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ARTIGO ORIGINAL

Effects of a group using digital technologies and physical activity on cognition and health of the elderly

Efeitos de um grupo de uso de tecnologias digitais e caminhada na cognição e saúde de idosos

Efectos de un grupo usando tecnologías digitales y caminando sobre la cognición y la salud de los ancianos

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Effects of a use digital technologies and physical activity on cognition

Abstract

Aim: to estimate the effects of a group using digital technologies and physical activity on cognitive function and health variables in the elderly.
Methods: intervention research with 29 elderly men (n=7) and women (n=22), all from the University of Cruz Alta community. The intervention consisted of a Program to use digital technologies and practice physical activity (walking). It had weekly meetings (total of 16 meetings) of approximately 90 minutes, first using digital technologies – computers and internet (approximately 60 minutes) and then walking (30 minutes). Cognitive function was measured by the Mini Mental State Examination. Sex, age, marital status, education, disease diagnosis, vision problems, medication, use of tobacco and alcohol and functional capacity were also collected through a questionnaire. The Body Mass Index was also checked. Participants were assessed before and after the program. The data were analyzed by paired Student's t-test with a 5% probability.
Results: it was evident that the proposed program improved cardiorespiratory fitness (519.14 pre-test - 583.86 post-test, p = 0.005) and cognitive ability (25.90 pre-test - 26.21 post-test, p> 0.001) of participants, in addition to influencing the cessation of tobacco use (20.7%).
Conclusion: these results show the importance of programs aimed at the cognitive improvement of elderly people, and health variables, considering that these can and should be inserted in health care settings.

Keywords: elderly, cognition, physical activity, computers.

Resumo

Objetivo: estimar o efeito de um grupo de uso de tecnologias digitais e atividade física na função cognitiva e variáveis de saúde em idosos.
Métodos: pesquisa de intervenção com 29 idosos, homens (n=7) e mulheres (n=22), todos da comunidade da Universidade de Cruz Alta (Unicruz). A intervenção consistiu em um Programa de uso de tecnologias digitais e prática de atividade física (caminhada). Teve encontros semanais (total de 16 encontros) de aproximadamente 90 minutos, primeiro utilizando tecnologias digitais – computador e internet (aproximadamente 60 minutos) e depois caminhando (30 minutos). A função cognitiva foi medida pelo Miniexame do Estado Mental. Sexo, idade, estado civil, escolaridade, diagnóstico de doenças, problemas de visão, medicamentos, uso de tabaco e álcool e capacidade funcional também foram coletados por meio de questionário. O Índice de Massa Corporal também foi verificado. Os participantes foram avaliados antes e depois do programa. Os dados foram analisados pelo teste t de Student pareado com 5% de probabilidade.

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Resultados: ficou evidente que o programa proposto melhorou a aptidão cardiorrespiratória (519,14 pré--teste - 583,86; pós-teste, p = 0,005) e a capacidade cognitiva (25,90 pré-teste – 26,21; pós-teste, p> 0,001) dos participantes, além de influenciar a cessação do tabagismo (20,7%).
Conclusão: esses resultados mostram a importância de programas voltados à melhora cognitiva de idosos, e variáveis de saúde, considerando que essas podem e devem ser inseridas em ambientes de atenção à saúde.
Palavras-chave: idosos, conhecimento, atividade física, computadores.

