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ORIGINAL RESEARCH

Is There an Association Between Self-Reported Dual-Task Performance and Fear of Falling in Older Adults?

Ecem Kartal Özcan,[1] Mustafa Karabulut,[2] Kürşad Karakoç,[3,4] and Banu Müjdeci[4]

[1]Department of Audiology, Gulhane Faculty of Health Sciences, University of Health Sciences, Ankara, Turkey; [2]Division of Balance Disorders, Department of Otorhinolaryngology and Head and Neck Surgery, School for Mental Health and Neuroscience, Maastricht University Medical Center, Maastricht, The Netherlands; [3]Audiology and Speech Pathology Doctoral Programme, Graduate School of Health Sciences, Ankara University, Ankara, Turkey; [4]Department of Audiology, Faculty of Health Sciences, Ankara Yıldırım Beyazıt University, Ankara, Turkey

Introduction: Is there an association between self-reported dual-task performance and fear of falling in older adults? ***Background/Objectives:*** Fear of falling tends to increase with age and can negatively impact dual-task abilities, leading to potential declines in overall quality of life. Therefore, it becomes crucial to evaluate dual-task performance in older adults, particularly prior to the onset of fear of falling. This study aims to investigate the potential association between self-reported dual-task performance and fear of falling in older adults. ***Methods:*** A total of 51 individuals (19 females and 32 males) were recruited. The participants met the inclusion criteria were administered the Dual-Task Questionnaire (DTQ), Falls Efficiency Scale International, and Physical Activity Scale for the Elderly. Multiple linear regression was performed to predict DTQ scores based on age, body mass index, and Physical Activity Scale for the Elderly. ***Results:*** A moderate positive correlation was found between Falls Efficiency Scale International scores and self-reported DTQ scores (r: .448, p: .001). Age, body mass index, and Physical Activity Scale for the Elderly were not found to be significant predictors of DTQ scores. ***Conclusions:*** Our study reveals a moderate positive association between fear of falling and self-reported dual-task performance in older adults. A direct relationship between physical activity performance, fear of falling, and self-reported dual-task performance was observed among older adults. ***Significance/Implications:*** Integrating self-reported measures like the DTQ in clinical evaluations can provide valuable insights into dual-task abilities of older adults.

Keywords: self-assessment, falls, physical functioning, movement

Key Points

- Fear of falling is linked to dual-task performance.
- Active older adults have better dual-task performance and less fear of falling.
- A self-reported Dual-Task Questionnaire benefits clinical evaluations for older adults.

The fear of falling tends to escalate with advancing age (Arfken et al., 1994; Scheffer et al., 2008). The prevalence of fear of falling has been documented as 43% and 27% for women and men, respectively (Tomita et al., 2018). Although fear of falling typically arises following previous falls, it can also manifest in individuals without any prior history of falls (Tinetti et al., 1994). This fear of falling has been associated with unfavorable conditions such as the presence of coexisting medical conditions (Lavedán et al., 2018), reliance on others in daily life activities, reduced walking speed (Chamberlin et al., 2005), compromised balance performance (Uemura et al., 2012), and limited physical performance due to activity constraints (Arfken et al., 1994; Martin et al., 2005).

Dual-task refers to an individual's ability to concentrate on two or more separate tasks concurrently (Gagne et al., 2017). The allocation of attention in dual-task scenarios is determined by the complexity and priority of the tasks involved (Kim & Brunt, 2007). The ability to execute different tasks simultaneously and accurately is influenced by the interplay between the motor and cognitive systems (Woollacott & Shumway-Cook, 2002), and the challenge arises when determining where to direct attention as the complexity of activities increases (Kim & Brunt, 2007). As most daily activities include multitasking to some extent, the need for executive functions like inhibitory skills becomes apparent. For example, individuals with high levels of fear of falling may find it challenging to inhibit or disregard irrelevant environmental cues while maintaining balance. Consequently, when performing cognitive tasks, fear of falling may compete for the limited attentional resources needed for balance control (Wollesen et al., 2017). Notably, the fear of falling can have a detrimental impact on the dual-task performance of older individuals (Sapmaz & Mujdeci, 2021) and may result in a decline in their overall quality of life (Arfken et al., 1994). The progressive phenomenon observed in older individuals makes it crucial to assess dual-task performance, particularly before the onset of the fear of falling.

