https://doi.org/10.5817/StS2025-1-5

The Effect of Parkour Concept on Functional Mobility in Older Adults

Lenka Svobodova[1], Antonin Tomas[2], Martin Sebera[3]

[1]Department of Physical Activities and Health Sciences, Faculty of Sports Studies, Masaryk University, Brno, Czech Republic

[2]In Motion Academy, Brno, Czech Republic

[3]Department of Physical Activities and Health Sciences, Faculty of Sports Studies, Masaryk University, Brno, Czech Republice

ABSTRACT

Introduction: One of the limiting factors in the quality of life of seniors is the increased risk of falls. According to the National Institute of Public Health (NIPH), falls occur naturally most often in daily activities. Many types of physical activity have already been tested in relation to fall prevention. We come up with a new type of exercise, modified parkour for older adults. Objective: The purpose of the study was to determine the effect of the Parkour concept on functional mobility in older adults. Patients and Methods: Twenty older adults without cognitive or neurological deficits (> 26 points in the MoCa test) completed a 10-week exercise program. The program included the practice of overcoming obstacles of various shapes and sizes and the practice of fall techniques under the guidance of an instructor. The level of functional mobility was evaluated using the Timed Up and Go test (TUG 1), the Timed Up and Go test Cognitive, and the Timed Up and Go test manual (TUG 3) and functional reach test (Reach) before and after completing the exercise program. Results: Although participants in the parkour intervention program showed good results in the reach test before starting it, they were able to improve significantly. The effect of the parkour concept is not statistically significant for the functional mobility measured by the TUG tests. The difference is small by Cohen's effect size (d = 0.22 and d = 0.26). There was a slight improvement in the functional mobility test without another task (TUG1) and the modified test with another movement task (TUG3). There was no significant change in the modified cognitive test (TUG2). Conclusion: Modified parkour is a new activity that requires more scientific research. For this age group, we consider a positive improvement in any part of physical fitness.

Keywords: older adults, parkour, mobility, age, obstacles

INTRODUCTION

The most significant demographic trend in the coming decades will be the increasing proportion of individuals aged 65 and older. Although the annual growth rate is projected to decline from the current 3% per annum, no cessation or reversal of this trend is anticipated before the late 2050s. The 65+ population is expected to peak around 2059 at approximately 3.205 million, representing an increase of 1.164 million (57%) compared to the early 21st century (CSU, 2018).

The rising proportion of older adults in the population has profound social and economic implications, necessitating proactive strategies to address the challenges associated with ageing. Among these challenges, the heightened risk of falls represents a significant public health concern. Falls are the leading cause of injury among older adults, with the incidence continuing to rise. The economic burden of treating fall-related injuries is substantial, with femoral fractures and intracranial injuries being among the most severe consequences. In response, the American Geriatrics Society advocates for a multifaceted intervention approach for individuals aged 65 and older. This includes the management of medical conditions that contribute to fall risk, correction of podiatric and visual impairments, medication optimization, provision of assistive devices, home environment modifications, and education for both seniors and their caregivers (Berková & Berka, 2018).

A key factor contributing to falls in older adults is the decline in physical function, particularly in strength, balance, and flexibility. Fear of falling often exacerbates this issue, leading to a reduction in physical activity and an overall decline in functional capacity (Kaplan, 2021). The magnitude of this problem is substantial; in 2019, over 34,000 individuals aged 65 and older died from fall-related injuries in the United States alone (PK Move, 2022). A similar trend is observed in the Czech Republic, where falls account for more than 1,000 deaths annually among older adults (Berková & Berka, 2018). Beyond the medical implications, falls among the elderly also impose significant social and economic burdens.

Given that falls frequently occur during routine daily activities, addressing functional mobility is critical in fall prevention. Functional mobility refers to an individual's ability to navigate their environment effectively, encompassing activities such as walking, bed mobility, and chair transfers (Sears, 2020). Evidence suggests that targeted interventions, including strength training, flexibility exercises, and balance training, can enhance functional mobility and reduce fall risk. Comprehensive exercise programs designed to improve functional mobility have shown promise in mitigating fall-related risks. One such intervention that warrants further investigation is parkour, which may offer a novel approach to enhancing movement competence and resilience in older adults.

