

ORIGINAL ARTICLE

Synchronous and asynchronous tele-exercise for older adults: study protocol for a randomized clinical trial

Tele-exercício síncrono e assíncrono para pessoas idosas: protocolo de estudo para um ensaio clínico randomizado

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KEYWORDS

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Exercise
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PALAVRAS-CHAVE

Saúde do Idoso
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ABSTRACT

Objective: Multicomponent physical training, carried out via tele-exercise, can contribute to a healthier lifestyle in the elderly. The objective is to present the intervention protocol of the “Idoso Ativo” (Active Older Adult) program via tele-exercise, synchronously and asynchronously. **Method:** This is a randomized clinical trial with two groups performing tele-exercise. Participant recruitment will be done via digital platforms, social media pages and printed leaflets distributed in the different regions of Distrito Federal. Both groups will perform exercises three times a week, lasting 50 min, and the intervention period will be 12 weeks. **Discussion:** The hypothesis is that the multicomponent exercise program offered online will provide improvements in muscular strength, balance and mobility in both groups. A higher adherence rate is expected in relation to the asynchronous group, and it is believed that the positive effects on physical health, minimizing the negative outcomes caused by inactivity, are present in participants in both groups.

RESUMO

Objetivo: O treinamento físico multicomponente, realizado via tele-exercício, pode contribuir para um estilo de vida mais saudável em pessoas idosas. O objetivo é apresentar o protocolo de intervenção do programa “Idoso Ativo” via tele-exercício, de forma síncrona e assíncrona. **Método:** Trata-se de um ensaio clínico randomizado com dois grupos realizando tele-exercício. O recrutamento dos participantes será feito via plataformas digitais, páginas de redes sociais e folhetos impressos distribuídos nas diferentes regiões do Distrito Federal. Ambos os grupos realizarão os exercícios três vezes por semana, com duração de 50 min, e o período de intervenção será de 12 semanas. **Discussão:** A hipótese é que o programa de exercícios multicomponentes, oferecido on-line, proporcionará melhora na força muscular, equilíbrio e mobilidade em ambos os grupos. Espera-se maior taxa de adesão em relação ao grupo síncrono, e acredita-se que os efeitos positivos na saúde física, minimizando os desfechos negativos causados pela inatividade, estejam presentes nos participantes de ambos os grupos.

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INTRODUCTION

Practicing physical exercise favors the slowing of functional decline and even a reversal, at any age¹. In older adults, functional training, especially multicomponent exercises, is associated with increased strength, mobility, gait speed and balance². Alternatively, a sedentary lifestyle is associated with worse physical performance and low mobility in dual-task activities, which are fundamental in carrying out activities of daily living³.

Regular physical exercise and a healthier lifestyle contribute positively to a better aging, possibly by promoting hypertrophy and increased muscle strength⁴, potentially maintaining and/or restoring the older adult's functionality, reducing pain, occurrence of falls and associated disabilities, improving their health and preventing frailty^{5,6}. The World Health Organization defends the need to implementing active aging policies and programs to increase healthy life expectancy and quality of life¹.

In this context, technology can be an ally in promoting a healthier lifestyle. Communication based on the use of smartphones and tablets has a strong potential to transform healthcare and clinical interventions for the population⁷. The telehealth modality involves telecommunications through a set of technologies supported by a variety of platforms designed to improve patient-centered healthcare. Telecare, an action of telehealth, has been growing and bringing benefits such as accessibility and the absence of the need for long journeys, presenting a good cost-benefit⁸. This type of intervention has been used by health professionals, contributing to a healthier lifestyle in older adults, preventing or delaying functional declines, and promoting socialization – when carried out in groups^{9,10}.

The digital platform YouTube is easily accessed by the elderly population⁹, and according to data offered by the platform itself, 70% of YouTube viewing time comes from mobile devices¹¹, becoming a resource with great potential for health promotion. Studies using online exercises are still growing and have potential in different forms of execution for elderly people. However, they still need to be further explored, as they involve aspects beyond physical training, such as skills in handling technological resources, usage of electronic devices and digital platforms, also checking the types of intervention. Given these considerations, the following tele-exercise intervention protocol aims to evaluate muscle strength, balance, muscle quality and the physical performance of older adults, before and after completing the *Idoso Ativo* (Active Older Adult) program, synchronously and asynchronously.