In this context, the relationship between dual-task performance and fear of falling in older individuals has raised curiosity. In the literature, the majority of dual-task assessments have traditionally been conducted using performance-based measures such as Time Up and Go Test (TUG), Time Up and Go Test$_{cognitive}$, Time Up and Go Test$_{motor}$ (O'Connell, 2014; Sapmaz & Mujdeci, 2021), as well as 10-m walk test (10MWT), 10MWT$_{Cognitive}$, 10MWT$_{Motor}$, and

Kartal Özcan https://orcid.org/0000-0001-7185-6955
Karakoç https://orcid.org/0000-0001-7874-2029
Müjdeci https://orcid.org/0000-0002-3660-3650
Karabulut (mustafa.karabulut@mumc.nl) is corresponding author, https://orcid.org/0000-0002-6149-3967

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$10MWT_{Cognitive\text{-}Motor}$ (Lama et al., 2018). Although these tests provide a detailed evaluation, they are time-consuming and require extra consumables. Moreover, traditional dual-task measurements may not be sufficient in predicting future falls (Beauchet et al., 2011). In contrast, for assessing functional abilities in daily life, self-reported assessments are favored over traditional dual-task evaluations conducted in laboratory settings (Abasıyanık et al., 2022; Mercieca-Bebber et al., 2018), as they capture an individual's perception and self-awareness of their abilities, offering insights into how they perceive their own functional capacity in real-world scenarios. Additionally, they provide a more holistic perspective by considering not only physical aspects but also cognitive and psychological factors. Few studies have investigated self-reported dual-task performance among older adults (Evans et al., 2009; Sertel et al., 2022; Tun & Wingfield, 1995). Therefore, the objective of this study is to examine the potential association between self-reported dual-task performance and fear of falling in older adults. We hypothesize that there is indeed an association between self-reported dual-task performance and fear of falling in this population.

Methods

Study Design

This is a prospective designed cross-sectional study which was performed following the Strengthening the Reporting of Observational Studies in Epidemiology recommendations (Von Elm et al., 2007).

Participants

The sample size for this study was calculated using G*Power software (Faul et al., 2007; version 3.1) based on the following input parameters: exact test family, bivariate normal model for correlation, and a priori to compute required sample size—given α, power, and effect size. A two-tailed power calculation was performed, with a significance level (α) of .05 and a desired statistical power ($1 - \beta$) of 80%. To establish the effect size, a pilot study was carried out, revealing a statistical correlation coefficient of .413. Consequently, the estimated sample size was determined to be 43 participants.

The inclusion criteria of our study were as follows: Participants had to score 24 or above on the Mini–Mental State Examination (MMSE), have normal vision with or without glasses as assessed by the Snellen chart, and be willing to participate as volunteers. Participants with a history of hearing loss, dizziness, vestibular, neurological, orthopedic, psychological disorder, polypharmacy, and uncontrollable systemic disease were excluded from the study. All data of our study participants were collected between August and October 2022 from community-dwelling older adults. Ethical approval for this study was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee (Approval No.: 2022-1039). Informed consent was obtained from all study participants prior to their participation.

Setting

Demographic data of the participants were collected, and their body mass index (BMI) was calculated using this formula: BMI = weight (kilograms)/(height [meter])^2. The BMI values were then categorized based on the World Health Organization's classification system as follows: BMI < 16: malnutrition or anorexia, 16.5–18.4: underweight, 18.5–24.9: normal weight, 25–29.9: overweight, and ≥30: obesity (Zierle-Ghosh & Jan, 2022). BMI was assessed as it can be associated with an individual's physical activity level and can also impact balance and mobility in older individuals. The MMSE and the Snellen test were administered to assess cognitive and visual abilities, respectively. The presence of hearing and balance deficits was investigated through a series of questions designed by the researchers. Participants who met the inclusion criteria were further administered the Dual-Task Questionnaire (DTQ), Falls Efficacy Scale International (FES-I), and Physical Activity Scale for the Elderly (PASE).

Mini-Mental State Examination

The MMSE was used as a screening tool to identify potential cognitive impairments among the participants (Folstein et al., 1975; Güngen et al., 2002). Comprising of 11 items, the MMSE is scored on a scale of 30, with a higher score indicating better cognitive function. Individuals scoring 24 and above were included in the study.