Parkour is a movement discipline that emphasizes the efficient and creative navigation of environmental obstacles using body control and spatial awareness. Its methodologies require practitioners to develop a deep understanding of the scenarios that commonly lead to falls and to cultivate strategies that either prevent these occurrences or transform them into controlled movements. As Blake Evitt, director of Parkour Generations Boston, who trained with the sport's founders in France, explains, *"The common thought was that parkour should be accessible to everyone."* This philosophy has contributed to the adaptation of parkour-based training programs for older adults, focusing on improving functional mobility and fall prevention (PK Move, 2022).

One such initiative, PK Move, is a parkour-based fitness and fall prevention program designed for individuals aged 50 and older. The fundamental principle behind PK Move is that falls typically do not occur as a result of extreme or reckless movements but rather during routine daily activities. Consequently, it is crucial to incorporate training that not only prevents falls but also equips older adults with strategies to mitigate their impact (PK Move, 2022). Parkour for seniors is structured around fundamental movement challenges: for example, how an individual can move safely in reverse, step over an obstacle while carrying an object, or transition between postures with stability. By breaking parkour training into progressive steps, older adults can engage in movement exercises that are both effective and enjoyable, much like younger practitioners experience the thrill of more advanced techniques such as rooftop jumps (Gilchrist & Wheaton, 2017).

The adaptation of parkour for older populations has also been explored in physiotherapy and rehabilitation contexts. Ben Musholt, a physical therapist and advocate for parkour as a tool for healthy aging, has contributed to the field by co-authoring *Parkour Strength Training* (2016) and developing the *Five Parkour Concepts for Healthy Aging*. His framework emphasizes five key components: scalability of movement, understanding and mitigating fall risks, environmental awareness, balance optimization, and the cultivation of power through controlled exertion (Musholt, 2017). These principles align with contemporary geriatric exercise science, which underscores the necessity of balance training, proprioceptive awareness, and functional strength exercises in fall prevention strategies.

The integration of parkour-based exercises into fall prevention programs offers a novel approach to enhancing functional mobility in older adults. By drawing inspiration from natural movement patterns and daily life scenarios, parkour training provides a practical and engaging method for improving coordination, stability, and confidence in movement. As the field of geriatric exercise continues to evolve, further research is warranted to assess the long-term impact of parkour-based interventions on fall risk reduction and overall physical health in aging populations.

Objective: The purpose of the study was to determine the effect of the Parkour concept on functional mobility in older adults. The level of functional mobility is an important parameter in the prevention of falls during daily activities.

METHODS

Study design and participants

Twenty healthy older adults (8 males and 12 females; age 67.5 years, SD 3.7 years, Body mass index 24.4, SD 3.5) were recruited into the older adults. The characteristics can be found in Table 1.

Individuals were eligible for inclusion in the study if they were 60 years of age or older, had no cognitive or neurological impairments (scoring >26 points on the Montreal Cognitive Assessment [MoCA]), and were free from any medical conditions or injuries that could affect gait or balance. Additionally, participants were required to be physically capable of engaging in exercise.

Following the baseline assessment, eligible participants enrolled in the intervention program, which was conducted from October to December 2021. The study adhered to the ethical principles outlined in the Declaration of Helsinki and received approval from the Masaryk University Ethics Committee (EKV-2021-002).

Table 1. Baseline characteristics of the participants

	Females (n=12)	Mean SD	Males (n=8)	Mean SD	All (n=20)	Mean SD
Mean age (years)	67.1	3.9	68.1	3.0	67.5	3.7
Mean weight (kg)	70.8	12.6	85.2	20.9	76.6	18.3
Mean height (cm)	161.7	4.7	176.1	8.9	167.4	9.8
Mean BMI (kg/m2)	25.9	2.9	22.2	2.8	24.4	3.5
WHR (Waist-to-Hip Ratio)	0.93	0.05	0.96	0.06	0.94	0.06

Interventions

The 10-week exercise program included the practice of overcoming obstacles of various shapes and sizes and the practice of falling techniques under the guidance of an instructor. Participants attended the training program twice a week for three months (20 sessions), and each session lasted 60 minutes. The session consisted of a warm-up (20–25 minutes), the main part (20–25 minutes), and a cool-down (10–15 minutes). The warm-up was divided into a general warm-up with various aerobic non-impact exercises and a specific warm-up. In the specific warm-up, we primarily focused on joint mobility tailored to each session and on general mobility exercises.

In the main part, participants engaged in a variety of exercises. Starting with coordination exercises on the ground and under obstacles, they explored different ways to overcome various obstacles. Other key topics included non-impact precision training, falling and failing techniques, hanging exercises, stability and balance exercises, and ledge climbing techniques. Each exercise had several modifications to accommodate individuals with varying levels of physical capability, respecting their range of motion, mental state, and other individual conditions.

