Turkish Journal of Clinical Research

Turk J Clin Res. 2025;1(1):1-6
https://doi.org/10.63909/1453001

RESEARCH ARTICLE

Is physical activity intensity an important factor for balance skills in sedentary individuals? A pilot study

Fiziksel aktivite yoğunluğu sedanter bireylerde denge becerileri için önemli bir faktör mü? Bir pilot çalışma

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Abstract

Aim: While regular sports and exercise are known to improve balance and postural control, it remains unclear whether daily routine physical activity has similar effects, particularly in sedentary individuals. This study aimed to examine whether the intensity of daily physical activity affects functional balance abilities in sedentary adults.

Methods: This prospective, cross-sectional study included 34 healthy sedentary individuals aged 19–50 years who did not engage in regular exercise. The Physical Activity Scale-2 (PAS-2) was used to determine participants' average daily physical activity levels in MET-minutes/day. Height, weight, and body mass index (BMI) were recorded. Balance was evaluated using the Functional Reach Test (FRT), Romberg Test (on firm and foam surfaces), One Leg Standing Test (OLST) with eyes open and closed, and the Timed Up and Go Test (TUG).

Results: Among the participants, 28 (82.3%) were female and 6 (17.7%) were male, with a mean age of 22.00±6.75 years. The average physical activity level was 2238.48 MET-min/day. No significant correlation was found between physical activity level and any of the balance test results or anthropometric variables ($p>0.05$).

Conclusion: In sedentary individuals, the intensity of daily routine physical activity does not appear to significantly influence functional balance skills. These findings highlight that general daily activity alone may not be sufficient to improve balance, emphasizing the need for structured and regular exercise interventions.

Keywords: Physical activity, sedentary life, balance, daily activity.

Özet

Amaç: Düzenli spor ve egzersizin denge ve postüral kontrolü geliştirdiği bilinmektedir; ancak günlük rutin fiziksel aktivitenin benzer etkileri olup olmadığı, özellikle sedanter bireylerde, belirsizliğini korumaktadır. Bu çalışma, günlük fiziksel aktivite yoğunluğunun sedanter yetişkinlerde fonksiyonel denge becerilerini etkileyip etkilemediğini incelemeyi amaçlamıştır.

Yöntemler: Bu prospektif, kesitsel çalışmaya, 19–50 yaş aralığında, düzenli egzersiz yapmayan 34 sağlıklı sedanter birey dahil edilmiştir. Katılımcıların günlük ortalama fiziksel aktivite düzeyleri, Fiziksel Aktivite Ölçeği-2 (FAÖ-2) kullanılarak MET-dakika/gün cinsinden belirlenmiştir. Boy, kilo ve vücut kitle indeksi (VKİ) kaydedilmiştir. Denge; Fonksiyonel Uzanma Testi (FUT), Romberg Testi (sert ve foam yüzeyde), gözler açık ve kapalı Tek Ayak Üzerinde Durma Testi (TADT) ve Zamanlı Kalk-Yürü Testi (ZKYT) ile değerlendirilmiştir.

Bulgular: Katılımcıların 28'i (%82,3) kadın, 6'sı (%17,7) erkektir ve yaş ortalaması 22.00±6,75 yıldır. Ortalama fiziksel aktivite düzeyi 2238,48 MET-dakika/gün olarak bulunmuştur. Fiziksel aktivite düzeyi ile denge test sonuçları veya antropometrik değişkenler arasında anlamlı bir ilişki bulunmamıştır ($p>0,05$).

Sonuç: Sedanter bireylerde, günlük rutin fiziksel aktivite yoğunluğu, fonksiyonel denge becerilerini anlamlı şekilde etkilememektedir. Bu bulgular, yalnızca genel günlük aktivitenin dengeyi geliştirmek için yeterli olmayabileceğini ve yapılandırılmış, düzenli egzersiz müdahalelerinin gerekliliğini vurgulamaktadır.

Anahtar Kelimeler: Fiziksel aktivite, sedanter yaşam, denge, günlük aktivite.

INTRODUCTION

Functional balance is a multidimensional motor skill that enables individuals to perform daily living activities safely and effectively (1). It is maintained through the interaction of various physiological systems, including postural control, muscle strength, proprioceptive feedback, vestibular system integration, and motor coordination (2). Therefore, balance refers not only to the ability to maintain a static position but also to the capacity to quickly adapt to environmental conditions. Today, considering the impact of functional balance impairments on fall risk and quality of life, the importance of interventions aimed at improving balance

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Cite as: Soylemez E, Can M, Aydogan Z. Is physical activity intensity an important factor for balance skills in sedentary individuals? A pilot study. Turk J Clin Res. 2025;1(1):1-6

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Received: 09 April 2025 | **Accepted:** 14 May 2025 | **Published:** 30 May 2025

Turk J Clin Res. 2025;1(1):1-6
https://doi.org/10.63909/1453001

is increasingly recognized (1).