Resumen
Objetivo: estimar el efecto de un grupo usando tecnologías digitales y caminando sobre la función cognitiva y variables de salud en adultos mayores.
Métodos: investigación de intervención con 29 adultos mayores, hombres (n=7) y mujeres (n=22), todos de la comunidad de Universidad de la Cruz Alta. La intervención consistió en un Programa de uso de tecnologías digitales y práctica de caminar. Tenía reuniones semanales (total de 16 reuniones) de aproximadamente 90 minutos, primero utilizando tecnologías digitales (aproximadamente 60 minutos) y luego caminando (30 minutos). La función cognitiva se midió mediante el Mini Examen del Estado Mental. También se recogieron a través de un cuestionario el sexo, la edad, el estado civil, la educación, el diagnóstico de la enfermedad, los problemas de visión, la medicación, el consumo de tabaco y alcohol y la capacidad funcional. También se verificó el Índice de Masa Corporal. Los participantes fueron evaluados antes y después del programa. Los datos se analizaron mediante la prueba t de Student pareada con una probabilidad del 5%.
Resultados: se evidenció que el programa propuesto mejoró la aptitud cardiorrespiratoria (519,14 pretest - 583,86 postest, p=0,005) y la capacidad cognitiva (25,90 pretest - 26,21 postest, p>0,001) de los participantes, además a influir en el cese del consumo de tabaco (20,7%).
Conclusión: stos resultados muestran la importancia de los programas dirigidos a la mejora cognitiva de las personas mayores y las variables de salud, considerando que estos pueden y deben insertarse en los entornos de atención a la salud.
Palabras clave: anciano, cognición, actividad física, ordenadores.

Introduction

The elderly population (60 years of age or older) has been increasing rapidly worldwide. In Brazil, data from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, 2018) show a decrease in the youth population and an increase in the elderly. The population maintained the aging trend of recent years, reaching 30.2 million in 2017, according to the Continuous National Household Sample Survey.[1]

Aging is a physiological process that occurs during life, characterized as a natural process in which morphological, functional, biochemical and psychological changes[2]. Beside to cause a compromise of the organism's autonomy and adaptation to the external environment what induces a greater number of diseases[2], decreased body weight, height and muscle mass, increased number of disabilities, decreased self-esteem and socialization[3], loss of memory and increase in cognitive problems.[4]

As the population ages, the number of people with cognitive problems increases. In 2016, the global number of individuals with some form of dementia was 43.8 million, with an increase of 20.2 million since 1990[5]. An estimate made by the WHO projected that every 20 years the number of people with dementia tends to double, with the projection that in 2030 the number will be 65.7 million people worldwide, totaling 7.7 million new cases per year.[6]

Throughout aging, the more advanced the age, the greater the risk of reduced cognitive performance. Among the most common neurocognitive changes are impairment of executive functions, episodic memory and processing speed. Such cognitive difficulties lead to changes in activities of daily living and may be associated with symptoms of dementia and / or depression.[7,8] As a result, the elderly with cognitive problems have reduced quality of life, worsen health[3] and increase the risk of mortality.[10]

In this perspective, the maintenance, stimulation and / or rehabilitation of cognitive function are important for the promotion of health, quality of life and independence of the elderly.[10] Studies show that there are several cognitively stimulating activities that have the effect of delaying cognitive decline in those who have cognitive problems, but those that stand out most are the use of digital technologies and regular physical activity.[11]

To rescue the social participation of the elderly, the use of digital technologies such as the internet has been shown to be effective, as it reduces mental and socio-economic limitations, improving citizenship, health, education, work, leisure and

social life, in addition to the potential to assist in cognitive maintenance[12] and the reduction and / or stabilization of dementia[10].

Maintaining a physical exercise routine also assists in the maintenance, stimulation and rehabilitation of cognitive function[12,13]. Meta-analysis with 47 studies on physical exercise and cognitive problems, published from 2007 to December 2013, showed that people who practiced physical exercise had a lower risk of cognitive decline (RR = 0.65; 95% CI = 0.55-0.76) and dementia (RR = 0.86; 95% CI = 0.76-0.97), when compared to those who did not perform it.[14]

This research is justified by to the great increase in cognitive problems in the elderly; by low frequency of the habit of the elderly using digital technologies - computer, tablet or cell phone (4.1%); and, by the big percentage of elderly physically inactive15. In this sense, the objective of this article was to estimate the effects of the participation of the elderly in a group using digital technologies and physical activity on cognitive function and health variables.

