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NOVEL MAT EXERGAMING TO IMPROVE PHYSICAL PERFORMANCES, COGNITIVE FUNCTION, DUAL-TASK WALKING, AND FALL RISK IN COMMUNITY-DWELLING OLDER ADULTS

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INTRODUCTION: Physical exercise and cognitive training have been previously demonstrated to improve physical functioning and reduce falls for older adults. The purposes of this study were to utilize an interactive exergame mat system to develop a novel cognitive-physical training program, and to explore the training effects on physical performance, cognitive function, dual-task walking (DTW), and fall risk compared to control.

METHODS: This was a quasi-experimental, non-randomized controlled intervention study in community-dwelling older adults. The exercise group (n=56, age: 70.7±4.6 years) received ladder-, 3-by-3 grid-, and circle-type of mat exergame with simultaneous cognitive-physical training (EMAT) while the control group (n=54, age: 72.0±5.7 years) underwent a multicomponent exercise intervention focused on physical and cognitive training. Two-hour training session per week over 3 months was applied. Functional fitness, MoCA, DTW with counting and carrying a tray with water, and fall risk questionnaire (FRQ) were assessed before and after interventions.

RESULTS: EMAT enhanced functional fitness, increased MoCA score, improved DTW, and decreased FRQ score (all P<0.05). EMAT showed a significant advantage compared to control in lower-extremity strength and flexibility, dynamic balance and agility, and FRQ score (all P<0.05).

CONCLUSION: The current study provides the evidence of a novel mat exergaming program on physical and cognitive performances. EMAT could also effectively reduce fall risks and increase the dual-task ability, walking while concurrently performing cognitive and/or motor interference tasks, which is important in fall prevention for older adults.

CLUSTER ANALYSIS OF MOTOR AND COGNITIVE SKILLS OF INSTITUTIONALIZED INDIVIDUALS WITH DEMENTIA: 4 PHENOTYPES FOR DEVELOPING INDIVIDUALIZED PHYSICAL ACTIVITY PROGRAMS

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INTRODUCTION: The number of individuals with dementia (IWD) increases to approximately 152 million in 2050 (Patterson et al., 2018). The decline of cognitive and motor skills in IWD eventually leads to permanent care. Almost three-quarters of residents in care facilities have dementia. Considering all medical and care aspects, the burden of health system is enormous. Thus, all treatments that can delay disease progression are valuable to consider. Physical activity (PA) is promising, but clear evidence is still not given (Blankevoort et al., 2010). One explanation is the multifaceted variation possibilities of PA. To the best of our knowledge, there are no individualized PA programs based on different preconditions of IWD, following the example of individualized medicine. This study identifies different phenotypes of IWD based on their motor and cognitive skills to develop individualized PA programs.

METHODS: Data was collected within a multicentre randomized controlled trial (Trautwein et al., 2017). We included IWD (>65 years) with primary dementia of mild and moderate state, living in care facilities. Cognitive skills were examined by Mini Mental State Examination (MMSE, global cognition); motor skills by Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT, balance), 6m Walk Test (WT, gait speed), modified 30-Second Chair-Stand Test (CST, lower limb function), and Timed Up&Go Test (TUG, mobility). Suitability of variables was tested by distributions, correlations and outlier identification. After z-transformation of all variables, we performed a hierarchical cluster analysis with Ward's method and tested the group differences by one-factorial ANOVA with Scheffe-Post-Hoc-Test.

RESULTS: Baseline data of 238 IWD (age 86±6 years, MMSE 17±4) were used. Based on MMSE, FICSIT, WT, and CST (TUG was excluded due to high correlations) four phenotypes were identified. Variables of cluster 1 (n=87; MMSE 13±2; FICSIT 2±1; WT 10±3sec; CST 7±3), cluster 2 (n=11; MMSE 15±6; FICSIT 0.5±0.5; WT 22±4sec; CST 4±2), cluster 3 (n=86; MMSE 20±3; FICSIT 3±1; WT 9±3sec; CST 10±3), and cluster 4 (n=54; MMSE 19±3; FICSIT 1±1; WT 12±2sec; CST 5±2) differ statistically significant.

