Original Article

Influence of Wiireabilitation on functional performance in the 6-minute walk test in sedentary elderly: a pilot study

Influência da Wiireabilitação sobre o desempenho funcional no teste de caminhada de 6 minutos em idosos sedentários: um estudo piloto

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ABSTRACT | INTRODUCTION: The incorporation of video games as additional tools in the practice of rehabilitation has enabled a new perspective of intervention in several areas; one is Wiireahabilitation, which has proven to be an effective tool in several clinical perspectives, it is also used in the practice of physical activity, and because of its playful characteristic, can be an important ally in the practice of physical exercise in populations with low adherence, especially the elderly. **OBJECTIVE:** To evaluate the influence of Wiireahabilitation on improving functional performance in the six-minute walk test (6MWT) in sedentary elderly. **METHODS:** This is a pilot study, which included elderly people aged 60 or over of both sexes and sedentary. All the elderly were initially evaluated by the 6-minute walk test (6MWT). Subsequently, an aerobic intervention was carried out through Wiireahabilitation, with a protocol defined by the researchers. Three months of intervention were programmed, with a frequency of three times a week and a duration of 30 minutes per session. The 6MWT was performed in the middle of the intervention protocol and at the end of the three months. For data analysis and interpretation, descriptive statistics were used. **RESULTS:** The study sample consisted of 5 participants, with a predominance of females (N = 4) and a mean age of 66.2 years ± 6.27. In the assessment of the 6MWT, all participants obtained more than 50 meters of gain in relation to the pre-test, showing an increase in functional performance. **CONCLUSION:** For the patients evaluated here, Wiireahabilitation proved to be an effective resource on functional performance in the 6-minute walk test.

KEYWORDS: Elderly. Physical Inactivity. Aerobic conditioning. Functional Performance.

RESUMO | INTRODUÇÃO: A incorporação de videogames como ferramentas auxiliares na prática da reabilitação possibilitou uma nova perspectiva de intervenção em diversas áreas, um deles é a Wiireabilitação, que tem se mostrado ferramenta eficaz em diversas perspectivas clínicas, sendo também utilizada na prática de atividade física, e, por sua característica lúdica, pode ser um importante aliado na prática de exercício físico em populações com baixa adesão, em especial, os idosos. **OBJETIVO:** Avaliar a influência da Wiireabilitação sobre a melhora do desempenho funcional no Teste de caminhada de seis minutos (TC6M) em idosos sedentários. **MÉTODOS:** Trata-se de um estudo piloto, onde foram incluídos idosos com 60 anos ou mais, de ambos os sexos e sedentários. Todos os idosos foram inicialmente avaliados pelo Teste de Caminhada de 6 minutos (TC6M). Posteriormente, procedeu-se com a intervenção aeróbica através da Wiireabilitação, tendo protocolo definido pelos pesquisadores. Foram programados três meses de intervenção, com frequência de três vezes por semana, e duração de 30 minutos por sessão. O TC6M foi realizado na metade do protocolo de intervenção e ao final dos três meses. Para análise e interpretação dos dados procedeu-se com a estatística descritiva. **RESULTADOS:** A amostra do estudo foi composta por 5 participantes, com predominância do sexo feminino (N=4) e média de idade de 66,2 anos ± 6,27. Na avaliação do TC6M todos os participantes obtiveram mais de 50 metros de ganho em relação ao pré-teste, evidenciando aumento no desempenho funcional. **CONCLUSÃO:** Para os pacientes aqui avaliados, a Wiireabilitação mostrou-se um recurso efetivo sobre o desempenho funcional no Teste de caminhada de 6 minutos.

PALAVRAS-CHAVE: Idosos. Inatividade Física. Condicionamento Aeróbico. Desempenho Funcional.

