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# Smartphone addiction among elderly individuals: its relationship with physical activity, activities of daily living, and balance levels

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## Abstract

**Background** The growing use of smartphones among elderly individuals, driven by social and informational needs, may lead to smartphone addiction, potentially impacting their daily lives. This study aimed to determine whether there is a difference in physical activity, activities of daily living, and balance levels between elderly individuals with and without smartphone addiction.

**Methods** This descriptive and cross-sectional study included 94 elderly individuals. Data were obtained using the Smartphone Addiction Scale-Short Version (SAS-SV), the Physical Activity Scale for the Elderly (PASE), the Lawton Instrumental Activities of Daily Living Scale (Lawton IADL), the Fullerton Advanced Balance Scale (FAB-T), and the Timed Up and Go Test (TUG). The participants were divided into two groups according to their SAS-SV scores: those with ($n = 45$) and those without ($n = 49$) smartphone addiction.

**Results** When the groups with and without smartphone addiction were compared, there was a significant difference between the groups in terms of Lawton IADL ($t = 4.223$, $p < 0.001$), total PASE ($t = 7.791$, $p < 0.001$), PASE work-related activity ($t = 2.541$, $p = 0.013$), household activity ($t = 3.598$, $p = 0.001$), and leisure activity ($t = 7.063$, $p < 0.001$). Structural equation modeling showed that Lawton IADL ($\beta = -0.320$, $p < 0.001$), PASE total ($\beta = -0.518$, $p < 0.001$), and PASE work-related activity ($\beta = -0.211$, $p = 0.033$), household activity ($\beta = -0.300$, $p = 0.002$), and leisure time activity ($\beta = -0.483$, $p < 0.001$) subscales had a direct negative predictive effect on SAS-SV. FAB-T had a direct positive predictive effect on total PASE ($\beta = 0.186$, $p = 0.030$) and work-related activity subscales ($\beta = 0.197$, $p = 0.046$). FAB-T had a direct positive predictive effect on Lawton IADL ($\beta = 0.247$, $p = 0.009$), but a direct negative effect on TUG ($\beta = -0.541$, $p < 0.001$).

**Conclusions** The study determined that smartphone addiction was directly related to the maintenance of physical activity and daily living activities in elderly individuals but did not lead to a change in balance status. Future studies should consider including potential confounders, such as baseline physical fitness, socioeconomic status, and cognitive impairment, in structural equation modeling to provide more comprehensive insights.

**Keywords** Elderly, Smartphone addiction, Physical activity, Activities of daily living, Balance

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## Background

In almost all parts of the world, the rate of elderly population in the total population has started to increase gradually as a result of prolonged life expectancy at birth, declining birth rates, and migration [1]. In Türkiye, the rate of elderly population increased to 10.2% in 2023 and according to this rate, Türkiye ranked 67th among 184 countries [2]. The increase in the number of elderly individuals prioritizes the needs arising from health services, personal care, domestic needs, socialization needs, and disabilities, if any. The developing technology today can make significant contributions to security, protection, mobility, independent living and participation in social life for elderly individuals [3].

Today, the most used digital technology is smartphones. In fact, smartphones have become a part of modern people's daily lives in terms of portability, instantaneity, and simplicity [4]. As a result of the widespread use of smartphones in recent years and the manufacturing of smartphones by considering the preferences of elderly individuals [5], the rate of smartphone use is gradually increasing among elderly individuals [6, 7]. In a study conducted in Türkiye, the rate of mobile phone/smartphone use was reported to be remarkably high (91.4%) in the 60-74 age group [5]. Smartphones can significantly contribute to the socialization of elderly individuals, their ability to live independently for a long term, and their quality of life [8, 9]. Elderly individuals can easily communicate with their children and close circles through smartphones [3, 10], thus maintaining their interpersonal relationships and receiving moral support [11]. Elderly individuals can also access information about health, news, and entertainment via smartphones. In addition, smartphones can facilitate elderly individuals' daily tasks and responsibilities through reminders for medication, appointment scheduling, and management of chronic health conditions [12]. Furthermore, thanks to mobile games targeting elderly users, elderly individuals can have activities to spend time during the day [3].