Methods

Type of study, population and sample

This quantitative, epidemiological and of intervention study, with a population composed of elderly men and women, living in University of Cruz Alta (UNICRUZ) community. The group on the use of digital technologies and physical activity (walking) was offered and publicized on the social media and the cadastre and in the UNICRUZ 92 research programs and 33 extension programs. At the beginning of each semester, online and telephone registrations are open to participants.

This project started in 2018/2, when it had its first class, which had seven students. Subsequently, two more classes were offered, 2019/1 and 2019/2 with 11 seniors in each class, totaling a sample of 29 participants. All participants signed the Free and Informed Consent Form – TCLE to participate in the research.

Group on the use of digital technologies and physical activity (walking)

The cognitive rehabilitation and stimulation program was based on the Oficina da Lembrança, created by the geriatric doctor and researcher André Junqueira Xavier, in 2000[16]. This proposal has already been used in several educational institutions as research and / or extension projects and has been showing great results for the community.

The program consists of meetings (workshops) that took place once a week during the university semester (about four months, totaling approximately 16 meetings in each class). The meetings were prepared, taught and observed by the monitors (scholarship holders - academics) of the Computer Science and Physical Education course at UNICRUZ - and volunteers - academics from any course in the area of health and Computer Science, in addition to masters in the Program Graduate in Comprehensive Health Care from the UNICRUZ and association with Regional University of the Northwest of the Atate of Rio Grande do Sul (UNIJUI), previously trained and supervised by the person responsible for the project. The monitors were also trained by the research coordinator to apply the research instruments to the elderly.

Each workshop lasted approximately 90 minutes, first using digital technologies for approximately 60 minutes and then 30 minutes of walking. The computer workshops took place in laboratory especific, and the walk was carried out on the walking track or in the multi-sport gym (on rainy days), all located at UNICRUZ.

The use of digital technologies consisted of activities on the computer, such as the use of a mouse, a free drawing tool, a photo presenter, games (puzzle, patience, minefield) with no scheduled time; browser learning, navigation, searching for words and texts; image search, internet browsing; electronic mail and cell phone use to exchange messages.

The practice of physical exercise took place initially through static stretching, followed by dynamic warm-up. The main part was the walk

with light to moderate intensity, with small oscillations of terrain. On rainy days, the exercises were performed in the university gym. The exercise execution time was 30 minutes.

In the first five meetings, the focus on the use of technologies was on basic computer tools, such as: turning the computer on and off, using the mouse, using a typing application (Klavaro), basic games and using Whatsapp. In the five subsequent meetings, the knowledge already explored was deepened, using Word, adding images, more elaborate games, without scheduled time, navigation and search for words and texts. The last six meetings had a greater focus on internet browsing (search for images and content), electronic mail, creation of social networks (email and facebook), power point and spreadsheets in excel. Physical activity remained constant from the beginning to the end of the meetings, with static stretching, dynamic warm-up and walking.

Data collection, instruments and study variables

The instruments were applied individually in a face-to-face interview, in a separate room, always being held at the beginning and end of each semester, that is, each class (2018/2, 2019/1 and 2019/2) had its collection period data at the beginning and end of each semester.

The instruments applied and their respective variables were:

Variable outcome:

- Cognitive capacity assessed by the Mini Mental State Examination (MMSE)[17]. In Brazil, this questionnaire was translated and validated by Bertolucci et al[18], having previously been used in population studies with the elderly and containing 30 questions about temporal and spatial orientation, fixation memory, evocation, attention, calculation and language. The cognitive function measured by the MMSE is classified by the level of education, where the elderly with cognitive impairment are those who reach values lower than 19/20 points (illiterate elderly and low education) and less than 23/24 points (elderly with a medium education and high)[19].

Dependent variables:

- Diagnostic sociodemographic record to identify sex, age, marital status, education in years of study, health history (arterial hypertension, diabetes, hypothyroidism, dyslipidemia, metabolic syndrome, depression, stroke, transient ischemic attack, acute myocardial infarction), memory complaints, number of medications for continuous use, use of tobacco and alcohol (observed for the duration of the study);

- 6-minute walk test: the test was performed on a flat court, with previously demarcated distances (50 meters per lap). Participants were accompanied and encouraged by the respondent, by constant verbal stimulus, to walk as fast as possible, not being able to run. After the end of the walk, the distance covered by the participant was calculated[20]. The elderly were classified as: with good cardiorespiratory fitness ≥579.20 meters covered; and with poor cardiorespiratory fitness <579.20 meters covered[21].