Snellen Test

The Snellen test, a commonly employed clinical test, was conducted to evaluate visual acuity of participants (Tsui & Patel, 2020). Standard material consisting of 11 lines of block letters was positioned at a distance of 6 m from the participants' eye level. Individuals with normal vision, with or without the use of glasses, were included in the study based on a ratio of 0.7.

History

Four questions were employed by the researchers to assess the presence of hearing or balance deficits. The following questions were posed: "Do you experience any hearing difficulties?" "Are you having trouble hearing sounds like birds, water, doorbells, or telephones?" "Have you complained about dizziness and/or imbalance?" "Do you feel dizzy when you go shopping, take a stroll, turn in bed, read, descend stairs, or in similar situations?" Participants were required to respond with either "Yes" or "No." Those who answered "No" to all questions were included in the study.

Falls Efficacy Scale International

The FES-I, comprising 16 items, was administered to assess the impact of fear of falling on daily activities among older individuals. Each question was scored on a scale ranging from 1 (*not at all concerned*) to 4 (*very concerned*), and the total score was calculated. The final score ranged from 16 (*complete lack of concern*) to 64 (*extreme concern*). The scores were further categorized as follows: 16–19: low concern, 20–27: moderate concern, and 28–64: high concern (Delbaere et al., 2010; Ulus et al., 2012).

Dual-Task Questionnaire

The DTQ was specifically designed to assess the frequency of self-reported difficulties encountered during dual-task activities of daily living over a 2-week period. Participants responded to the DTQ using a 5-point scale, where each response option represented a different level of frequency: *never* (0 points), *rarely* (1 point), *sometimes* (2 points), *often* (3 points), and *very often* (4 points). The average score per question was computed by dividing the total survey score by 10. Higher scores on the DTQ indicate poorer performance in dual-task activities (Evans et al., 2009).

Physical Activity Scale for the Elderly

The PASE is composed of 12 items that evaluate the frequency and duration of leisure, household, and work-related activities engaged

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in by older adults over the past week. Scoring is based on the assignment of PASE weights to each activity performed by participants during that period. These weights were derived from a composite score obtained through a comparison of 3-day physical activity monitoring, a 3-day physical activity diary, and a general self-report using the PASE instrument (Washburn et al., 1999). The product of activity frequencies and activity weights was calculated, and the total PASE score was obtained by summing the scores for each activity. The overall PASE score ranges from 0 to 400, with higher scores indicating greater engagement in physical activity. A specific cutoff value for PASE has not yet been determined (Washburn et al., 1993).

Statistical Analysis

Statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS; version 26.0). To calculate whether or not the data were distributed normally, visual (histogram and scatter plots) and statistical (Kolmogorov–Smirnov and Shapiro–Wilk) methods were applied. Since the data did not exhibit a normal distribution, quantitative data were reported as median ± interquartile range. Spearman correlation analysis was used to examine the correlation between variables. Furthermore, multiple linear regression analysis was performed to predict DTQ scores based on age, BMI, and PASE. Statistical significance was set at a p value of <.05.

Table 1 Participant Demographics and Descriptive Statistics

Variables	Median (IQR)	Range (min–max)
Age	69 (66–70); mean: 69.3 ± 3.5	65–80
Sex	19 females, 32 males	
BMI	27.34 (25.55–29.43)	23.44–43.28
FES-I	18 (18–20)	17–30
DTQ	0.2 (0.0–0.6)	0–1
PASE	120.83 (86–153.63)	33.6–239.3

Note. BMI = body mass index; FES-I = Falls Efficacy Scale International; DTQ = Dual-Task Questionnaire; PASE = Physical Activity Scale for the Elderly; IQR = interquartile range; min = minimum; max = maximum.

Results

A total of 51 individuals, consisting of 19 females and 32 males, aged between 65 and 80 years (mean age: 69.3 ± 3.5 years), were recruited for this study. Table 1 displays the demographic characteristics of the participants. Overall, a moderate positive correlation was found between FES-I scores and self-reported DTQ scores (r: .448, p: .001) in all participants (Figure 1). Among individuals with a normal weight based on BMI ($N = 8$), a strong positive association was found between FES-I scores and DTQ scores (r: .835, p: .010). Among those classified as overweight ($N = 31$), a moderate positive association was found between FES-I scores and DTQ scores (r: .490, p: .005). However, no association was found between FES-I scores and DTQ scores in individuals classified as obese ($N = 12$; p: .604).