The increase in the use of smartphones among elderly individuals due to their social and information needs raises the question of whether elderly individuals are vulnerable to smartphone addiction [9, 13]. Smartphone addiction is defined as excessive use of smartphones despite their negative effects [4]. It is classified under the category of behavioral addictions [14] and is a type of addiction that is not associated with a chemical substance but causes a feeling of discomfort when not used [15]. Smartphone addiction can seriously affect individuals' daily lives [16, 17]. In a study conducted in China, it was revealed that mobile phone addiction has a direct effect on sleep quality in elderly individuals [6]. In another study, it was emphasized that measures should be taken to address the risk of disrupting productivity at home and work [18].

Smartphone addiction can also negatively affect individuals' physical health [16, 17]. In particular, it can lead to habitual physical inactivity, causing changes in body composition and the risk of obesity [17]. Moreover, smartphone use may cause musculoskeletal symptoms, incorrect posture, and impaired postural control, as it requires the neck to be bent downwards and the head to be held in the same position for a long time [14, 19, 20]. The center of gravity shifts forward due to impaired posture, which can lead to impaired balance [21]. In a previous study, it was reported that smartphone use could limit visual information and weaken postural balance [22]. In the study of Onofrei et al. (2020) [23], it was found that the use of smartphones for texting or calling significantly impaired static balance.

Although the rate of smartphone use among elderly individuals has increased significantly, little is known about the impact of smartphone addiction [4, 9]. This study aims to shed light on the relationship between smartphone addiction and physical activity, activities of daily living (ADL), and balance levels in elderly individuals The significance of the study lies in its potential to contribute to the literature and assist health professionals in developing effective interventions to support the daily activities and overall well-being of elderly individuals, while also helping them maintain balance. In this context, answers were sought to the following questions in this study:

- Is there a difference between physical activity, ADL, and balance levels of individuals with and without smartphone addiction?
- Do smartphone addiction levels affect physical activity, ADL, and balance scores?

## Methods

### Study design and setting

This study had a descriptive and cross-sectional design, and a structural equation modeling was used to examine the relationship between smartphone use and physical activity, ADL, and balance. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist was used for the reporting of study data.

### Study setting

This study was conducted with participants who came to the Sakarya Metropolitan Municipality Elderly Support and Coordination Center (YADEM). YADEM is a vibrant recreational center operated with the support of the municipality, dedicated to enhancing the quality of life for citizens aged 65 and above. The center offers a diverse range of courses and activities designed to promote lifelong learning, creativity, and social engagement. Participants can explore their interests and develop new skills through programs such as Quran studies, painting, wood painting, and a book reading club. For those passionate about innovation and the arts, YADEM also features a technology club, cinema club, and music club, providing opportunities to stay connected with modern trends and express themselves creatively. With its welcoming atmosphere and enriching activities, YADEM serves as a hub for personal growth, cultural enrichment, and community connection for senior citizens.

## Study sample

The inclusion criteria for participants were a) being aged 65 years or over, b) owning and using a smartphone for at least six months, c) being able to perform basic daily activities independently, d) having no cognitive impairments that could affect their ability to understand or respond to the study instruments, and e) volunteering to participate in the study. The exclusion criteria were a) having any physical disability or illness (e.g., severe arthritis, stroke, Parkinson's disease) that significantly impacts balance or walking, b) being diagnosed with severe visual or hearing impairments that could interfere with smartphone use or daily activities, c) having any psychiatric disorders or conditions (e.g., severe depression, dementia) that might affect participation, and d) being involved in any rehabilitation program related to balance or physical activity during the study period.

The A-priori sample size calculator for structural equation models was used to calculate the number of elderly individuals to be included in the study sample (https://www.danie lsoper.com/statcalc/calculator.aspx?id=89). A minimum sample size of 91 participants was calculated for the required parameter values including the expected effect size of 0.4, the desired statistical power level of 0.90, six latent variables, two observed indicators, and a probability value of 0.05. The study included 102 elderly individuals. However, 8 participant excluded duo to not willing to participate in the study (n = 7) and have physical limitations caused by hemiparesis (n = 1). Accordingly, the study was completed with 94 elderly individuals (Figure 1). Inclusion and exclusion criteria were meticulously implemented to minimize potential biases and