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Introduction

The aging process is determined by a multiplicity of factors that affect functional capacity, causing a decline in organic functions (morphological, psychological, biochemical, and neuromuscular). This process is influenced by several factors, such as lifestyle, socioeconomic conditions, genetic aspects, chronic diseases, among others.[1,2]

This physiological decline leads to the loss of functional capacity of the elderly, affecting their mobility and stopping or decreasing their ability to perform their Basic Activities of Daily Living (BADL) and Instrumental Activities of Daily Living (IADL). However, it can be changeable, based on adequate health care, directing it to a good physical, mental and social functioning.[2,3]

Given the importance of preventive and interventionist practices that aim to promote healthy aging is perceived, which excels in maintaining functional capacity, enabling the elderly to carry out their activities with autonomy and independence. In this context, several intervention procedures, preventive or rehabilitative, are available to achieve such objectives, with a current emphasis on biotechnology resources.[4,5]

The use of technology has become increasingly effective in various sectors of the health area, both in the preventive scope and in the rehabilitation of diseases already installed, is also incorporated in the performance of a physical activity, for therapeutic or recreational purposes, highlighting the virtual reality technologies.[6] Among these technologies, the use of exergames has been highlighted, including the Nintendo® Wii, a video game that uses sensors that capture the movements performed by the user. This resource has been used as an alternative to the practice of aerobic physical activity in a recreational way allowing patients to reduce their physical inactivity and improve their functional performance in a pleasurable way that will bring better physical and psychological results due to the entertainment provided, with the use of the tool. This is a technological resource used even in intensive care units.[7-9]

Some researchers agree that this practice is a motivational alternative, especially for those who have difficulties in joining or staying in physical activity programs, making exercise more spontaneous and, consequently, more pleasurable and enjoyable, of extreme relevance when talking about the elderly population.[10,11]

Some researchers in the area currently focus on the theme of the relationship between the Nintendo® Wii and the practice of physical exercise. The most recent researches have shown that this instrument is a great ally in the fight and treatment of obesity, reducing the risk of morbidities, as well as, in the field of geriatrics, where it demonstrates significant responses, because, in addition to favoring physical conditioning, it improves balance, reducing the risk of falls.[7,12]

Although scientific investigations on the use of this game have been increasing, experimental studies on this topic are still limited, especially with regard to the effectiveness of this resource in aerobic conditioning programs.[13,14] Within this perspective, the present study aimed to assess the influence of Wiireahabilitation on functional performance on the six-minute walk test in physically inactive elderly.

Methods

This article is a pilot study, approved by the Research Ethics Committee of Centro Universitário CESMAC, under protocol number 1449/2012. The data were collected from August to December 2014. Before the collection started, the Free and Informed Consent Form was read and subsequently signed by the research volunteers. The study was carried out at the motor physiotherapy outpatient clinic of SUPRIMIDO. The subjects were recruited from the Active Aging Group of Santa Casa (GEASC). GEASC is a health promotion and education project at Santa Casa de Misericórdia in Maceió. It takes place weekly, lasting one year, where the elderly participants receive instructions from the multidisciplinary team in lectures and dynamic activities aimed at active aging.

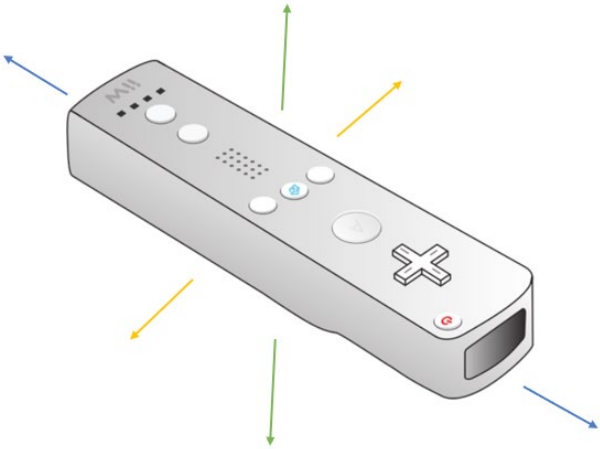
The researchers went to the physical space where GEASC meetings take place, and the elderly were explained about the research objectives, and a formal invitation to participate was made. Inclusion criteria were individuals aged 60 years or over of both sexes, regardless of race and color. Individuals with cardiovascular disorders who practiced regular physical activity were excluded; with cognitive impairment; visually and hearing impaired; elderly people with decompensated clinical disorders; those with medical restrictions for practicing aerobic activity and osteoarticular or neurological disorders that make orthostatic posture and interaction with the resource used for the research impossible (Nintendo® Wii).