- Functional capacity measured by the Brazilian Multidimensional Functional Assessment Questionnaire (BOMFAQ / OARS). It consists of 15 questions on activities of daily living to assess functional capacity on activities of daily living (lying / getting up, eating, walking on the plane, bathing, dressing and going to the bathroom when you feel like and in time) classifies the elderly as: without functional disability without difficulty to perform any activity or difficulty / inability to perform up to three activities and with functional disability - difficulty / inability to perform more than three activities[22]; and,

- Overweight / Obesity: no (<27 Kg / m2), yes (≥27.0 Kg / m2). Calculated by the Body Mass Index (BMI) which is the division of body weight (Kg) by height (cm) squared.

Data analysis

The database and statistical analyzes of the study were performed using the STATA 11.0 statistical package. The normality of the data was tested, in addition to descriptive statistics, through absolute and relative frequencies, for the

qualitative variables, and a measure of central tendency and dispersion, for the quantitative ones, with a significance level of 5%. In order to characterize the study sample, frequencies, means and standard deviation were used. To compare the averages of the variables collected in the pre and post-test, paired Student's t-test was used.

Ethical aspects

This study complied with all ethical principles according to Resolution No. 466 of 2012, of the National Health Council, being submitted for evaluation to the Research Ethics Committee and subsequently accepted under opinion 3.202.288. All study participants signed the Informed Consent Form and confidentiality of information, voluntary participation and the possibility to leave the study at any time, without justification, were guaranteed.

Results and Discussion

Table 1 shows the sociodemographic data of the elderly participants in the study. It was found that the majority were young elderly (64.28 ± 4.10 years) female (75.9%), retired (69%), married (51.7%), with at least one disease diagnosed (hipertension) by doctor, and complete elementary school (8.83 ± 5.66 years of study).

Table 1 – Sociodemographic data of the elderly participants in the group using digital technologies and physical activity. 2018/2019 (n = 29).

Variable	N	%
Gender		
Feminine	22	75.9%
Male	7	24.1%
Profession		
Retired	20	69.0%
Homemaker	5	17.2%
Mechanical	3	10.3%
Screenwriter	1	3.4%
Marital status		
Married	15	51.7%
Separated	6	20.7%
Single	2	6.9%
Widowed	6	20.7%
Disease		
No	6	20.7%
Yes	23	79.3%
	Mean ± standard deviation	
Age	64.28 ± 4.105	
Years of study	8.83 ± 5.664	

Table 2 shows the health characteristics, functional capacity, cardiorespiratory capacity and cognitive function before and after participating in the group of use of digital technologies and physical activity analyzed categorically. It was evident that the elderly who participated in the program had improved BMI, reduced the number of diseases and ceased the habit of using tobacco observed for the duration of the study, improved cardiorespiratory fitness and improved cognitive function.

Table 2 – Health characteristics, functional capacity, level of leisure physical activity, sedentary behavior, cardiorespiratory capacity and cognitive function before and after the elderly participants in the group using digital technologies and physical activity. 2018/2019. Percentage data (n = 29).

Variable	Pre-tests n (%)	Post-tests n (%)	P
BMI			>0.001*
Normal	14 (48.3%)	15 (51.7%)	
Overweight / obese	15 (51.7%)	14 (48.3%)	
Vision problem			--
No	1 (3.4%)	1 (3.4%)	
Yes	28 (96.6%)	28 (96.6%)	
Medication			--
No	3 (10.3%)	3 (10.3%)	
Yes	26 (89.7%)	26 (89.7%)	
Use of tobacco			>0.001*
No	26 (89.7%)	29 (100%)	
Yes	3 (10.3%)	0 (0%)	
Use of alcohol			--
No	23 (79.3%)	23 (79.3%)	
Yes	6 (20.7%)	6 (20.7%)	
Cardiorespiratory fitness			0.017*
Bad	23 (79.3%)	13 (44.8%)	
Good	6 (20.7%)	16 (55.2%)	
Functional capacity			--
With disability	3 (10.3%)	3 (10.3%)	
No disability	26 (89.7%)	26 (89.7%)	
Cognitive ability			0.020*
Compromisse	6 (20.7%)	4 (13.8%)	
No compromisse	23 (79.3%)	25 (86.2%)	