The median PASE score in our study was 120.83, as there is no established cutoff value in the literature. Subgroup analysis based on a cutoff value of 120.83 in PASE showed no significant association between FES-I scores and self-reported DTQ scores (p: .113) among individuals with cutoff score or below ($N = 26$), while a substantial positive association was observed (r: .645, $p = .001$) among individuals above the cutoff score ($N = 25$; Figure 2).

Multiple linear regression analysis was performed to evaluate whether age, BMI, and PASE scores collectively predicted DTQ scores. The results showed that age, BMI, and PASE scores were not significant predictors of DTQ scores (p: .323; see Table 2).

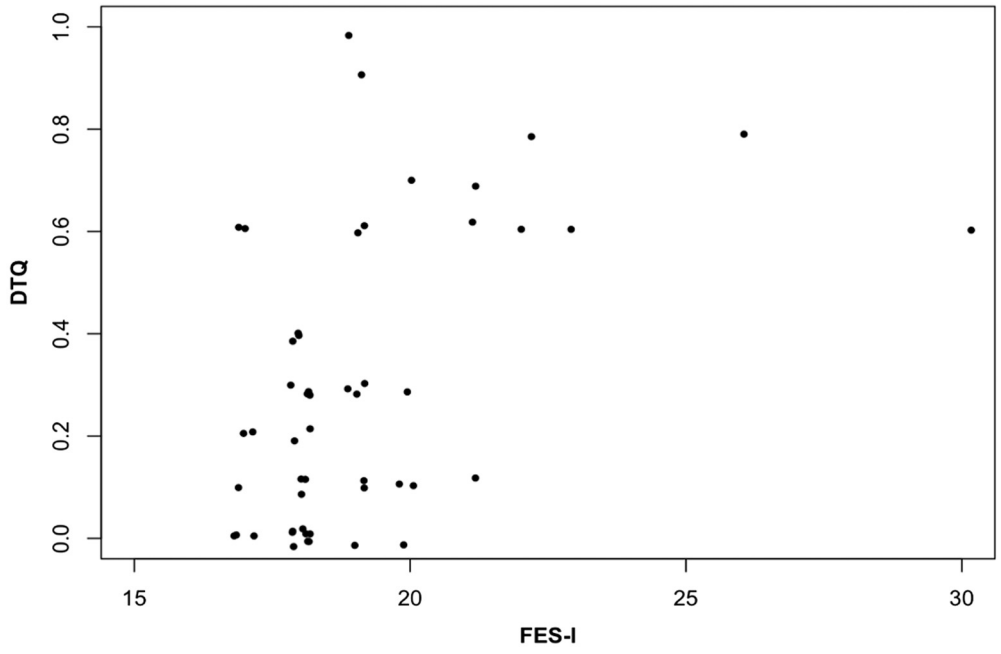


Figure 1 — Scatter plot between FES-I and DTQ scores in all participants ($N = 51$). FES-I = Falls Efficacy Scale International; DTQ = Dual-Task Questionnaire.