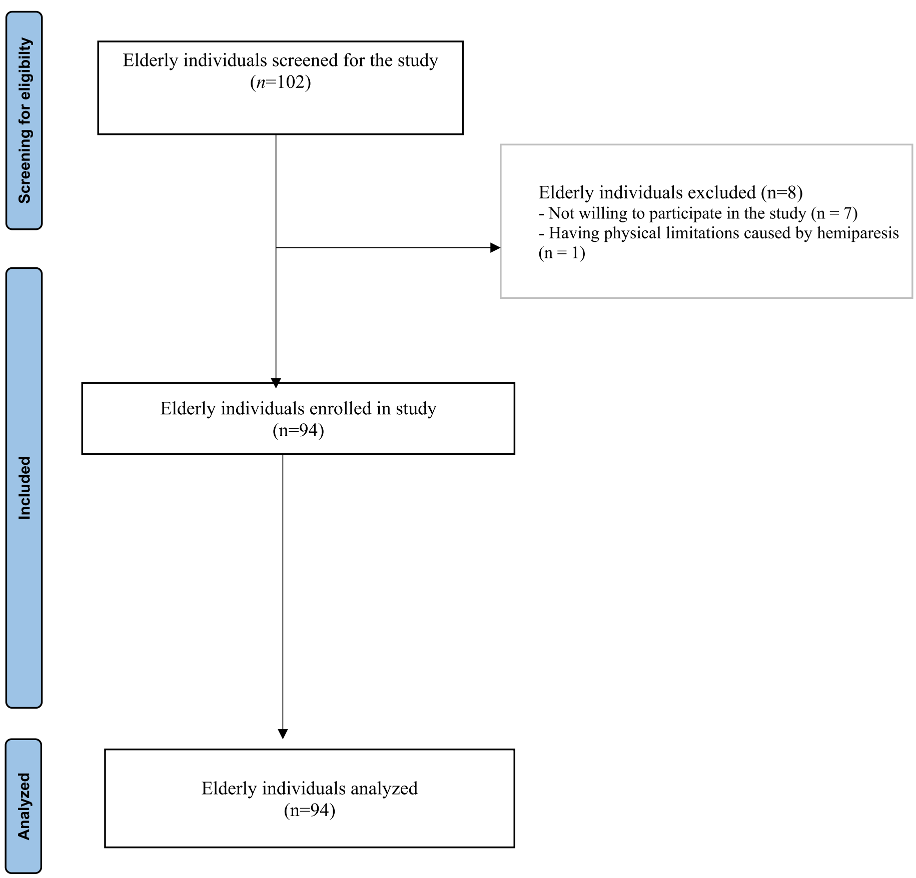


**Fig 1.** Flow diagram of the study sample

strengthen the validity of the study. No missing data were encountered in the study.

### Data collection tools

In this study, a "Personal Information Form" was used to determine the descriptive characteristics of the participants; the "Smartphone Addiction Scale-Short Version (SAS-SV)" was used to assess smartphone addiction; the "Physical Activity Scale for the Elderly (PASE)" was used to assess physical activity status; the "Lawton Instrumental Activities of Daily Living Scale (Lawton IADL)" was used to determine ADL; the "Fullerton Advanced Balance Scale (FAB-T)" and the "Timed Up and Go Test (TUG)" were used to evaluate balance. All data collection instruments were validated tools to minimize recall bias and ensure reliability.

*Personal Information Form:* The form was created by the authors by reviewing the literature and consisted of 13 questions regarding age, sex, marital status, education level, employment status, smoking status, alcohol consumption, number of drugs used daily, hospitalization in the last year, chronic diseases, general life satisfaction, duration of smartphone use, and reasons for use.

*Smartphone Addiction Scale-Short Version (SAS-SV):* The scale was developed by Kwon et al. to measure the risk of smartphone addiction, consists of 10 items, and is rated on a six-point Likert-type scale [24]. Scale items are scored from 1 to 6. Scale scores range from 10 to 60. The higher the scale score, the higher the risk for addiction. In the study conducted by Noyan et al., the cut-off point was determined as 31 for women and 33 for men. The Cronbach alpha coefficient of internal consistency and concurrent validity of the original form was 0.91. In the Turkish validity and reliability study conducted by Noyan et al., the Cronbach alpha value was found to be 0.87 [25]. In this study, the Cronbach alpha value of the scale was 0.92.