The elderly who participated in the program reduced the BMI (Table 2 and **Table 3**), elucidating the positive interference of the practice of walking in the levels of adiposity of the participants, as well as Hortencio et al[23], in a study that evaluated the effects of an exercise program on the reduction of cardiovascular risk factors in the elderly, and obtained a statistically significant reduction in weight, BMI, systolic and diastolic blood pressure in the elderly evaluated (p <0.001 in all the cases).

This finding can also be explained by the fact that the study participants ceased the habit of using tobacco duration of the study, a behavior that can help in reducing diseases associated with smoking such as cancers (lung, larynx, mouth, esophagus, pancreas, bladder, kidneys, stomach, leukemia and uterine cervix), cardiovascular diseases (sudden death, acute myocardial infarction, unstable angina, stroke, peripheral vascular occlusive disease and aortic aneurysm), lung diseases (chronic obstructive pulmonary disease, asthma, tendency to pneumonia and increased morbidity of viruses), gastrointestinal diseases (peptic ulcer, gastroesophageal reflux), oral diseases (leukoplakia, gingivitis, gum problems and tooth pigmentation), osteoporosis, cataracts, premature skin wrinkles and worsening hypothyroidism[24]. In addition, tobacco use can influence cardiorespiratory fitness[24] and cognitive function[3].

As for cardiorespiratory fitness, there are many physiological changes in smoking individuals, such as an effective increase of 14% in heart rate and 6% in blood pressure, an increase in blood viscosity, reducing cardiorespiratory fitness[24]. With the cessation of tobacco (the cessation was observed for the duration of the study). use and the practice of walking, an improvement in the cardiorespiratory fitness of the elderly participants in the study was observed. In addition,

the walk proposed in this study program, like other aerobic exercises, increases the maximum aerobic capacity, making the supply of oxygen to the muscle greater, with a reduction in heart rate and blood pressure when performing physical activities[25].

Another point that may have contributed for the elderly who participated in the program to improve their BMI, to reduce the number of diseases, to stop smoking and to improve their cardiorespiratory fitness was the use of computers, considering that this technological behavior is associated with better health habits[26], as well as the practice of walking[25].

Table 3 shows BMI, cardiorespiratory fitness and cognitive function before and after participating in the group using digital technologies and physical activity analyzed by means and standard deviations. It was evident the reduction in BMI and the gain in cardiorespiratory and cognitive fitness, showing the effectiveness of using digital technologies and physical activity in these variables.

Table 3 – BMI, cardiorespiratory fitness and cognitive function before and after participation in the group using digital technologies and physical activity. 2018/2019 (n = 29).

Variable	Pre-tests x±SD	Post-tests x±SD	P
BMI	26.20 ± 4.02	26.063 ± 3.95	>0.001*
Cardiorespiratory fitness	519.14 ± 84.7	583.86 ± 65.38	0.005*
Cognitive ability	25.90 ± 3.02	26.21 ± 3.00	>0.001*

In this sense, the combination of the use of digital technologies and the practice of physical activity showed a strong influence on the improvement of the cognitive function of the elderly surveyed, a fact also proven in other studies that used this combination.[11,13,27,28,29]