A maximum number of five participants was established, which were selected through a lottery, respecting the time limit, physical space limitations, and equipment needed for data collection. After being selected, the individuals were invited to attend the physical space where the motor physiotherapy outpatient clinic of the hospital was involved in the research works. At first, the elderly underwent an initial assessment, where socioeconomic and demographic data and health issues were collected. After collecting these data, the elderly were submitted to the 6-minute walk test. Participants were previously instructed to wear light clothing and appropriate footwear to perform this test. They received all instructions for carrying out the test, which was carried out in the constant presence of the researchers, following the recommended protocol for carrying out the test.[13]

The entire test was carried out in a 30-meter corridor. The elderly were previously instructed to obtain the maximum understanding of the effort perception scale performed in the 1st, 3rd, and 6th minute of the test. Before starting and after the end of the evaluation, respiratory rate (RF), heart rate (HR), peripheral oxygen saturation (SpO2), and blood pressure (BP) were monitored. SpO2 was checked using a portable pulse oximeter (Connect TM) during the test. BP measured using the adult sphygmomanometer with velcro cuff (22-32cm, OMROMTM), and RF was measured before and at the end of the test. During the 6 minutes, the number of turns taken was recorded, and at the end of each test, the number of turns taken was recorded, as well as the number of meters of the last turn, in order to calculate the distance covered by the volunteer.[13]

After the initial evaluation, each elderly person's appointment days were scheduled, always interspersed, three times a week, on alternate days: Monday, Wednesday, and Friday. The resource used for aerobic training was the Nintendo® Wii video game, a Nintendo® home console that uses sensors to capture the movements performed by the user through the Wii Remote Plus (Figure 1), a control, which includes a gyroscope, maintained with the patient during the activities carried out for the accurate capture of his movements. In addition, it uses an infrared camera, a small speaker for emitting simple sounds, and three built-in accelerometers. Another device used to capture movements was the Wii Balance Board (Figure 2), a platform with pressure sensors that capture the user's movements according to the changes in the center of gravity.[6]

Figure 1. Demonstration of the vector lines of motion capture of the Wii Remote Plus.