*Physical Activity Scale for The Elderly (PASE):* The scale is a self-reported questionnaire consisting of 12 questions regarding the frequency and duration of leisure activities, household activities, and work-related activities during the last 7-day period. The rating of each item varies. The total PASE score is calculated by multiplying the time spent on each activity (hours per week) or participation in an activity (yes or no) by the item weights and then summing the overall activities [26]. The overall PASE score ranges from 0 to 400 and a higher score indicates a better level of physical activity. In the Turkish validity and reliability study conducted by Ayvat et al., the Cronbach alpha value was found to be 0.71 [27]. In this study, the Cronbach alpha value of the scale was 0.73.

*The Lawton Instrumental Activities of Daily Living Scale (Lawton IADL):* It consists of 8 questions regarding telephone use, food preparation, shopping, daily housework, laundry, ability to get on a transportation vehicle, ability to use drugs, and money management. The individual is evaluated by 3 points if he/she does the activities independently, 2 points if he/she does them with assistance, and 1 point if he/she cannot do them at all. The higher the scale score, the more independent the individual is. In the Turkish validity and reliability study conducted by Işık et al., the Cronbach alpha value was found to be 0.84 [28]. In this study, the Cronbach alpha value of the scale was 0.83.

*Fullerton Advanced Balance Scale (FAB-T):* It consists of 10 questions with a four-point grading. The lowest score obtainable from the scale is 0 and the highest score is 40. A higher score on the scale indicates better balance ability [29]. In the Turkish validity and reliability study, the Cronbach alpha value was found to be 0.96 [30]. In this study, the Cronbach alpha value of the scale was 0.93.

*Timed Up and Go Test (TUG):* The test is easy-to-administer and reliable in assessing balance function. The patient is asked to get up from the sitting position without holding on to the chair arms, walk three meters and then walk back without touching anything, walk towards the chair and return to the sitting position and during this process he/she is evaluated by the observer. The stopwatch is started with the word "start" and stopped when the patient sits down. The duration of TUG was measured in seconds (s). The patient performed three repetitions and the result with the shortest time was recorded. The shortest time achieved indicates a better balance and mobilization ability [31].

### Data collection process

The data were collected between March and June 2024. The purpose of the study was explained to all participants and the data were collected after obtaining their informed consent. The data were collected by the researcher using a personal information form, SAS-SV, PASE, Lawton IADL, FAB-T, and TUG in face-to-face interviews. Data collection took approximately 45 minutes for each participant and was conducted during their visits to YADEM. All assessments were performed by the physiotherapist on the team. After completing the TUG and FAB-T evaluations, participants were given a 5-minute rest period before proceeding with the remaining assessments.

Before the analysis, the participants were divided into two groups according to their SAS-SV scores: those with and those without smartphone addiction. The grouping was based on the cut-off points which were determined in the study conducted by Noyan et al., [25] for females and 33 for males. Based on the cut-off point, it was determined that the group without smartphone addiction consisted of 49 participants and the group with smartphone addiction consisted of 45 participants.

#### Ethical considerations
This study was approved by Sakarya University of Applied Sciences (Decision Number: 14/03/2024-42/05). Before data collection, the researchers explained to the participants the purpose of the study, that voluntary participation was essential, that anonymity was guaranteed, and that their data would be used only for this study. Informed consent was taken from all participants. The patients were also allowed to withdraw from the study any time without stating any reason. The Declaration of Helsinki was adhered to throughout all phases of this study.

#### Data analysis
SPSS version 29.0 (IBM Corp, Armonk, New York) was used for descriptive data and the comparison of groups with and without smartphone addiction. In this study, to increase the methodological rigor, Cronbach's alpha was calculated separately for each scale. The alpha values were interpreted as follows: 0.70-0.79: Acceptable reliability, 0.80-0.89: Good reliability, 0.90 and above: Excellent reliability. When the fit to normal distribution was examined, the z-score values for standard skewness and kurtosis ranged between -1.967 and 1.966 and between -1.608 and 2.521, respectively, and these values were less than 3.29 [32]. Accordingly, it was determined that the data obtained were suitable for normal distribution and structural equation analyses could be performed (Supplementary material 1). Means and standard deviations were used to express continuous data, whereas frequencies and percentages were used for categorical data. In the comparison of groups with and without smartphone addiction, the independent samples t test was used for continuous variables and chi-square test was used for categorical variables.