CONCLUSION: Following the example of individualized medicine, the four identified phenotypes illustrate the necessity of individualized PA programs with different priorities. These findings need to be evaluated: First, by cluster analysis within different samples of IWD, possibly with different cognitive and motor variables, and second by evaluation of the effectiveness of individualized PA programs based on phenotypes. Nevertheless, this new concept can contribute to increase evidence of PA in IWD and thus, might offer new possibilities for the implementation of PA in care facilities.

THE EFFECTS OF A MULTIMODAL EXERCISE PROGRAM PLUS BRAIN GAMES APPS IN COGNITIVE PARAMETERS OF NURSING HOME RESIDENTS

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INTRODUCTION: The aging process leads to inevitable life changes and is characterized by a progressive loss of psychological and physiological functions (1). Often, these changes lead to institutionalization, where cognition and physical fitness tends to decline (2). Some studies have shown that multimodal exercise programs can have a broad impact in older adults, improving a number of cognitive and physical functions, including executive functioning, speed of behavior and balance (3). Also, in recent years there has been a growing interest in the use of digital technological devices for promoting specific competencies in the elderly. Moreover, to the best of our knowledge, few studies on the effects of multimodal exercise interventions have focused on nursing home residents. Therefore, the main objective of this pilot study is to examine the effects of an intervention designed for nursing home residents that include both a multimodal exercise component and a videogame component (brain games apps).

METHODS: Twelve older women and men were selected by convenience among a nursing home residence. During the first 4 weeks (control period), the participants continued with their normal daily life activities. After the control period, the group engaged in an intervention program for 6 weeks. The intervention program consisted of a multimodal exercise program (2 times per week) plus selected brain games played on a tablet computer (2 times per week). The 4 exercise sessions per week were alternated between multimodal exercise program and brain games performed on the tablet computer.

Assessment of cognition was collected: prior to the control period (T0), after the control period (T1), and at the end of the intervention (T2). The 8 ft up-and-go test of the senior fitness test (4) was performed with and without a cognitive dual task (counting backward from 30). This type of assessment has been shown to be reliable and valid to establish the fall risk of healthy elderly people (5). A clinical psychologist administered the Mini-Mental State Examination (MMS) as well as the Montreal Cognitive Assessment (MOCA) questionnaire to analyze the effects of the program on immediate and short-term memory.

RESULTS: The intervention did not affect the ability to perform the 8 ft up-and-go test under single- and dual-task conditions ($p=0.250$ and $p=0.375$ respectively). Regarding immediate and short-term memory ability (measured by questions from the MMS and MOCA questionnaires), we found an improvement in one of the items related to short-term memory on MOCA. In this case, an increase in memory capacity was observed between T0 and T2 ($p=0.033$).

CONCLUSION: In this pilot study, we found a few positive changes in related cognitive variables as the result of the planned intervention. Nevertheless, the gains observed in short-term memory are encouraging. It is important that future studies test the effectiveness of engaging older adults in similar interventions using a large sample and a longer duration.

EFFECTS OF GROUP-BASED EXERCISE PROGRAM ON COGNITIVE FUNCTION, BIOMARKER AND SENIOR FUNCTIONAL FITNESS IN OLDER ADULTS AT DIFFERENT LEVELS OF COGNITIVE IMPAIRMENT

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INTRODUCTION: Insulin growth factor-1(IGF-1) has been shown to have potent effects on cellular neuroplasticity of central nervous system development and maturation. The Senior Functional Fitness Test (SFFT), which evaluates the functional fitness performance, the physiological capacity to perform normal everyday activities safely and independently of older adults. The purpose of this study is to explore the effects of functional physical fitness and cognitive performance (biomarker : IGF-1) after a group exercise program intervention with different level of cognitive impairment in Community-dwelling Older Adults.