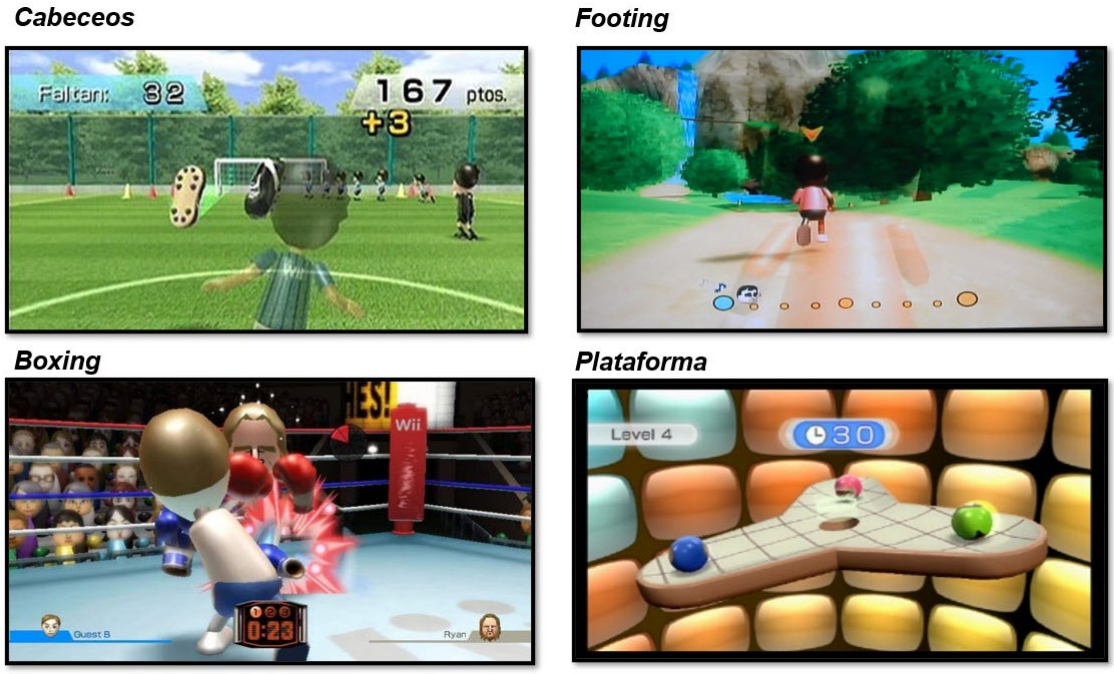
Source: https://pt.365psd.com/vector/wii-remote-clip-art-49907

Figure 2. Schematic demonstration of the system for capturing weight unloading by pressure sensors on the Wii Balance Board

Source: The author (2021).

The games used were part of the Wii Fit Plus package, which has a game block aimed at aerobic training. The researchers defined the protocol, where three months (12 weeks) of intervention were programmed, with a frequency of three times a week and a duration of 30 minutes per session. The established protocol respected the principle of aerobic training, where the games were used: Heads, Footing, Boxing, and Platforms (Figure 3). The conduct was always initiated with the game Cabeceos, aiming at warming up and adapting to the resource. This game simulates the sporting activity of football, where the individual must head the balls thrown by the opponent and / or avoid possible obstacles. It is performed with the patient in orthostasis on the balance platform (Wii Balance Board). It performs alternate weight unloading on lower limbs, together with a latero-lateral inclination of the trunk when interacting with the game; this stage lasted for five minutes.

Figure 3. Graphical representation of the games



Source: Wii Fit Plus, Nintendo® Wii.

Then, we proceeded with the aerobic games, where we opted for the Footing and Boxing games, with a duration of ten minutes each, done within the capacity that the individual reached. Footing consists of a static running game. With the control (Wii Remote Plus) at the hip, the individual in orthostasis performs flexion and extension of the hip and knees simulating the activity, always being stimulated by the examiner to achieve better functional performance. In Boxing, the patient positions himself in orthostasis, with a broad base, performing shoulder flexion with elbow flexion and extension, holding the controller (Wii Remote Plus), trying to knock out the opponent who appears on the game screen in the video game.

Lastly, for cooling, the Platforms game was performed, with five minutes of exercise. During the game, a patient performs weight unloading in orthostasis under the balance platform (Wii Balance Board), in order to pocket the ball. All patients repeated the 6MWT in the middle (at the end of the 6th week) and at the end of the three months (after the 12th week) of intervention, aiming to compare these results with those of the initial evaluation. The study protocol is described in table 1. For analysis and interpretation of the data, we proceeded with descriptive statistics, with the results arranged in means, proportions and frequencies.