Another important point to consider is that these two proposed behaviors (use of digital technologies and physical activity) can have mutual influence and help together to improve cognitive func*tion.* Krug et al.[26] in a longitudinal study, verified the association between changes in the use of internet and in the practice of leisure-time physical activity over four years among elderly people in the EpiFloripa study. 1.705 elderly people were interviewed at baseline and 1,197 at follow-up. The prevalence of staying physically active at leisure (during follow-up) was 15.8% (95% CI = 12.6-19.0) and showed an association with switching to using the internet (RRR = 4.1; 95% CI = 2.06-8.55) and to keep using the internet (RRR = 5.52; 95% CI = 3.25-9.36), that is, elderly people who use computers and the internet are more physically active.[26]

Many studies already show that internet use can slow cognitive decline or even promote cognitive function[10,12,28,30], improving executive functions and episodic memory, creativity, cognitive flexibility, attention, task execution and other cognitive skills, in addition to decreasing the risks of people having impairment in activities of daily living.

The practice of physical activities can also be considered a good form of rehabilitation of cognitive function, considering that different physical activity programs can express satisfactory performance and avoid cognitive decline, dementias and Alzheimer's disease[31]. Smith et al[32] in a large meta-analytical study, found a moderate and significant effect of aerobic training on some aspects of cognitive function (attention, processing speed, executive function and memory) in the elderly.

In the elderly, the effect of regular physical activity can induce brain neuroplasticity and adult neurogenesis[33], with increased vascular capacity of the central nervous system and better performance of synaptic activity[34].

Table 4 shows the cognitive function before and after the cognitive stimulation and rehabilitation program mediated by the use of digital technology and the comparative walk between groups, that is, elderly people who had 75% or more of frequency

of participation in the program (most frequent elderly) compared to elderly people who did not have this frequency (less frequent elderly people).

Table 4 – Comparison of cognitive function before and after participation in the group using digital technologies and physical activity between more frequent elderly people (75% or more of frequency of participation in the program) and less frequent elderly people. 2018/2019. Data in average values.

Variable	Less frequent elderly n=14		Most frequent elderly n=15		P
	Pre-test x±SD	Post-Teste x± SD	Pre-test x± SD	Post-Test x± SD	
Cognitive ability	25.36±3.81[a]	25.50±3.99[b]	26.40±2.06[a]	26.87±1.50[c]	0.030[b]

It was evident that both groups improved cognitive function, but the elderly who had more frequency of participation in the program (75% or more) obtained better results (26.40 ± 2.06 pre-test, for 26.87 ± 1.50 post-test) in relation to the less frequent elderly (25.36 ± 3.81 pre-test, to 25.50 ± 3.99 post-test), showing that the frequency of participation in the program ncreases the probability of cognitive gain. However, both groups remained without cognitive impairment. These results prove once again the effectiveness of the use of digital technologies combined with the practice of walking, showing that the more these two behaviors are used, the greater the cognitive gains will be. In recent years, this combination of physical activity and mental health has been deepened[26,35], showing mainly improvements in attention, reasoning, concentration, executive function, response time, capacity of memory and task capacity.[36]

Conclusion

The group of use of digital technologies and physical activity not only maintained their cognitive functions, but obtained improvements, as well as benefits in their health variables. The present study contributes not only to the academic field, with scientific clarifications on the topic of cognition, health variables and the elderly, but also contributed to the quality of life of the elderly, who ceased smoking, had improvements in BMI, improved cardiorespiratory fitness and improved cognitive function.

The main limitations found during the present study are linked to the sampling process not being randomized, which can limit the conclusions and generalizations of the results. In addition, the reduced sample size also impacts the results found. Another limitation found was the distance from the place where the practices were carried out, in relation to the city center (6 kilometers), making it possible to access the program only by public transport or personal vehicle. In addition, the fact that the participation of the elderly in other places of physical activity was encouraged by the researchers and not controlled in the study, may have interfered in the results of the same, as well as the use of digital technologies at other times of the day was also not controlled.

The positive points of the study are related to the impact of the program on the quality of life of the elderly, as providing this improvement at a time like this of social distance, and knowing that each elderly person will have the necessary knowledge to communicate with friends and family through of digital technologies.

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Conflict interest

This article has no conflict of interest.

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