METHOD

Study design

This is an experimental, longitudinal, randomized clinical trial (RCT) protocol, with blind assessment and a quantitative approach. The protocol was approved by the Ethics and Research Committee of the Catholic University of Brasília (CAAE no. 50279821.3.0000.0029, decision no. 4.922.410) and published in the Brazilian Registry of Clinical Trials (ReBEC) under number RBR-75dvnfm. This study

protocol was reported in accordance with the standard Protocol Items: Recommendations for Intervention Test Statement (SPIRIT).

Setting and participants

The present study will be carried out with older adults of the community, with the following inclusion criteria: individuals ≥ 60 years old, visual, hearing and motor capability to handle a mobile device (smartphone), who have a smartphone, who have not practiced moderate physical exercise regularly for the last three months. Also, those who reach the minimum score on the Mini Mental State Examination (MMSE) will be included, according to the following cutoff points: 17 for illiterate, 22 for 1 to 4 years of schooling, 24 for 5 to 8 years of schooling and 26 for >9 years of schooling^{12,13}.

The exclusion criteria are older adults who are bedridden, unable to remain in an upright position, low visual acuity and hearing impairment (who do not use equipment that minimizes deficits), who are unable to walk independently (those who use mobility devices, such as a cane, for example, may participate). Older adults who do not have internet access and who are unfamiliar with using mobile phones and resources such as WhatsApp, Google Meet and YouTube, without someone to assist them closely, will also be excluded.

Recruitment

Participants will be recruited through advertising on digital platforms (newspapers and university websites), social media (Instagram®) and printed leaflets distributed in different regions of the Distrito Federal. Registration can be done by filling out an electronic form, telephone call or contact via WhatsApp®.

Participants who are selected will undergo an initial assessment, in person, at the Physical Assessment and Training Laboratory of the Catholic University of Brasília and will receive items to carry out the exercise program such as dumbbells, shin pads, and a digital device for blood pressure measurement. To prescribe the load, a one-repetition test with maximum load will be carried out.

Randomization and allocation

After the assessment, volunteers will be randomized and allocation by a blind researcher, via the website¹⁴. After dividing the participants into two groups (synchronous and asynchronous), a WhatsApp® group will be created with the participants of each group, through which all information regarding the exercises will be sent, as well as clarification of doubts and welcoming the participants. Due to the nature of the interventions, the team conducting the exercise sessions and the participants cannot be blinded.

Volunteers will also receive guidance on how to measure their blood pressure before and after exercise, take a photo of the device with the measurements and send it to the WhatsApp group. This will allow blood pressure monitoring and see if it is within normal limits that day to perform the exercises). They will also be instructed on the use of appropriate clothing for exercising (sneakers, light and

comfortable clothing). Reasons for program discontinuity and follow-up losses will be recorded throughout the study.

Intervention

All participants will start the exercise program at the same time and, both groups will perform exercises lasting 50 min, three times a week, for 12 weeks, totaling 150 h of moderate physical activity recommended by the Physical Activity Guide for the Brazilian population of the Ministry of Health¹⁵. In the synchronous group, the intervention will take place online using the Google Meet platform, three times a week on specific days and times, while the asynchronous group will have a first online meeting synchronously, to guide the exercises and postures of the participants. After this first meeting, volunteers will organize themselves on the days that are most convenient, maintaining a frequency of three times a week.

As strategies to improve adherence to intervention protocols, videos will be sent biweekly on the importance of practicing physical exercises, in addition to direct contact with participants via WhatsApp. Participants can withdraw at any time or be excluded in the case of 6 consecutive absences or health problems that prevent them from continuing the exercises remotely. Participants are allowed to walk on different exercise days in the program. Practicing bodybuilding, or other moderate intensity activity concomitantly during the intervention period, will be grounds for exclusion of the participant.

The “*Idoso Ativo*” (Active Older Adult) training¹⁶ available on the YouTube platform divides the exercises into two phases. Each phase lasts six weeks and contains four categories: warm-up, strengthening, balance and mobility.

Phase 1 – 1st to 6th week

Warm-up: Initially, the older adults will check their vital signs. After this observation and the normality of these

signs, the volunteers will begin warming up, starting with the movement of walking in place for 2 min, accelerating the pace in the second minute; followed by walking in place with suspension of the lower limbs; upper-body flexion/extension with elevation of the upper limbs and active global body stretching (time: 5 min) (Figure 1).