Table 1. Study protocol

Stage	Description
Initial assessment	Collection of socioeconomic and demographic data and health issues.
Evaluation of functional capacity related to response to exercise in submaximal effort	Application of the 6-minute walk test.
Heating and adaptation to the resource	Game Heads (5 minutes). Simulation of the activity of heading balls in different directions and avoiding obstacles, alternating the weight unloading in lower limbs, and performing lateral trunk inclination for both sides. Game performing in orthostasis with the supervision of the therapist.
First Training	Footing game (10 minutes). With the Wii remote Plus control in his pocket, the individual performs a simulation of static running, following his path in the projection of the game. The therapist supervises the exercise, correcting possible trade-offs, encouraging the individual to perform better, always monitoring vital signs and the Borg Scale, in the beginning, in the fifth minute, and at the end of the exercise.
Second Training	Boxing game (10 minutes). With the controls on the hands, the individual simulates boxing hips, maintaining the shoulder flexion and performing the elbow flexion and extension, constantly trying to knock out the virtual opponent. The therapist supervises the exercise, correcting possible compensations, encouraging the individual to perform better, constantly monitoring vital signs and the Borg Scale, in the beginning, in the fifth minute, and at the end of the exercise.
Cooling	Platform's game (5 minutes). The individual in orthostasis, carrying out unloading and weight transfer, within the stability limit, attempts to pot balls inside the hole of a virtual platform. The game was performed under the supervision of the therapist.
Evaluation of functional capacity related to response to exercise in a submaximal effort	(Re) evaluation of the 6-minute walk test after the end of the 6th week of intervention.
Final assessment of functional capacity related to response to exercise in a submaximal effort	(Re) evaluation of the 6-minute walk test after the end of the 12th week of intervention.

Source: The author (2021).

Results

The study sample consisted of 5 individuals, with a predominance of females (N = 4). The average age found was 66.2 ± 6.27 years, with a minimum of 60 and a maximum of 74 years. Most of the evaluated participants had a high level of education (80%) and an income higher than 1 minimum wage (100%).

About health status, all participants reported living with less than two comorbidities, did not practice physical activity, mainly reported using only one medication, and perceived their health as good. All data regarding socioeconomic, demographic, and health characteristics are described in table 2.

Table 2. Distribution of the frequency of socioeconomic, demographic and health variables

Variable	Categories	Frequency	%
Sex	M	1	20,0
	F	4	80,0
Age range	<70 years old	3	60,0
	≥70 years old	2	40,0
Education	< 4 years old	0	0
	5 – 9 years old	1	20,0
	> 9 years old	4	80,0
Income	1 Wage	0	0
	> 1 Wage	5	100
Number of diseases	< 2 illnesses	5	100
	≥ 3 illnesses	0	0
Medication	Until 1	3	60,0
	2	1	20,0
	≥ 3	1	20,0
Physical activity	No	5	100
	Yes	0	0
Perception of Health	Bad	0	0
	Good	5	100

Source: The author (2021).

As for evaluating the 6-minute walk test, satisfactory results were found in the pre- and post-test relationship, where all participants obtained more than 50 meters of gain in relation to the pre-test. The results can be seen in table 3.

Table 3. Distribution of the results of the pre and post evaluation of the 6-minute walk test in meters and percentage of gain

Variable		Pre-intervention	After 6th week	After 12th week	%
TC6M	Participant 1	471,4	494,30	521,4	110
	Participant 2	573,1	600,9	624,2	108
	Participant 3	460,0	510,2	594,0	129
	Participant 4	525,0	577,0	625,0	119
	Participant 5	503,7	555,4	621,6	121

Source: The author (2021).

Discussion

The research presented here, a pilot study, evaluated the effect of fitness training for the elderly through Wiireahabilitation on the 6-minute walk test that assesses the functional capacity related to the response to exercise in the submaximal effort. The results of the five elderly participants in the research showed an increase in the distance covered during the test, showing that it was possible to achieve positive results in the evaluated outcome in these participants. All the elderly evaluated had an increase of more than fifty meters.