Standard error of measurement (SEM) was performed to define the effects of smartphone addiction on physical activity, ADL, and balance scores in elderly individuals with chronic diseases using AMOS computer program. The structural model of the study was established with path analysis. Path analysis describes the magnitude and significance of causal relationships between variables and is a component of multiple regression analysis. The effect of an independent variable on the dependent variable is indicated by a standardized regression coefficient (β) in the path model. The critical ratio (CR) was calculated by dividing the value by the standard error of an estimation. The path parameter was statistically significant if the CR for a regression weight was >1.96. The degree of fit of the structural model was also evaluated. The following fit statistics and criteria were adopted to assess the model fit: Chi-square/SD (CMIN/sd ≤3), The Root Mean Square Error of Approximation (RMSEA<0.08), Goodness of fit index (GFI >0.95), Comparative fit index (CFI≥0,90), and Normed fit index (0.95<NFI<1.00). For all data analyses, a p-value of < 0.05 indicated statistical significance.

## Results
The mean age of the participants was 70.67±4.24 years. Approximately half of the participants (51.1%) were female, and the majority (80.9%) were married. Of the participants, 42.6% were primary school graduates and the majority (85.1%) were not actively employed. Only 19.2% of the participants were current smokers and 4.3% consumed alcohol. Most of the participants took one to three drugs daily and only 13.8% had been hospitalized in the past year. When the chronic diseases of the participants were analyzed, 78.7% had any chronic disease. The most common diseases were hypertension (46.8%), diabetes (30.9%), hyperlipidemia (23.4%), osteoporosis (21.3%), asthma/COPD (6.4%), and heart failure (5.3%). The overall life satisfaction of the participants was moderate with a frequency of 66%. Of the participants, 66% spent less than three hours on the smartphone, while 34% spent between three and seven hours. The reasons for smartphone use were as follows: communication (98.9%), news (30.9%), social media (44.7%), messaging (12.8%), and games (12.8%) (Table 1).

When descriptive characteristics were compared between the groups with and without smartphone addiction, there was no difference between the groups in all descriptive data except the duration of daily smartphone use ($p$>0.005). There was a significant difference between the groups in terms of duration of smartphone use ($\chi 2$ =8.474, $p$=0.004) (Table 1).

### Scale score averages and normality test results
The mean SAS-SV, FAB-T, and Lawton IADL scores of the participants were 27.15±9.44, 26.78±8.25, and 6.68±1.46, respectively. The mean total PASE score was 168.93±81.12. The mean scores on the work-related activity, household activity, and leisure time activity subscales of PASE were 28.67±16.46, 60.74±43.92, and 91.72±47.86, respectively. The mean TUG score was 15.36±4.55 seconds (Supplementary Material 1). Table 2.

#### Comparisons between groups and scales
In the comparison of the groups with and without smartphone addiction, there was a significant difference between the groups in terms of Lawton IADL (t=4.223, $p$<0.001), total PASE (t=7.791, $p$<0.001), PASE work-related activity (t=2.541, $p$=0.013), household activity (t=3.598, $p$=0.001), and leisure time activity (t=7.063,