Strengthening: Participants will perform exercises in three axes of movement, namely: abduction/adduction of the lower limbs; knee flexion/extension; Mini squat. For all exercises, 3 sets of 8 to 12 repetitions are recommended (Figure 1).

Balance: Lunges with a stick (3 sets of 12 repetitions); balance in single leg support: initially maintaining the position for 5 s and progressing weekly up to 30 s; lower limb flexion (3 sets of 12 repetitions) (Figure 2).

Flexibility: Stretches will be held for 30 s; active stretching of cervical muscles; stretching of abductors/adductors of the lower limbs; stretching of the posterior thigh muscles (Figure 2).

Phase 2 – 7th to 12th week

Warm-up: After observation and normality of vital signs, the warm-up period will begin. Marching with obstacles, walking forward and sideways (2 times each exercise); step (2 min); jumping jacks (12 repetitions), (time: 5 min). For the safety of participants, it will be advised to make marks on the floor instead of using rods, to avoid the risk of falling (Figure 3).

Strengthening: Sitting on a chair, the participant will perform a knee extension; standing, supported on a chair, perform triple flexion of the lower limb; calf strengthening while standing and walking on toes; squats with body suspension (3 sets of 12 repetitions) (Figure 4).

Balance: weight transfer; suspension of an object with laterality; Lunges with weight (3 sets of 12 repetitions); single leg support (30 s) (Figure 5).

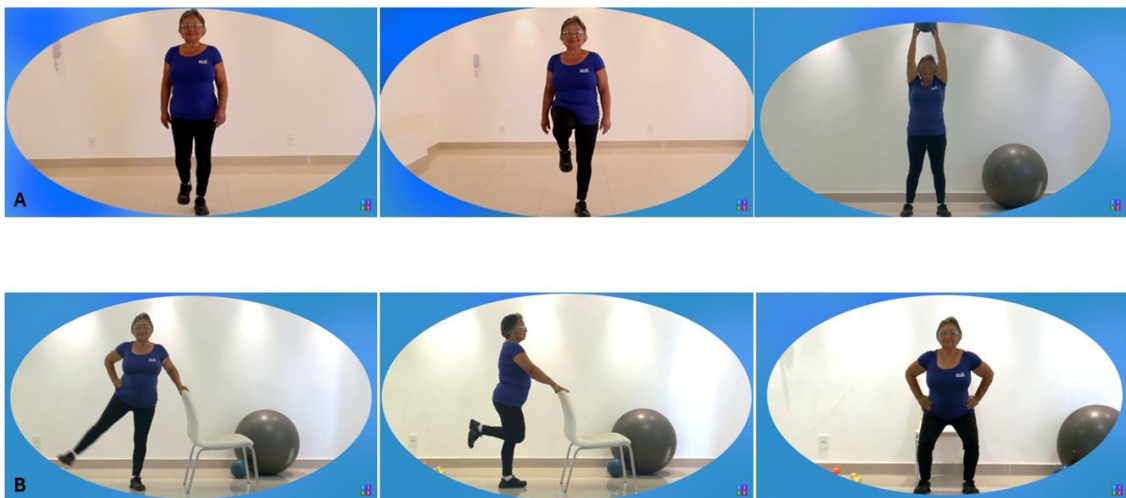


Figure 1 – A - Phase 1 warm-up exercises. Walking in place for 2 min, accelerating the pace in the second minute; followed by walking in place with suspension of the lower limbs; upper-body flexion/extension with elevation of the upper limbs and active global body stretching; B - Phase 1 strengthening exercises: abduction/adduction of the lower limbs; knee flexion/extension; Mini squat