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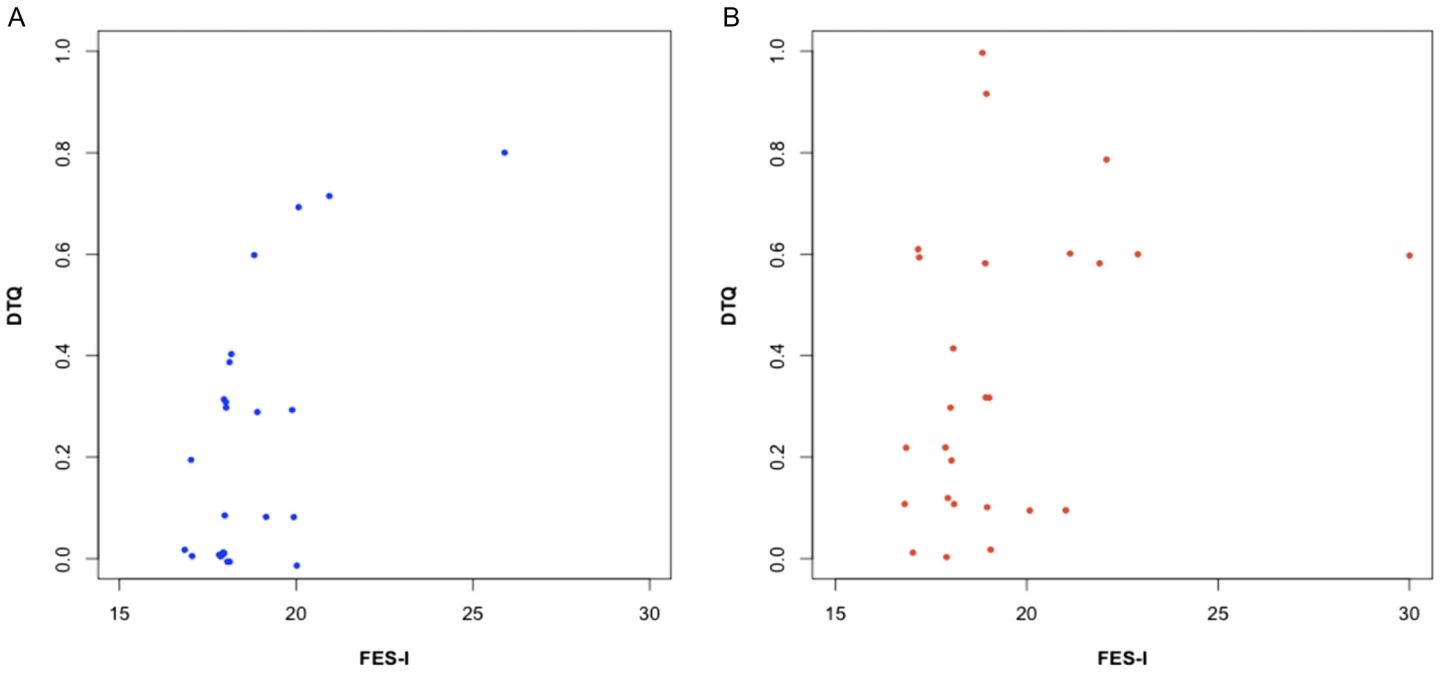


Figure 2 — (A) Scatter plot between FES-I and DTQ scores among individuals above the cutoff score ($N = 25$; r: .645, $p = .001$). (B) Scatter plot between FES-I and DTQ scores among individuals with cutoff score or below ($N = 26$; $p = .113$). FES-I = Falls Efficacy Scale International; DTQ = Dual-Task Questionnaire.

Table 2 Multiple Linear Regression to Predict DTQ Scores Based on Age, BMI, and PASE

	B	Sh	β	*t*	*p*	*R*	R^2	*F*	*p*
DTQ									
Age	–0.013	0.011	–0.167	–1.189	.240				
BMI	–0.003	0.011	–0.040	–.282	.136	.266	.071	1.191	.323
PASE	–0.001	0.001	–0.214	–1.516	.779				

Note. $p < .05$: multiple linear regression. BMI = body mass index; DTQ = Dual-Task Questionnaire; PASE = Physical Activity Scale for the Elderly.

Discussion

In the present study, we identified a moderate association between the fear of falling and self-reported dual-task performance among older adults. Moreover, a substantial correlation was observed between fear of falling and self-reported dual-task performance specifically in individuals exhibiting high levels of physical activity. Notably, age, BMI, and PASE scores did not exhibit any predictive ability for the dependent variable, DTQ scores.

Several studies in the literature have explored the relationship between fear of falling and dual-task performance, providing valuable insights into this topic (O'Connell, 2014; Sapmaz & Mujdeci, 2021; Uemura et al., 2012). For example, Sapmaz and Mujdeci (2021) conducted a study and revealed that older adults with higher levels of fear of falling exhibited decreased dual-task performance. Similarly, Brustio et al. categorized older adults into three groups based on their fear of falling scores (no fear, moderate, and severe) and observed a progressive decline in dual-task performance as fear of falling severity increased (Brustio et al., 2018). Another study by Wang et al. divided older adults into high and low fear of falling groups, demonstrating that those with greater fear of falling displayed poorer dual-task performance (Wang et al., 2021). The findings of our study align with these previous investigations, highlighting the consistency in the association between fear of falling and dual-task performance. Notably, our study employed a self-reported DTQ, in contrast to earlier studies that utilized a combination of motor and cognitive tasks. However, it is worth noting that Reelick et al. (2009) reported no significant impact of fear of falling on dual-task performance in older individuals. These contrasting findings may be attributed to differences in the age range of participants and methodological variations across the studies.