In the final part, we focused on compensation exercises suited to each session, including but not limited to stretching, stabilizing, and strength exercises. At the beginning and end of some sessions, we also discussed risk and fear management as well as task-oriented training, which were then applied during the exercises.

In general, the program focused on building a set of physical and mental skills applicable to real-world environments, with an emphasis on preventing falls and injuries.

Measures

All participants reported their age, and their body height and weight were measured using a portable stadiometer and scale. To assess health risks more accurately, we also examined the waist-to-hip ratio to determine the distribution of fat in the waist, hips, and buttocks.

Screening for functional mobility was conducted using two tests. First, we used the Timed Up and Go test (TUG 1), the Timed Up and Go Cognitive test, and the Timed Up and Go Manual test (TUG 3) before and after completing the exercise program. The time required to perform the Timed Up and Go test was measured. Participants sat on a chair, walked as quickly as possible around a cone, returned to the chair, and sat down. Two trials were conducted, with a short interval of 30 seconds between them. Both times were recorded to the nearest tenth of a second, and the fastest time was used for analysis (Ryan, 2013).

The Functional Reach Test was used as the second assessment of functional mobility. The participant was instructed to stand next to, but not touching, a wall, positioning the arm closest to the wall at 90 degrees of shoulder flexion with a closed fist. According to the methodology, the test is performed with the left side facing the wall. The assessor recorded the starting position at the third metacarpal head using a yardstick. The participant was instructed to *"reach as far as you can forward without taking a step."* The final position of the third metacarpal was recorded. Scores were determined by measuring the difference between the starting and ending positions, representing the reach distance, typically recorded in centimeters. Three trials were performed, and the average of the last two was used for analysis (Ryan, 2013).

Data Analysis

We use Shapiro-Wilk normality test. The size of the difference between the input and output measurements was assessed by a paired-sample t-test. The statistical significance level was $\alpha=0.05$. We used Cohen´s d to calculate the effect size. Statistical significance determines whether the result is unlikely to have occurred by chance. Substantive significance (Cohen's d) determines whether the result has practical impact in the real world. We combine these two levels to know whether the difference is statistically significant, but also whether it makes sense in practice.

RESULTS

Table 2 summarizes the basic statistical characteristics of the tested variables, including the number of valid cases (N), mean, median, minimum, maximum, and standard deviation (SD), providing an overview of data distribution and variability. The number 1 for the test is the measurement before the intervention program, the number 2 is the measurement after the intervention program.

Table 2. Basic statistical characteristics

Test	Valid N	Mean	Median	Minimum	Maximum	SD
Reach-1	20	44.30	45.50	29.00	56.00	7.62
Reach-2	20	49.00	49.50	37.00	61.00	5.98
TUG1-1	20	4.78	4.88 3.37		7.09	0.94
TUG1-2	20	4.60	4.59 3.45		6.10	0.70
TUG2-1	20	5.65	5.27 3.56		9.46	1.49
TUG2-2	20	5.54	5.32 3.25		7.93	1.33
TUG3-1	20	5.24	5.18 3.44		6.97	0.87
TUG3-2	20	5.02	4.90 3.68		6.81	0.82

Table 3 presents the results of the Reach Test, analyzed using a paired-sample t-test, including the mean, standard deviation (SD), sample size (N), mean difference (Diff.), t-value (t), degrees of freedom (df), and significance level (p), assessing changes between dependent samples.

Table 3. Reach test - T test for dependent samples

Variable	Mean	SD	N	Diff.	t	df	p
Reach test-1	44.300	7.623					
Reach test-2	49.000	5.982	20	-4.700	-3.138	19	0.005

Notes: SD – standard deviation, indicates statistical significance, t – value of Student's distribution, df – degree of freedom, p – probability - probability at which we reject the null hypothesis, marked differences are significant at $p < .05000$

Table 3 shows the differences between the first and second measurements, that is, before and after the intervention program. We can see a statistically significant improvement. The participants have improved in functional reach. The result is shown graphically for better clarity.