Balance skills can be assessed using advanced balance measurement devices as well as simple functional balance tests. These tests do not require any specialized equipment. One of the most practical among them is the One-Leg Stand Test (OLST) (3), which is used to evaluate an individual's balance skills and fall risk. Additionally, the eyes-closed version of the test also assesses vestibular input. However, it should be noted that OLST is a static balance test and does not evaluate performance under dynamic conditions. Dynamic balance skills are commonly assessed using the Timed Up and Go (TUG) test (4), which also provides insights into gait performance. On the other hand, the Functional Reach Test (FRT) is particularly useful for assessing semi-dynamic balance (5). This test can be easily administered with the help of a simple measuring tape.

Exercise is a frequently utilized intervention for improving functional balance, as it allows the central nervous system to reorganize motor outputs through repetitive practice. It has been reported that the improvements in balance achieved through exercise are not limited to increased muscle strength or flexibility, but are also closely related to motor learning processes (6). Motor learning enables the acquisition of new movement patterns and the optimization of existing ones through repetition and experience. This process contributes to the development of both proactive and reactive balance strategies via neuroplastic changes at the cortical and subcortical levels.

For patients who present to clinics with balance disorders or vestibular complaints, balance exercises are often recommended to improve balance skills and reduce vestibular symptoms (7). However, some patients, particularly those who lead sedentary lives, may perceive these exercises as unnecessary or too simple, claiming that they are already active during the day or engage in casual walking. Nevertheless, it remains unclear to what extent routine daily activities contribute to the improvement of balance skills in such sedentary individuals. The aim of this study is to investigate the effect of daily routine activity intensity on functional balance skills in individuals with sedentary lifestyles.

METHODS

Participants and Ethical Approval

Written and verbal informed consent was obtained from all participants. Ethical approval for this study was granted by the Karabük University SHC Ethics Committee (Date: 19.06.2023; Decision No: 2023/05).

Study Design and Participants

This study was conducted on students and staff at Karabük University in the Audiometry Laboratory. This prospective, cross-sectional study included 34 healthy individuals who did not engage in regular physical exercise. The Physical Activity Scale-2 (PAS-2) was used to assess participants' average daily physical activity levels. Participants' height and weight were recorded, and body mass index (BMI) was calculated. Functional balance and mobility were assessed using the Functional Reach Test (FRT), Romberg Test (on firm and foam surfaces), the One-Leg Standing Test (OLST) with eyes open and closed, and the Timed Up and Go Test (TUG).

Inclusion Criteria

- Aged between 19 and 50 years
- Being a healthy individual (without any known chronic disease or disability)
- Not engaging in regular sports (no regular exercise at least 3 days a week in the past 6 months)
- Providing consent for the administration of the PAS-2 and other physical tests
- Being suitable for anthropometric and balance/mobility assessments

Exclusion Criteria

- Having a history of neurological, vestibular, orthopedic, or cardiovascular disease
- Use of medications that may affect balance
- Pregnancy
- Inability to participate due to visual, auditory, or cognitive impairments
- History of falls in the past 6 months
- Inability to cooperate in the PAS-2 or other physical assessments

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Physical Activity Assessment: PAS-2

The Turkish version of the Physical Activity Scale-2 (PAS-2) was used in the study (8). The scale consists of 9 items assessing sedentary behavior and physical activity levels (light, moderate, and vigorous) during work, transportation, and leisure time. The metabolic equivalent (MET) values corresponding to each item allow for estimation of daily and weekly physical activity levels. The content validity index (CVI) of individual items ranges between 0.8 and 1.0, and the overall CVI of the scale is 0.92.

Balance Assessment

Participants' static balance was evaluated using the Romberg Test (firm and foam surface) and the OLST with eyes open and closed. For the Romberg Test, participants were asked to remove their shoes and stand with their feet together. For the OLST, participants removed their shoes and lifted one leg of their choice. They were asked to maintain the position for 30 seconds, and the time they could hold the position was recorded using a stopwatch.