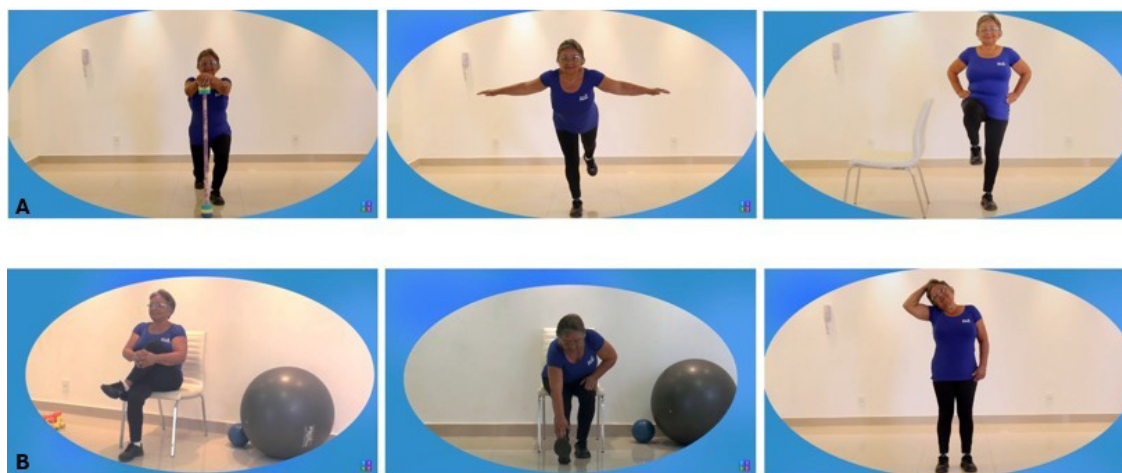


Figure 2 – C - Phase 1 balance exercises: Lunges with a stick; balance in single leg support; lower limb flexion; **D - Phase 1 flexibility exercises:** active stretching of cervical muscles; stretching of abductors/adductors of the lower limbs; stretching of the posterior thigh muscles.



Figure 3 – Phase 2 warm-up exercises: Marching with obstacles, walking forward and sideways; step; jumping jacks

Flexibility: stretching of knee extensors; stretching of posterior thigh muscles (held for 30 s); global stretching (raising your arms above your head, stretching your entire body and standing on toes. Hold the position for 5 s and release arms), repeat the movement four times (Figure 6).

To individualize the exercises and respect the participants' limits, at the end of each week the responsible researcher will check the older adult's effort using Borg's CR10 Scale. On this scale, each value has a description equivalent to the intensity of the exercise performed. The responses regarding the subjective perception of

effort will be recorded on the participant's progress form, to be used as a basis for load progression. From the second week of intervention, the load will progress as participants report a level of physical effort lower than "not very intense" after performing the exercises¹⁷. Each increase in load will be 1 kg.

In each phase, the older adult will undergo an adaptation to the exercises, and in the first week, it will be without load, and in the subsequent five weeks, the volunteers will have progressive additional loads as previously assessed by the 1-repetition maximum test. The load will be increased



Figure 4 – Phase 2 strengthening exercises: knee extension; triple flexion of the lower limb; calf strengthening while standing and walking on toes; squats with body suspension.



Figure 5 – Phase 2 balance exercises: weight transfer; suspension of an object with laterality; lunges with weight; single leg support.



Figure 6 – Phase 2 flexibility exercises: stretching of knee extensors; stretching of posterior thigh muscles; global stretching.

Table 1 – Temporal description of the study protocol.

Timepoint	Week 1	Intervention		Week 13
		Fase 1 (week 1- 6)	Fase 2 (week 7–12)	
Allocation	X			
Assessments				
MMSE	X			
DXA	X			X
Isokinetic dynamometry	X			X
SPPB	X			X
TUG	X			X
Handgrip strength	X			X
Single leg support test	X			X
Experimental condition				
Synchronous Group		X	X	
Asynchronous Group		X	X	

MMSE: Mini Mental State Examination; DEXA: Dual-energy X-ray absorptiometry; SPPB: Short Physical Performance Battery; TGU: Timed Up and Go.

again from the second week onwards. For each exercise, the older adults will do 3 sets of 8 to 12 repetitions and have up to 1 minute of recovery between sets.

Two previously trained physical therapists will be responsible for monitoring the intervention and all evaluations will be performed by a trained evaluator blinded to group allocation. The physiotherapists responsible for the intervention, as well as the participants in each group, will not be blind considering the nature of the study. Table 1 shows the temporal description of the study protocol (schedule of enrollment, interventions, and assessments).

Outcomes

Primary outcomes

The primary outcomes will be the muscle strength verified by peak torque by isokinetic dynamometry based on performing the knee flexion-extension joint movement at angular speeds of 60°/s and 180°/s^{18,19}. Handgrip strength will be measured isometrically (maximum effort maintained for 6 seconds), on the dominant upper limb, with the volunteer positioned in accordance with the recommendations of the American Society of Hand Therapy²⁰. Grip strength will be measured using the second position of the grip handle of the Jamar® dynamometer and scores will be calculated by averaging 3 repetitions, with a 60-second rest interval between repetitions^{17,21}.