**Table 1** Descriptive characteristics of participants (*N*=94)

| Characteristic | Total | | No smartphone addiction (*n*=49) | | Having a smartphone addiction (*n*=45) | | Test statistic |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Age (year) (Min: 65.0; Max: 80.0) | 70.67±4.24 | | 70.61±4.36 | | 70.73±4.16 | | t=-0.137 p=0.891 |
| Gender | | | | | | | |
| Male | 46 | 48.9 | 20 | 40.8 | 26 | 57.8 | χ2=2.701 |
| Female | 48 | 51.1 | 29 | 59.2 | 19 | 42.2 | p=0.100 |
| Marital status | | | | | | | |
| Married | 76 | 80.9 | 40 | 81.6 | 36 | 80.0 | χ2=0.040 |
| Widowed | 18 | 19.1 | 9 | 18.4 | 9 | 20.0 | *p*=0.841 |
| Education level | | | | | | | |
| Illiterate | 10 | 10.6 | 6 | 12. | 4 | 8.9 | χ2=3.469 |
| Primary school | 40 | 42.6 | 21 | 42.9 | 19 | 42.2 | *p*=0.483 |
| High school | 25 | 26.6 | 10 | 20.4 | 15 | 33.3 | |
| University | 19 | 20.2 | 12 | 24.5 | 7 | 15.6 | |
| Employment | | | | | | | |
| Unemployed- Retired | 80 | 85.1 | 39 | 79.6 | 41 | 91.1 | χ2=2.456 |
| Employed | 14 | 14.9 | 10 | 20.4 | 4 | 8.9 | *p*=0.117 |
| Smoking status | | | | | | | |
| Current Smoker | 18 | 19.2 | 11 | 22.4 | 7 | 15.6 | χ2=1.678 |
| Ex-smoker | 11 | 11.7 | 4 | 8.2 | 7 | 15.6 | *p*=0.432 |
| Never smoked | 65 | 69.1 | 34 | 69.4 | 31 | 68.9 | |
| Alcohol status | | | | | | | |
| Yes | 4 | 4.3 | 2 | 4.1 | 2 | 4.4 | χ2=0.008 |
| No | 90 | 95.7 | 47 | 95.9 | 43 | 95.6 | *p*=0.931 |
| Hospitalization | | | | | | | |
| Yes | 13 | 13.8 | 7 | 14.3 | 6 | 13.3 | χ2=0.018 |
| No | 81 | 86.2 | 42 | 85.7 | 39 | 86.7 | *p*=0.894 |
| Chronic Disease | | | | | | | |
| Yes | 74 | 78.7 | 39 | 79.6 | 35 | 77.8 | χ2=0.046 |
| No | 20 | 21.3 | 10 | 20.4 | 10 | 22.2 | p=0.830 |
| Number of medications taken daily | | | | | | | |
| 1-3 | 67 | 71.3 | 34 | 69.4 | 33 | 73.3 | χ2=1.888 |
| 4-6 | 25 | 26.6 | 13 | 26.5 | 12 | 26.7 | p=0.389 |
| >6 | 2 | 2.1 | 2 | 4.1 | 0 | 0 | |
| Overall life satisfaction | | | | | | | |
| Low | 2 | 2.1 | 1 | 2.0 | 1 | 2.2 | χ2=2.647 |
| Medium | 62 | 66.0 | 36 | 73.5 | 26 | 57.8 | *p*=0.266 |
| High | 30 | 31.9 | 12 | 24.5 | 18 | 40.0 | |
| Average daily smartphone usage time | | | | | | | |
| under 3 hours | 62 | 66.0 | 39 | 79.6 | 23 | 51.1 | χ2=**8.474** |
| Between 3-7 hours | 32 | 34.0 | 10 | 20.4 | 22 | 48.9 | *p*=**0.004** |
| Reason for smartphone use | | | | | | | |
| Communication | 93 | 98.9 | 48 | 98.0 | 45 | 100 | |
| News | 29 | 30.9 | 12 | 24.5 | 17 | 37.8 | |
| social media | 42 | 44.7 | 16 | 32.7 | 26 | 57.8 | |
| Messaging | 12 | 12.8 | 5 | 10.2 | 7 | 15.6 | |
| Game | 12 | 12.8 | 5 | 10.2 | 7 | 15.6 | |

**Table 2** Results Regarding the Scale Scores of the participants (*N*=94)

| Scales | | | Skewness | | | Kurtosis | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Statistic | SE | Z Skewness | Statistic | SE | Z Kurtosis |
| SAS-SV | 27.15 | 9.44 | 0.011 | 0.249 | 0.044 | -0.042 | 0.493 | -0.085 |
| FAB-T | 26.78 | 8.25 | -0.490 | 0.249 | -1.967 | -0.595 | 0.493 | -1.206 |
| PASE Total | 168.93 | 81.12 | 0.418 | 0.249 | 1.678 | -0.048 | 0.493 | -0.097 |
| PASE work-related activities | 28.67 | 16.46 | 1.458 | 0.956 | 1.525 | 0.808 | 0.493 | 1.638 |
| PASE household | 60.74 | 43.92 | 0.266 | 0.249 | 1.068 | -0.793 | 0.493 | -1.608 |
| PASE leisure time | 91.72 | 47.86 | 0.341 | 0.249 | 1.369 | -0.590 | 0.493 | -1.196 |
| Lawton IADL | 6.68 | 1.468 | -1.473 | 0.955 | -1.542 | 1.169 | 0.493 | 2.371 |
| TUG | 15.36 | 4.55 | 1.274 | 0.648 | 1.966 | 2.504 | 0.993 | 2.521 |