Dynamic balance was assessed using the FRT and TUG. For the FRT, participants were instructed to stand with their feet together and reach forward with one arm extended. The forward reach distance in the anterior plane was measured using a tape fixed to the wall. For the TUG, participants were instructed to complete a 3-meter walking course as quickly as possible. The test started and ended in a seated position, and the completion time was measured with a stopwatch.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 21. The Shapiro-Wilk test was used to assess normality. Descriptive statistics were presented as n, percentage, and mean±standard deviation. Depending on data distribution, Pearson or Spearman correlation analysis was used to examine the relationships between variables. The significance level was set at p=0.05.

RESULTS

Participants were 28 (82.3%) female, 6 (17.7%) male, and the mean age was 22.00±6.75 years. The mean PAS-2 score of the participants was 2238.48 MET-min/day. All participants had Romberg and eyes-open OLST scores of 30 seconds. Mean height was 164.38±8.26 cm, mean weight was 58.76±10.23 kg, mean BMI was 21.74±3.65, mean FRT score was 36.85±9.64 cm, mean TUG score was 7.15±0.78 seconds, and mean eyes-closed OLST score was 21.68±10.67 seconds. There was no correlation between the PAS-2 score and height, weight, BMI, FRT, TUG, Romberg, and OLST scores (p>0.05, Figure 1).

DISCUSSION

The aim of this study was to investigate whether the intensity of daily routine physical activity affects functional balance abilities in sedentary individuals. Our findings indicated that in sedentary individuals, daily physical activity levels do not significantly influence either static or dynamic balance.

Physical activity levels have been declining steadily, in parallel with advances in technology. Promoting physical activity has become a public health priority supported by governments worldwide to maintain and improve health (9). Walking is the most commonly recommended form of physical activity, and taking an average of 7.500 steps per day is considered necessary for a healthy lifestyle, while more than 10.000 steps per day is classified as high physical activity (10).

It is well known that engaging in sports improves balance abilities. Kara et al. (11) compared static and dynamic balance skills between elite ice hockey players and individuals who do not participate in sports professionally. Although they found no difference between groups in the sensory organization test, ice hockey players performed better in the adaptation test and unilateral stance test. Tatlıcı et al. (12) assessed the balance skills of basketball and soccer players using the Biodex balance system and reported that soccer players had better dynamic balance. A systematic review suggested that to achieve improvements in balance, at least 45-minute sports sessions, twice a week for a minimum of 8 weeks, are required (13). Sports enhance the musculoskeletal system and also develop proprioceptive and vestibular

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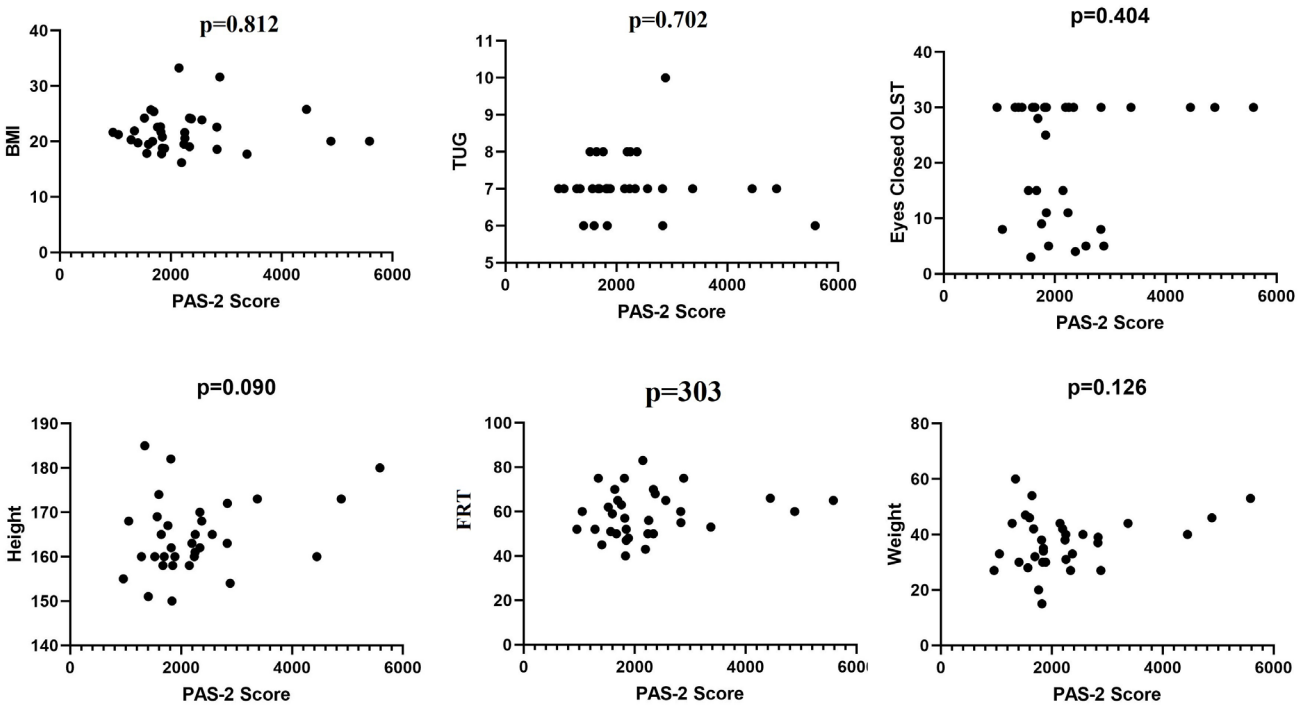