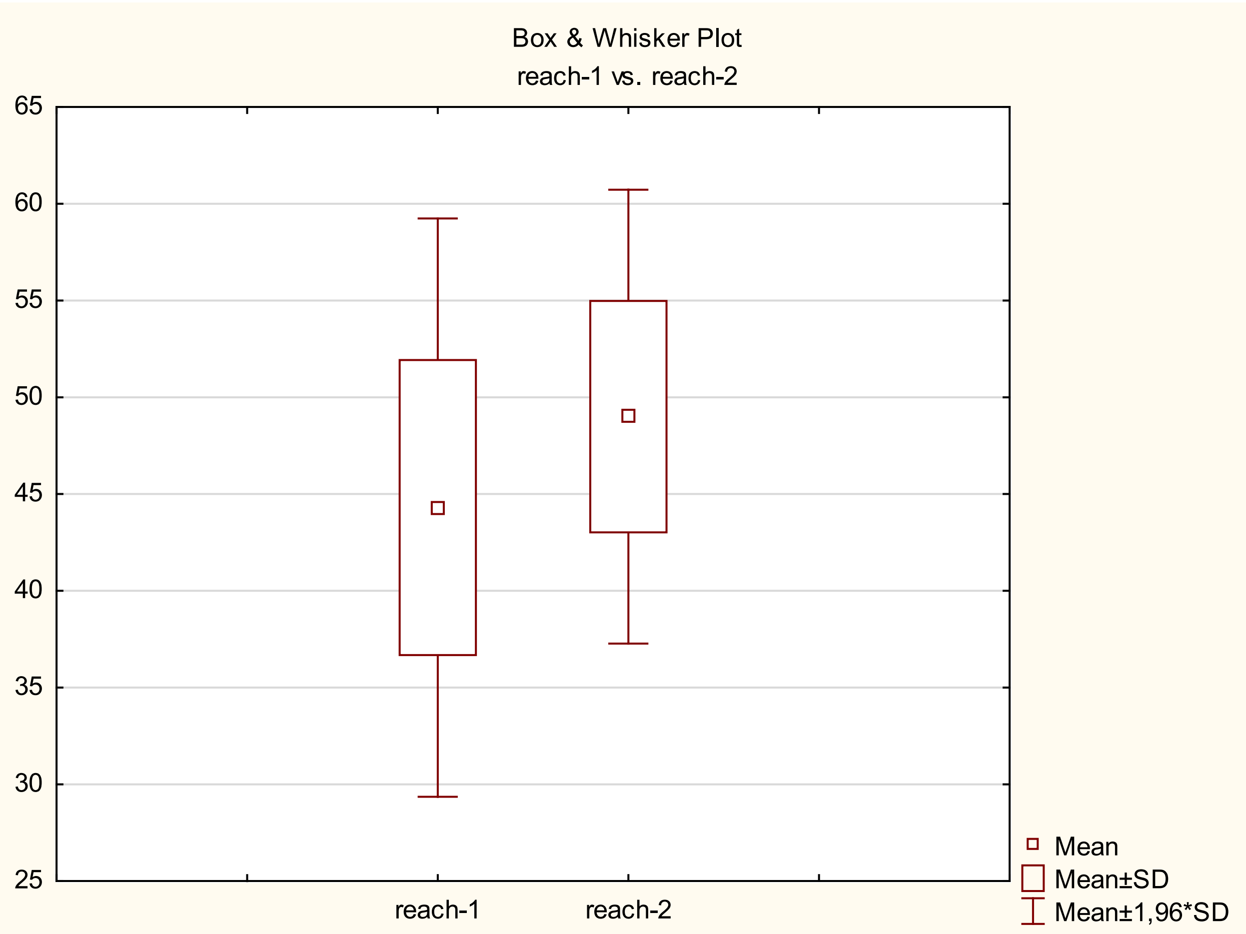

Figure 1. Reach test

The group of participants who attended the intervention program focused on parkour performed better in functional reach. It was measured by the functional reach test. Significant differences are visible in Figure 1.

Table 4 presents the results of the TUG 1 test, analyzed using a paired-sample t-test, including the mean, standard deviation (SD), sample size (N), mean difference (Diff.), t-value (t), degrees of freedom (df), and significance level (p), assessing changes between dependent samples.

Table 4. TUG 1 - T test for dependent samples

Variable	Mean	SD	N	Diff.	t	df	p
TUG1-1	4.779	0.938					
TUG1-2	4.597	0.695	20	0.181	1.269	19	0.219

Notes: SD – standard deviation, indicates statistical significance, t – value of Student's distribution, df – degree of freedom, p – probability - probability at which we reject the null hypothesis, marked differences are significant at p < .05000

Table 4 presents the mean values for TUG 1 test. The mean values in the second measurement indicate an improvement, but they are not statistically significant.. For a better view is add figure 2.