METHODS: 43 participant 60 to 80 years old were divided into mild cognitive impairment (MCI, $n=21$) group and serious cognitive impairment (SCI, $n=22$) group using the Saint Louis University Mental Status (SLUMS) questionnaire. All the subjects performed a group-based exercise program. Group-based exercise program performed twice-weekly multicomponent exercise training for 1.5hours led by a certified fitness instructor for 12 weeks. The primary outcomes were SLUMS score, serum levels of IGF-1 and the performance of SFFT before and after all training. SFFT was used to measure upper muscle strength (30-second arm curl and grip), lower muscle strength (30-second chair-to-stand), aerobic endurance (two-minute step), agility and dynamic balance (eight-foot up-and-go). A paired samples t-test was used to compare the functional fitness, biochemical indicator, and cognitive performance.

RESULTS: After the 12-week exercise intervention, the cognitive ability for MCI(+8.8%) and SCI(+19.9%) had both increased significantly($p < .05$), and the change of SCI had increased significantly than MCI ($p < .05$). There was no significant change in serum levels of IGF-1 between groups at both pre- and post-study. In lower limb strength, MCI(+14.8%) and SCI(+12.8%) had increased significantly($p < .05$). In upper strength (grip), MCI(+15.7%) and SCI(+16.3%) had increased significantly($p < .05$). MCI(-15.3%) and SCI(-9.2%) had improved significantly in agility and dynamic balance ($p < .05$). Although both MCI and SCI increased lower/upper strength and dynamic balance, there was still no significant different change between the two groups. In aerobic endurance, MCI(+14.6%) and SCI (+40.1%) had significantly improved($p < .05$), and SCI had a growing trend towards higher ($p = .07$).

CONCLUSION: This study suggests the impact of a structured twice-weekly group-based multicomponent exercise program may benefit the functional fitness and the cognitive except biomarker IGF-1in older adults with middle or serious cognitive impairment. Probably, there was not high enough intensity to stimulate the thresholding, due to no significant change in the biomarker. According to this study, a group-based exercise program can slow down the fading of the cognitive performance, improving Senior Functional Fitness in the elderly with moderate to serious cognitive impairment in the community.

FEASIBILITY STUDY OF PROLONGED STATIC AND DYNAMIC STANDING AS COMPARED TO SITTING IN OLDER ADULTS WITH TYPE 2 DIABETES MELLITUS

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INTRODUCTION: Physical inactivity is prevalent in older adults and poses a risk factor for the development of type 2 diabetes mellitus (T2DM). The aim of this pilot study was to examine the feasibility and possible clinical effects of two forms of non-exercise physical activity intervention using a standing desk in older adults with T2DM.

METHODS: Twelve older adult patients with T2DM were tested in the semi-randomized crossover design, in which baseline 180-minute sitting was compared to either 240-min static or dynamic standing to increase overall movement. Oxygen uptake, cognitive performance, as well as sessions and breaks duration, overall movement activity, and musculoskeletal discomfort was monitored during all three sessions.

RESULTS: All participants were able to complete all sessions, representing feasibility of prolonged-term standing paradigm in older patients with T2DM. Oxygen uptake and overall movements were progressively increased from sitting, static and dynamic standing, respectively ($p < .001$). The duration of breaks during dynamic standing was shorter as compare to static standing ($p=0.024$) as well as total musculoskeletal discomfort and legs swelling was higher in static standing as compared to sitting or dynamic standing ($p=0.043$). Finally, no negative impact on cognition was observed in both standing conditions.

CONCLUSION: Standing as a non-exercise physical intervention is feasible in older adults with T2DM and may have clinical benefits. Standing with cued movements seem especially beneficial and might represent a novel non-behavior-invasive intervention concept, that targets sedentariness and can be easily and safely integrated into daily routines.