Existing literature includes studies that have investigated the relationship between physical activity levels and dual-task performance (Gobbo et al., 2014; Heiden & Lajoie, 2010; Sapmaz & Mujdeci, 2021). For instance, Sapmaz and Mujdeci (2021) found that older adults with a high fear of falling exhibited lower PASE scores compared to those without fear of falling. However, no previous research has explored the influence of physical activity levels on the association between fear of falling and dual-task performance. Due to the absence of a defined cutoff value for PASE in the literature, we categorized PASE scores into two groups based on the median value obtained from our study (120.83≤: low physical activity level, 120.83≥: high physical activity level). The present study revealed that both individuals classified as having an ideal weight and those classified as overweight, based on their BMI,

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exhibited a strong and moderate association between fear of falling and self-reported dual-task performance, as measured by the PASE, respectively. However, such an association was not observed in obese individuals and those with lower levels of physical activity. These findings may be explained as follows: Participants characterized by obesity and low physical activity levels may have experienced limited engagement in daily life activities that require dual-task performance and could potentially trigger fear of falling (Gomes et al., 2022). Consequently, such individuals might have been exposed to fewer instances of dual-task situations and thus may not have encountered the difficulties associated with such scenarios. Therefore, it is plausible that these participants provided only estimative responses to the questionnaire items evaluating dual-task performance and fear of falling. Conversely, normal weight individuals and overweight individuals, and those with higher levels of physical activity, likely encountered dual-task situations and experienced challenges related to such conditions, as well as the potential instability, falls, and similar circumstances that they may induce in their daily lives. Hence, these participants may have responded to the dual-task performance and fear of falling questions based on their experiences and encountered difficulties.

In our study, we found that age, BMI, and PASE scores did not have a significant impact on dual-task performance. However, the literature contains studies that have separately investigated the association between dual-task performance and these three factors. Regarding aging, previous research has consistently demonstrated a detrimental effect on dual-task performance (Brustio et al., 2017; Lama et al., 2018). The influence of physical activity levels on dual-task performance has yielded conflicting results. A systematic review by Gobbo et al. reported no significant impact of physical activity level, including training exercises, on dual-task performance (Gobbo et al., 2014). Conversely, a randomized controlled trial identified a positive effect of physical activity level on dual-task performance (Heiden & Lajoie, 2010). Limited research has explored the relationship between BMI and dual-task performance (Mehta et al., 2015; Shaik et al., 2022). Mehta et al. found that increased BMI had an adverse effect on balance, particularly in dual-task scenarios related to daily activities, among older adults (Mehta et al., 2015). However, in our study, these three variables did not emerge as predictors of dual-task performance. Although indirectly consistent with the existing literature, this may be attributed to the diversity of individuals included in our study.

We acknowledge several limitations in our study. First, we did not collect fall history information from the participants. This decision was taken to minimize any potential influence on the self-reported DTQ scores. Second, our assessment of individuals' hearing and balance disorders relied solely on self-reported responses, without conducting audiological and vestibular tests to confirm these conditions. It is also important to note that our study primarily focused on older individuals under the age of 80 years. This demographic limitation is worth considering when interpreting the results, as fear of falling tends to be more prevalent in individuals with multiple risk factors, such as cognitive impairment and sensory impairments. These risk factors may interact with fear of falling and dual-task performance in complex ways that warrant further investigation. Additionally, selecting almost healthy participants does not necessarily mean that the results only depict the relationship between fear of falling and dual-task performance. Other factors, such as individuals' lifestyles, mental states, or educational backgrounds, can influence the outcomes and should be taken into consideration. These factors may have contributed to the presence of a moderate level of association.

In conclusion, our study revealed a moderate association between self-reported dual-task performance and fear of falling in the older adults. Furthermore, we observed a direct relationship between physical activity performance, fear of falling, and self-reported dual-task performance among older adults. Based on these findings, we consider that integrating self-reported measures like the DTQ in clinical evaluations can provide valuable insights into individuals' dual-task abilities, offering a faster and practical assessment compared to traditional methods.

Acknowledgments

Institution and Ethics Approval and Informed Consent: Ethical approval for this study was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee (Approval No.: 2022-1039). Informed consent was obtained from all study participants prior to their participation.

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