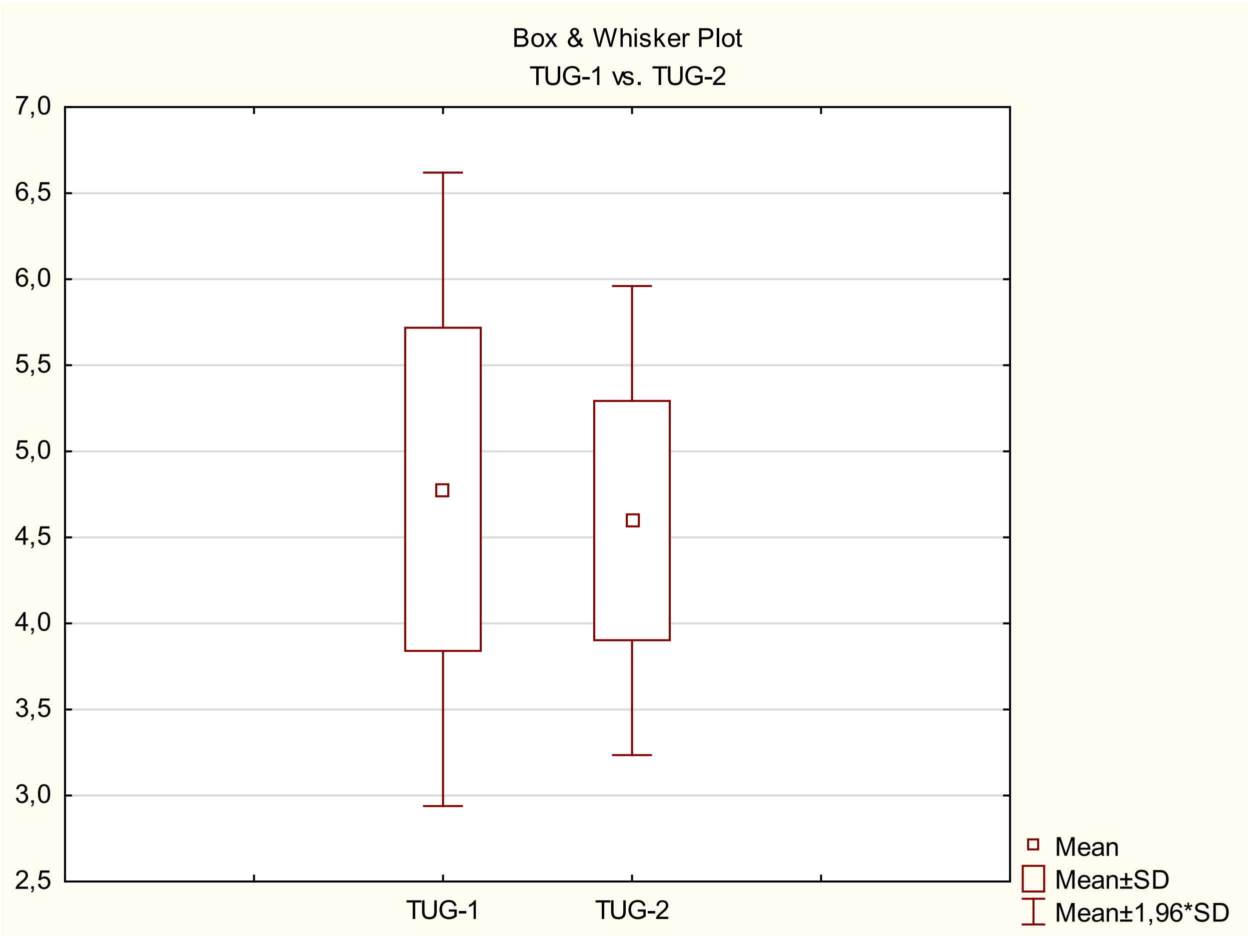

Figure 2. Timed Up and Go test (TUG1)

Table 5 presents the results of the TUG 2 test, analyzed using a paired-sample t-test, including the mean, standard deviation (SD), sample size (N), mean difference (Diff.), t-value (t), degrees of freedom (df), and significance level (p), assessing changes between dependent samples.

