018; Li, 2014). Tai Chi has been found to improve the stability of older adults along with muscle strength and flexibility (Chen, 2019). A tailored exercise program using Tai Chi has been more effective as a training intervention in fall reduction than conventional approaches (Li et al., 2018). The regimen known as Tai Ji Quan: Moving for Better Balance integrated the cognitive, sensory, and musculoskeletal systems, including weight-bearing and shifting movements which are known in Tai Chi (Li, 2014). Therefore, this protocol explores Arnis, which is similar to Tai Chi, and has the potential to improve balance in older adults through its techniques and movement.

The primary objective of this study is to determine the effects of a 12-week Arnis-based exercise program on static and dynamic balance control among healthy community-dwelling older adults. The secondary objective is to determine the effects of the Arnis-based exercise program on the older adults’ concern for falling and lower limb strength. This study will add an Arnis-based exercise program as an alternative intervention in improving balance in the geriatric population for physical therapists (PT) and other health professionals. The administration of a culturally specific exercise program may increase the engagement and interest of older adults.

Methods

Study Design

A pilot randomized controlled study design will be utilized as the study aims to assess the effectiveness of a novel Arnis-based exercise program on the balance control of healthy community-dwelling older adults. This method is used when participants are introduced to a new intervention to check whether the treatment improves their condition. Ethical approval has been granted by the University of Santo Tomas, College of Rehabilitation Sciences Ethical Review Committee (SI-2021-023-R2). The study protocol has been registered on Health Research and Development
Eligibility Criteria

Healthy Filipino community-dwelling older adults aged 60 years or above from a partner community of the University of Santo Tomas (UST) will be included in the study. They will be selected based on the following inclusion criteria:

1. Lives with at least one adult companion to provide standby assistance and ensure safety, and prevent falls (Gopinath et al., 2013).
2. Has a mobile phone, laptop, or desktop that can access the internet
3. Stands without assistance (Mustafa et al., 2022)
4. Ambulates independently without an assistive device (Lip et al., 2015)
5. Cleared by a healthcare practitioner to engage in physical activity, as proven by a written letter with the practitioner’s signature
6. With or without a history of falls in the past 12 months (Li et al., 2018).
7. Have no medical conditions based on the Modified PAR-Q Questionnaire (Lipardo et al., 2019).
8. Having a score of > 25/30 in the Mini-Mental State Examination in Filipino ensures comprehension (Duncan et al., 2016; Nguyen & Kruse, 2012).

Sample Size Computation

Considering a 90% power, two-sided 5% significance, and an allocation ratio of 1 for the main clinical trial, the recommended sample size for this pilot trial is 20. Ten older adults should be allocated per treatment arm for a standardized large effect size of 0.8 (Whitehead et al., 2016).

Sampling Methodology

Participant recruitment will be done within 1 month using simple random sampling based on the list of older adults from city hall records. A total of twenty (20) participants will be randomly chosen through a third party who is uninvolved in the study and will be asked to generate the names to maintain neutrality. Should a participant fail to meet the recruitment criteria, another participant would be randomly selected through the computer-generated program by a third party composed of statisticians not involved in the study. Retention of participants will be promoted throughout the program with constant communication and reminders through the coordinators of the partner community. Moreover, incentives will be given to participants after the program. In addition, research goals, recruitment information, forms and risk details are to be made available in both English and Filipino for ease of comprehension and understanding to increase voluntary participation. The sampling process can be visualized in Figure 1.

Setting

Due to the imposed restrictions brought about by the COVID-19 pandemic, the study will be conducted online method via Zoom or Google Meet. A participant’s companion may assist the participant in setting up the Zoom or Google meet. Strict adherence to established protocols will be followed. The study will be in partnership with the community of Binangonan, Rizal. The program will be delivered through telerehabilitation.