The resource used in the implementation of training for physical confinement was the Nintendo® Wii, a device considered to be a non-immersive virtual reality that stands out as a playful resource in the implementation of various therapies;[6,14] being the focus of study by researchers in the field of activity physical, which assess the effects of using this resource on the components of body interaction, motivational aspects, and comparative studies of this practice with conventional practices not associated with virtual reality.[15]

In this sense, although the protocol of this study was directed towards physical conditioning, the improvement achieved by the five participants in this pilot study can be attributed to gains in several skills, such as optimization of muscle strength, mobility, and body balance. In this sense, the study by Contreras et al.[16] stands out, which evaluated muscle strength and the risk of falling in sedentary elderly people through the use of the Nintendo® Wii and found that the practice performed through this resource causes improvements in the individual concerning physiological changes arising from the aging process, which can be perceived in different ways, in the short and long term.

The authors found that the participants showed improvement in muscle strength, balance, postural control, and a decrease in the risk of falling. The resource also served as a stimulus for regular physical activity because it is also entertainment, providing better well-being and a consequent positive impact on quality of life.

Another aspect that should be taken into account is the games used in the research protocol, which involved running and fighting simulation, activities that provide important energy expenditure, since they promote the movement of the upper limbs and also the use of the lower limbs, in higher speeds, in which large muscle groups are required.[17]

In this sense, the study by Guérios[18], who, in his doctoral thesis, aimed to make a comparative analysis of oxygen consumption (VO2) and heart rate response between a treadmill run and a static run using the game, stands out Wii Fit. After analyzing the data, there was a significant difference between the VO2 levels in the two activities, with higher values for the treadmill. HR, however, showed no statistical difference. However, the author concludes that both activities can be considered vigorous.[18]

Not many studies were found with the direction addressed here in the elderly population. However, the exercises and the protocol established for aerobic training were performed according to aerobic training principles. Thus, the expected gains for conventional training in a real environment, already largely elucidated by the literature, could be attributed to the virtual training, with the advantage of the motivational aspect possibility by the constant feedback provided by the Nintendo® Wii.

In this perspective, it is highlighted that aerobic training promotes several adjustments in the muscular and cardiovascular system, such as an increase in the number and size of mitochondria. The increase in the capillary network plays an important role in improving aerobic capacity, facilitating the transport and muscular extraction of oxygen, thus contributing to greater consumption of maximum oxygen and physical performance.[19]

As already mentioned, another factor that could justify the gain in the distance covered in the Walk Test of the participants in this research is that the conditioning program implemented was also able to improve muscle strength and contractility, especially in the lower limbs, which in the elderly it is important, given the physiological process of muscle mass loss, especially in those with respiratory changes.[20]

In addition, the increase in strength now reported could also interfere with the gait speed of these individuals, which is another variable that has an important influence on the distance covered. Therefore, the increase in speed results in an increase in the distance obtained, representing a strong correlation between cardiovascular and peripheral muscle conditioning exhibited by individuals.[21]

The incorporation of video games as auxiliary tools in the practice of physical activity and rehabilitation enabled a new perspective of intervention in these areas, as it is a playful, motivational therapeutic tool, which increases adherence to therapy, with the Nintendo® Wii being one of the resources most used.

However, it is noteworthy that studies of greater scientific rigor are necessary so that the evidence about the effect of this therapy on the outcome assessed here is established in the literature. This study has limitations, mainly because it is a pilot study, with a reduced number of participants and the absence of a control group, increasing the risk of bias. Therefore, despite important results that may suggest positive effects of using Wiireahabilitation on the improvement in performance in the walk test, given the functional increase, it is necessary that further studies, such as randomized clinical trials, be carried out.

Conclusion

For the patients evaluated here, Wiireahabilitation proved to be an effective resource for increasing the functional performance of the 6-minute walk test after training with conditioning therapy, being able to influence the result in the 6-minute walk test positively.

Author contributions

Soutinho FS, Soares FCS, Silva VA, Florêncio ABS, Lima NFS participated in the conception and analysis of the data and writing of the article. Silva VA participated in the writing of the scientific article.

Competing interests

No financial, legal, or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation manuscript, statistical analysis, etc.).

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