Table 5. TUG 2 – T test for dependent samples

Variable	Mean	SD	N	Diff.	t	df	p
TUG2-1	5.649	1.490					
TUG2-2	5.537	1.326	20	0.113	0.503	19	0.621

Notes: SD – standard deviation, indicates statistical significance, t – value of Student's distribution, df – degree of freedom, p – probability – probability at which we reject the null hypothesis, marked differences are significant at $p < .05000$

Table 5 presents evidence of the timed up and go test with the cognitive task. There is no statistically significant change after attending the intervention program. For a better view is add figure 3.

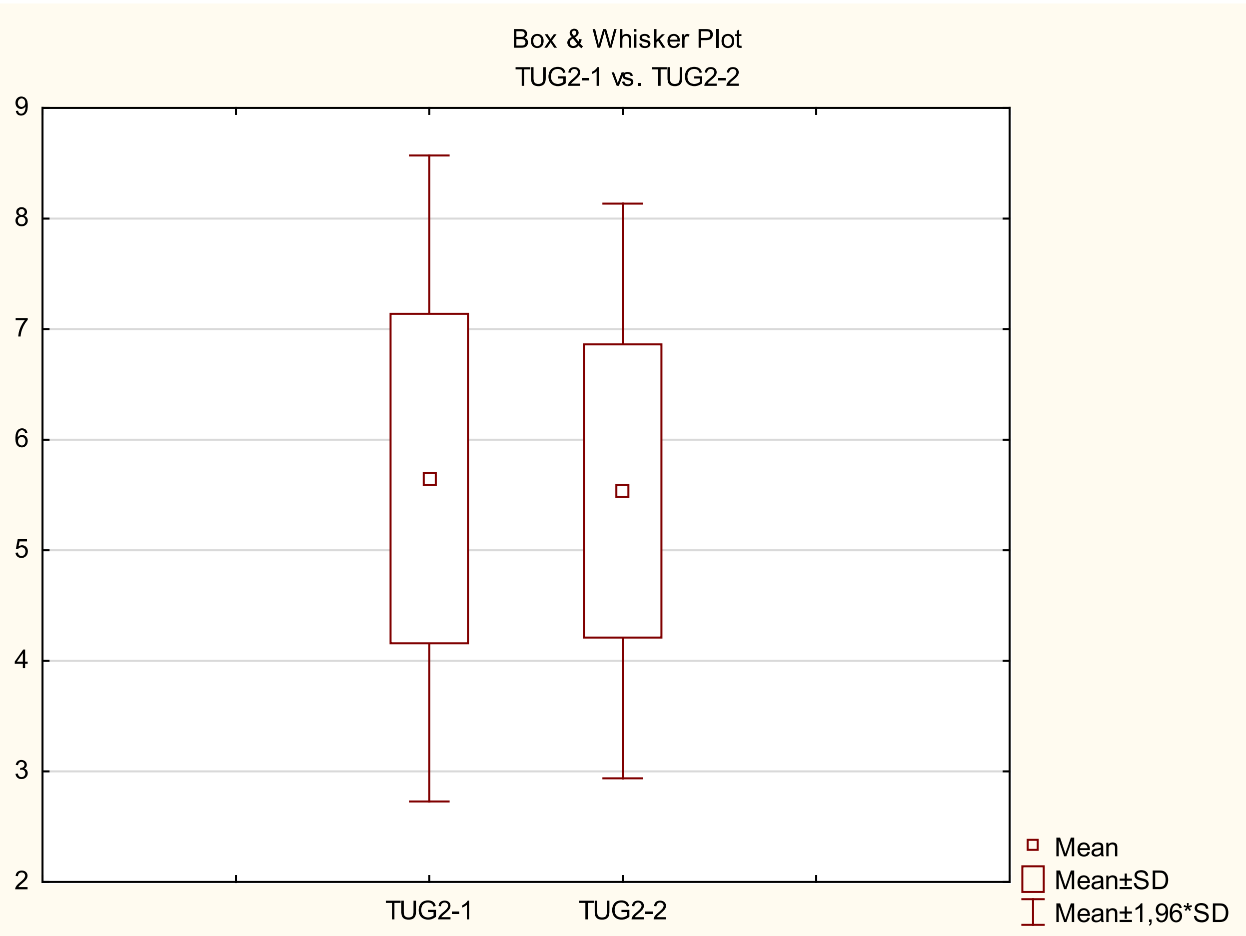

Figure 3. Timed Up and Go test - Cognitive (TUG2)

Figure 3 shows a slight improvement in the second measurement, but as shown in Table 5 the improvement is not statistically significant.