Instrument

The study was designed with primary and secondary outcome measures wherein the primary will be the main outcome that we target dovetailed to the main objective of the study. The secondary outcomes are likewise aligned with the secondary aims of the study. (Vetter & Mascha, 2017) The primary outcome measure tools for this study are the Berg Balance Scale (BBS) and Timed-Up and Go Test (TUG), while the secondary outcome measures are the Falls Efficacy Scale - International Filipino (FES-I) and 30-Second Chair Sit-to-stand Test (30CST).
Berg Balance Scale

The BBS is a 14-item objective measure that assesses static balance and the risk of falling in adults through direct observation. The items of the questionnaire include static and dynamic activities of varying difficulty. According to Wang et al., (2006), BBS has good interrater reliability (ICC = 0.87) observed among community-dwelling elderly Taiwanese, and moderate to high reliability has been established for the BBS within various settings and diagnoses. Construct validity was examined in community-dwelling Taiwanese concerning the BBS (r = -0.53, p =0.1). It is a well-established valid outcome measurement tool for fall risk prediction in different populations (Muir-Hunter et al., 2015). Item-level scores range from 0, indicating the inability to complete the task, to 4, indicating independent completion. A total score of 41–56 on the scale is determined as good balance or low fall risk, a score of 21–40 indicates medium fall risk while a total score of 0-20 suggest a high risk for falls (Neuls et al., 2011).
Assessment Procedures

Eligible participants will be assessed through the BBS, TUG, FES-I F, and 30CST at baseline and within a week after the last treatment session. Measurements will be taken at the participant’s home by a blinded assessor. The assessor is a licensed PT with at least one year of experience, is fully vaccinated with at least one booster, and who resides near or in the area (Lipardo, Añonuevo, et al., 2022). Participants must also have a companion at home during the assessments. Blinding of the participants and of the clinicians will not be possible given the nature of the intervention.

Intervention

After baseline assessments, eligible older adults will be randomly allocated in a 1:1 ratio into either the Arnis intervention group or the control group study using the “True Random Number Generator” of Random.org. An independent research assistant who is not involved in the recruitment and assessment will perform the allocation of participants and will also contact the participants to inform them of their group assignment.

Arnis Intervention Group

The intervention group will participate in an Arnis-based exercise program in addition to their usual daily activities. They will engage in a 12-week non-combative Arnis-based exercise regimen evaluated and approved by a panel of experts and adapted from the exploratory study of Lipardo, Añonuevo et al. (2022). The exercise program consists of three phases that will gradually progress in intensity. Phase 1 (Weeks 1-4) focuses on familiarization and mastery of basic Arnis techniques with a low-intensity exercise. Phase 2 (Weeks 5-8) incorporates progression in the exercise routines with low-to-moderate level of intensity. Phase 3 (Weeks 9-12) includes movements that challenge static and dynamic balance control with moderate-intensity exercise.

The program will be delivered through telerehabilitation three times a week, and assessment for progression will be done weekly using the Rating of Perceived Exertion (RPE) Scale and Talk test. The Talk test is a subjective method for monitoring exercise intensity based on the ability of the subject to hold a conversation while exercising. Each Arnis movement pattern will be performed for 2-5 sets. Every session will start with a warm-up period (5-10 minutes), followed by the main Arnis-based exercises (30-40 minutes) and a cool-down period (5 minutes). The participants will follow a video recording of the exercises to learn the basic forms and stances virtually. They will join video calls with a licensed PT and researchers. The licensed PT with at least a year of experience will have a different task from the PT assessors who will obtain the baseline and 12-week measurements. The PT will facilitate and oversee the exercise session by providing feedback to ensure the participants’ accuracy of movement execution and safety. The researchers will assist the PT in monitoring the participants every exercise session. Adherence to the program will be monitored through check-ins and recorded in a weekly calendar journal that will indicate the schedule and duration of
their participation. All equipment and necessities such as the arnis sticks, mobile load, and refreshments will be provided.