Figure 1. Relationship between PAS-2 score and height, weight, BMI, FRT, TUG, and OLST scores

systems. Therefore, regular sports participation can improve both static and dynamic balance skills.

On the other hand, the relationship between physical activity level and balance performance remains unclear. Nadiye et al. (14) investigated the relationship between static balance and physical activity in amateur athletes and found no significant association between the two. Similarly, another study reported that the number of daily steps did not affect balance (9). In contrast, Zhu et al. (15) found that objectively measured daily activity levels were associated with better balance abilities, suggesting that increased physical activity improves balance.

The present study demonstrated no significant relationship between physical activity intensity and static or dynamic balance abilities. While engaging in sports appears to improve balance, the lack of association with physical activity level is noteworthy. Several factors might explain this finding. Firstly, variations in physical activity levels among sedentary individuals may not be sufficient to create meaningful differences in balance. It is possible that improvement in balance skills requires more structured and professional-level activities. Additionally, the type of physical activity might influence balance. This is because balance is maintained through the integration of proprioceptive, vestibular, and visual inputs. For instance, plyometric exercises may enhance proprioceptive input, whereas sports like boxing can impair vestibular function due to the risk of head trauma (16).

Furthermore, the functional balance tests used in our study except for TUG are highly specific. The FRT involves maximal forward reaching, and the OLST assesses single-leg stance ability, both of which are rarely performed in daily life. As a result, motor learning acquired through these tests may not translate into observable differences in balance among sedentary individuals. The TUG test, on the other hand, may not be sensitive enough to detect small variations in healthy individuals. Nonetheless, to better understand the relationship between physical activity level and balance abilities, more studies using objective assessments of both variables are needed.

This study has certain limitations. Additionally, the unequal gender distribution in our sample—where female participants were more numerous than males—may have introduced a potential limitation. While our primary objective was not to compare outcomes

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by gender, this imbalance could have influenced the statistical power of certain subgroup analyses and limits the generalizability of the findings to a more balanced population. Moreover, the relatively young mean age of our participants may have had a favorable effect on balance performance. Younger individuals typically have better preserved musculoskeletal and sensory systems, including proprioceptive and vestibular pathways. This may have contributed to a ceiling effect in test results, limiting the observable differences related to varying physical activity levels within the sedentary population.

Additionally, the study was conducted among healthy adult individuals. Future research should investigate this relationship in specific clinical populations or among geriatric individuals.

CONCLUSION

The average physical activity level of individuals with a sedentary lifestyle was found to be 2238.48 MET-min/day. This study demonstrates that there is no relationship between physical activity levels and balance skills in individuals with a sedentary lifestyle. Based on our findings, it can be concluded that regular exercise is important for improving functional balance skills.

Acknowledgement: This study was presented as an oral presentation at the 2nd International Pediatric Audiology Congress (Istanbul-Türkiye on April 4-6, 2025).

Ethical Approval: Ethical approval for this study was granted by the Karabük University SHC Ethics Committee (Date: 19.06.2023; Decision No: 2023/05).

Author Contributions: Idea/Concept: E.S., M.C., Z.A.; Design: E.S., M.C., Z.A.; Supervision: E.S., M.C., Z.A.; Resources: E.S., M.C., Z.A.; Materials: E.S., M.C., Z.A.; Data Collection and/or Processing: E.S., M.C., Z.A.; Analysis and/or Interpretation: E.S., M.C., Z.A.; Literature Review: E.S., M.C., Z.A.; Written: E.S., M.C., Z.A.; Critical Reviews: E.S., M.C., Z.A.

Conflict of Interest: There is no conflict of interest between authors.

Financial Disclosure: There is no financial support or funding for this study.

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