The lower limb performance measured by the Short Physical Performance Battery (SPPB). The instrument is used for screening elderly people at risk of developing future disabilities²² and consists of three tests: static balance standing, in three positions – with feet together, with one foot partially in front of the other and with one foot completely in front of the other; walking speed at a habitual pace over a 3-meter distance; lower limb muscle

strength through the movement of getting up from a chair and sitting down five consecutive times. The Timed Up and Go (TUG) will be to check mobility and dynamic balance and the Single Leg Support Test will be to check static balance. Both tests are easy to apply and low cost.

And to assess body composition, DEXA will be performed, which provides an image of the patient's body in different nuclei, highlighting the amount of fat in each part, as well as the values of lean and fat mass per segment, and lasts approximately 10-15min^{23,24}.

Other results

Adherence will be monitored through participant records sent by the WhatsApp group. Therefore, participants who perform the exercises three times a week will be considered fully adherent. The collected data will be stored in an Excel spreadsheet, available only to the responsible researchers. At the end of the study, the results will be published.

Statistics

The descriptive analysis will be carried out using absolute and relative frequencies for qualitative variables. For quantitative variables, descriptive measures will be used: mean, median, standard deviation, interquartile range, and minimum and maximum values.

Comparisons will be made between pre- and post-functional reinstatement values for the two groups: Synchronous and Asynchronous, using paired samples statistical tests: Student's t or Wilcoxon, depending on the data normality. The groups will also be compared to each other using the independent samples, Student's t or Mann-Whitney U tests, also depending on the data distribution. The Shapiro Wilk test will be used to verify the presumption of normality of quantitative variables.

Linear regression analysis will be performed to identify demographic and epidemiological variables associated with outcomes related to gains in the test, using isokinetic dynamometry. The explanatory variables that present $p > 0.20$ in the bivariate analysis will be selected in the model and the residuals will be analyzed and multicollinearity checked.

The data will be compiled in a Microsoft Excel spreadsheet (2016) and analyzed using the IBM SPSS (Statistical Package for the Social Sciences version 23, IBM Corp., 2015), with bilateral tests and significance level of 5%.

Sample size

For power analysis (ANCOVA: fixed effects, main effects and interaction – a priori), handgrip strength will be the dependent variable as represent an independent risk factor for mortality and cardiovascular disease²⁵. Considering an effect size of 0.27 (eta squared), alpha error probability of 0.05, power of 0.80, numerator df (e.g., 1), number of groups of (e.g., 2) and number of covariates (e.g., 1). The total numbers of participants in each group necessary to achieve a power of 0.80, would be 53.5 (total of 107 participants). The significance level adopted in this study will be $p \leq 0,05$ and the software used for analysis was SPSS 20.0, G*Power 3.1²⁶ and JASP 0.16.3.0.

DISCUSSION

According to the Ministry of Health¹⁵, regular physical exercise is among the main fall prevention strategies, with some studies showing that functional and balance exercises can contribute positively to reducing the risk of falling^{27,28} therefore, thinking about prevention and treatment strategies is fundamental²⁹.

In this context, the hypothesis is that the multicomponent exercise program “*Idoso Ativo*” (Active Older Adult), offered online, will provide an improvement in muscular strength, balance and mobility in both groups. Due to the greater socialization generated in the synchronous group, a higher adherence rate is expected in relation to the asynchronous group. Still, it is believed that the positive effects on physical health, minimizing negative outcomes caused by inactivity, are present in participants in both groups.

The method of publishing exercises on a digital platform has been studied and improved in recent years³⁰⁻³². The study by Ballin et al.³⁰ compared two groups, one performing the online exercise modality and the other performing the in-person exercise modality for a period of 10 weeks. As a result, the researchers found that there was no difference between the groups. Two other studies^{31,32} carried out the proposed intervention only online, dividing into two groups, one synchronous (exercises via teleservice) and the other asynchronous (recorded exercises). Schwartz et al.³¹ found good adherence to both intervention proposals, so that participants in both groups improved physical activity levels. In the study by Moreira-Neto et al.³², the results showed that individuals who performed remotely supervised exercises had higher levels of vigorous-intensity physical activity, in relation to individuals who performed self-guided exercises in the unsupervised group.

In this way, the “*Idoso Ativo*” (Active Older Adult) program, available free of charge on the YouTube digital platform, is effective and can result in positive social benefits for the older adult population, facilitating and encouraging exercise as well as a healthier lifestyle. The program can be used directly by this population, or as support for health professionals in assisting older adults.

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