Control Group

Participants in the control group will carry out their usual daily activities for the study duration. Daily activities performed by Filipino older adults may include home gardening, physical exercises, watching television, reading a newspaper, listening to the radio, and engaging in social activities (Ogena, 2019). Added measures of having weekly check-ins will be implemented to ensure that the participants will not do any physical activity stated in the exclusion criteria.

Plan for Data Analyses

Data will be encoded to MS Excel and analyzed through IBM SPSS version 28. Demographic characteristics will be summarized through descriptive statistics. Inferential statistics through a paired t-test will be conducted to compare the baseline and the 12-week assessments of the control and intervention groups. An independent t-test will be conducted between baseline and the 12-week assessment for between-group analysis. If the assumptions of the parametric tests are not met, alternatives such as the Wilcoxon Signed Rank Test and the Mann-Whitney U test will be utilized. A p-value of < 0.05 would be considered statistically significant.

Ethical Considerations

The study will adhere to the Philippine National Ethical Guidelines for Health and Health-related Research (2017) along with the Data Privacy Act of 2012. The study will also be kept ethically sound by national standards. In addition, the study will abide by the Declaration of Helsinki (2013). Ethical approval will be sought from the UST-CRS Ethics Review Committee. Since the participants are a population considered vulnerable, only those with a consent form voluntarily signed by the participant and co-signed by a legally authorized representative will be allowed to participate in this study. The individual will be informed that they have the right to refuse participation and withdraw at any given moment of the study. If any participant opt to withdraw from the program, their data and personal information will be kept confidential. Pertinent protocol modification will also be disseminated among relevant parties promptly. The safety of the participants is of utmost importance, with the recruitment criteria playing an integral role in ensuring that the participants are healthy individuals. There will be a close one-on-one monitoring during the exercise to address physical risks and the researchers will ensure that the participants have stable vital signs before, during, and after exercising. Participants will also have an allotted 1-minute break as indicated in the adapted protocol or as needed. For both the control and intervention group, A list of contact numbers of the nearest hospitals will be given. Prior coordination will also be made to the two nearest hospitals to ensure transport accommodations as well as arrangements with the barangay. In situations wherein anticipated risks occur, the exercise program will be terminated. The participant will then rest and be monitored by the companion and the PT present in the Zoom or Google Meet for 5 minutes. If no improvement is seen, the participant will be taken to the nearest hospital. Inter-Agency Task Force for the Management of Emerging Infectious Diseases and Local Government Unit guidelines will be strictly adhered to.

All data collected will be kept confidential through de-identification codes and will only be used for this study. Access to data extracted from the participants is limited to the research team and journal databases, if necessary. Collected data from the participants will be stored in a Google Drive only accessible by the research team and faculty co-authors. Individual documents will be encrypted to prevent data breaches. To prevent data loss, copies of the data will also be protected. The devices that the researchers will use will be password-protected. Public access to protocol and data set will be granted. However, released data will not be indicative of the patient’s identity and demographics, nor will it create risks or harm to the participant. After the data analysis and research presentation, the results will be initially disseminated to the participants. All collected data will be transferred for safe-keeping in the Center of Health Research and Movement Science (CHRMS) for five years. All copies of collected data will be disposed of manually. Data processed as hardcopies will be shredded and data saved as electronic files will be manually deleted.

Funding

This study is supported by the UST Simbahayan, the Community Development Office of UST, which aims to empower and develop communities.

Expected Results

This pilot study will provide preliminary data on the effectiveness of the Arnis-based exercise program on balance control in older adults, which could serve as a reference for future, more extensive experimental studies.

Conflict of interest statement

Two of the authors, Donald S. Lipardo and Donald G. Manlapaz, are members of the Editorial Board of the Philippine Journal of Physical Therapy. All other authors declare no competing interests.

References


Appendix A

Protocol Version No.: SI-2021-023-R2

Issue Date: August 28, 2022

Protocol Amendment Number: 03


Revision Chronology

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