Table 6 presents the results of the TUG 3 test, analyzed using a paired-sample t-test, including the mean, standard deviation (SD), sample size (N), mean difference (Diff.), t-value (t), degrees of freedom (df), and significance level (p), assessing changes between dependent samples.

Table 6. TUG3 – T test for dependent samples

Variable	Mean	SD	N	Diff.	t	df	p
TUG3-1	5.242	0.875					
TUG3-2	5.020	0.817	20	0.222	1.556	19	0.136

Notes: SD – standard deviation, indicates statistical significance, t – value of Student's distribution, df – degree of freedom, p – probability – probability at which we reject the null hypothesis, marked differences are significant at $p < .05000$

Table 6 presents the values reached by participants in the timed up-and-go test with manual task before and after the intervention program. There is no statistically significant change. The data presented in Table 6 is visually represented in Figure 4, illustrating the differences observed in the TUG 3 test through a graphical depiction of the results.

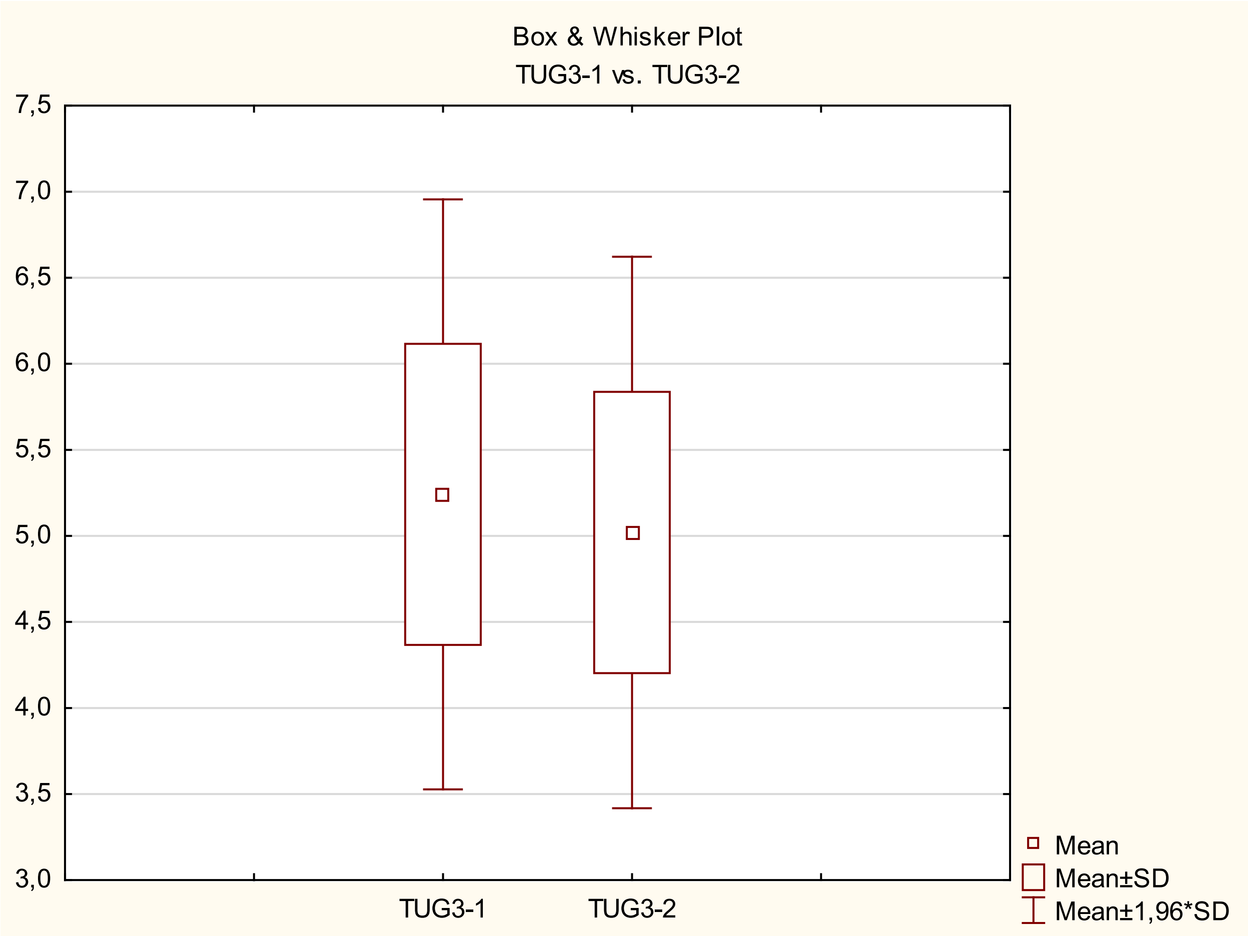

Figure 4. Timed Up and go test – manual (TUG3)

In Figure 4 we can see an improvement between the first and second measurements. The improvement was not statistically significant, but according to but according to Cohen's d (Table 7).

Table 7 presents evidence of effect sizes for the reach test, TUG 1, TUG 2, and TUG 3, calculated using Cohen's coefficient, providing insight into the magnitude of observed differences.

Table 7. Effect size by Cohen´s d

Test	Effect size
Reach test	-0.69
TUG1	0.22
TUG2 – Cognitive	0.08
TUG3 – Manual	0.26

Table 7 presents evidence based on Cohen´s coefficient of effect size. According to the reference values for Cohen´s (d 0.80 → big effect, d (0.50–0.80) middle effect, d (0.20–0.50) small effect). Cohen's coefficient of effect size shows improvement in the reach test; the effect size is medium; TUG1 and the TUG3, and effect size is small.

DISCUSSION

A study examining the impact of the Parkour concept on functional mobility in older adults found statistically significant improvements in functional reach but no significant changes in timed up-and-go tests, including cognitive and manual tasks.

It should be noted that the participants were motivated seniors who already demonstrated good or average performance relative to their age during the initial assessment. As shown in Table 2, their performance in the reach test was already at a high level at the beginning of the study. The lowest recorded performance was 29 cm, while the highest was 56 cm. Duncan et al. (1992) reported that a reduced ability to reach is associated with an increased risk of future falls, with odds ratios of 8.2 for those unable to reach at all and 4 for those who could reach less than 15.2 cm.

Although our participants in the parkour intervention program initially performed well in the reach test, they still achieved significant improvements. Range of motion is a key component of overall functional mobility, which plays a crucial role in the daily activities of older adults. Based on our results, we can conclude that our parkour-based concept has a positive effect specifically on improving the range of motion.

In the baseline TUG test, participants' performance ranged from the 95th percentile to the 30th percentile. However, tests requiring the simultaneous execution of two tasks presented a subjective challenge for them. Numerous studies have confirmed that aging negatively affects multitasking ability (O'Brien, 2011; McCulloch et al., 2009). Researchers at the University of California suggest that the negative impact of multitasking on working memory is not necessarily a memory deficit per se, but rather the result of an interaction between attention and memory (Makovski & Pertzov, 2015; Han & Kim, 2009).

We explored whether parkour training could help improve multitasking ability. A fundamental aspect of parkour is developing the ability to assess one's surroundings and navigate obstacles as efficiently as possible. Even when overcoming obstacles, it is essential to remain aware of the surrounding environment. An example would be navigating an unstable obstacle (Colom et al., 2010; Uncapher et al., 2015; Gorman & Green, 2016).

Multitasking ability was assessed using the TUG Cognitive and TUG Manual tests. However, no test demonstrated a statistically significant improvement following the intervention program. Cohen's effect size coefficient indicated a small improvement in TUG1 and TUG3. Our results suggest that, in terms of multitasking, participants experienced greater difficulty combining manual and cognitive tasks than performing two manual tasks simultaneously.

CONCLUSION

Modified parkour is a novel activity that requires further scientific research. For this age group, any improvement in physical fitness can be considered a positive outcome.

After completing the parkour-based intervention, our participants showed significant improvement in the reach test and slight improvements in the TUG test and TUG Manual. These tests assess the level of functional mobility. We propose repeating the intervention program with an expanded sample size to further validate our findings.

LIMITATIONS

The study population was relatively small, as this was a pilot exercise program. Additionally, the study required significant financial resources due to the cost of renting a specialized gym for parkour training and providing professional guidance for the exercises.

DATA SHARING STATEMENT

All data can be accessed upon reasonable request from the corresponding author.

FUNDING

This research was carried out at Masaryk University as part of project number MUNI/A/1426/2020 with the support of the Specific University Research Grant provided by the Ministry of Education, Youth and Sports of the Czech Republic.

ACKNOWLEDGMENT

The authors sincerely thank the participants who participated in this project and contributed to the development of the new intervention program.

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Contact Information:

Lenka Svobodova, svobodova@fsps.muni.cz