*FAB-T* Fullerton Advanced Balance Scale, *Lawton IADL* The Lawton Instrumental Activities of Daily Living Scale, *PASE* Physical Activity Scale for The Elderly, *SAS-SV* Smartphone Addiction Scale-Short Version, *SD* Standard Deviation, *SE* Standard Error, *TUG* Timed Up and Go Test

$p$<0.001). The total PASE score, scores on its subscales, and Lawton IADL scores were lower in the group with smartphone addiction compared to the group without smartphone addiction. There was no significant difference between the groups in terms of FAB-T (t=0.910, $p$=0.365) and TUG (t=-0.471, $p$=0.644) (Table 3).

## Structural equation modeling

All path coefficients are presented in Figure 2. The model showed good fit: CMIN/sd=2.954, GFI=0.975, CFI=0.962, NFI=0.974, RMSEA =0.065. SAS-SV was a direct negative predictor of total PASE (β=-0.518, $p$<0.001), work-related activity (β=-0.211, $p$=0.033), household activity (β=-0.300, $p$=0.002), and leisure activity subscalea (β=-0.483, $p$<0.001). Furthermore, SAS-SV was a direct negative predictor for Lawton IADL (β=-0.320, $p$<0.001). SAS-SV had no effect on FAB-T (β=-0.060, $p$=0.560) and TUG (β=0.000, $p$=0.998). FAB-T had a direct positive predictive effect on total PASE (β=0.186, $p$=0.030) and the work-related activity subscale. FAB-T had a direct positive predictive effect on Lawton IADL (β=0.247, $p$=0.009) but a direct negative effect on TUG (β=-0.541, $p$<0.001) (Table 4).

## Discussion

Elderly individuals differ from other age groups both physically and psychologically. Therefore, it is important to examine the problem of smartphone addiction among elderly individuals, especially its effects on daily life and physical health [7]. In this study, the relationship between smartphone addiction and physical activity, ADL, and balance levels in elderly individuals was examined and it was determined that smartphone use was found to be related to physical activity and ADL in addition to balance.

Smartphone use has increased significantly in recent years, affecting the lives of all users from youth to old age [9]. As a result of increased use, it has been reported in some studies that smartphones cause a decrease in physical activity [17, 33, 34]. In this study, it was determined that the physical activity levels of participants with smartphone addiction were lower than those without addiction and that physical activity levels decreased as

**Table 3** Comparisons Between Groups with and without Smartphone Addiction on Key Variables (*N*=94)

| Scales | No smartphone addiction (n=49) | | Having a smartphone addiction (n=45) | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Test statistic | *P* value |
| FAB-T | 27.53 | 7.93 | 25.97 | 8.60 | 0.910 | 0.365 |
| PASE Total | 217.69 | 65.25 | 115.84 | 61.11 | 7.791 | **<0.001** |
| PASE work-related activities | 23.46 | 33.11 | 8.84 | 20.69 | 2.541 | **0.013** |
| PASE household | 75.44 | 44.67 | 44.73 | 37.38 | 3.598 | **0.001** |
| PASE leisure time | 118.77 | 38.71 | 187.0 | 62.26 | 7.063 | **<0.001** |
| Lawton IADL | 7.24 | 1.03 | 6.06 | 1.62 | 4.225 | **<0.001** |
| TUG | 15.15 | 3.81 | 15.59 | 5.28 | -0.471 | 0.644 |

*FAB-T* Fullerton Advanced Balance Scale, *Lawton IADL* The Lawton Instrumental Activities of Daily Living Scale, *PASE* Physical Activity Scale for The Elderly, *SAS-SV* Smartphone Addiction Scale-Short Version, *SD* Standard Deviation, *TUG* Timed Up and Go Test

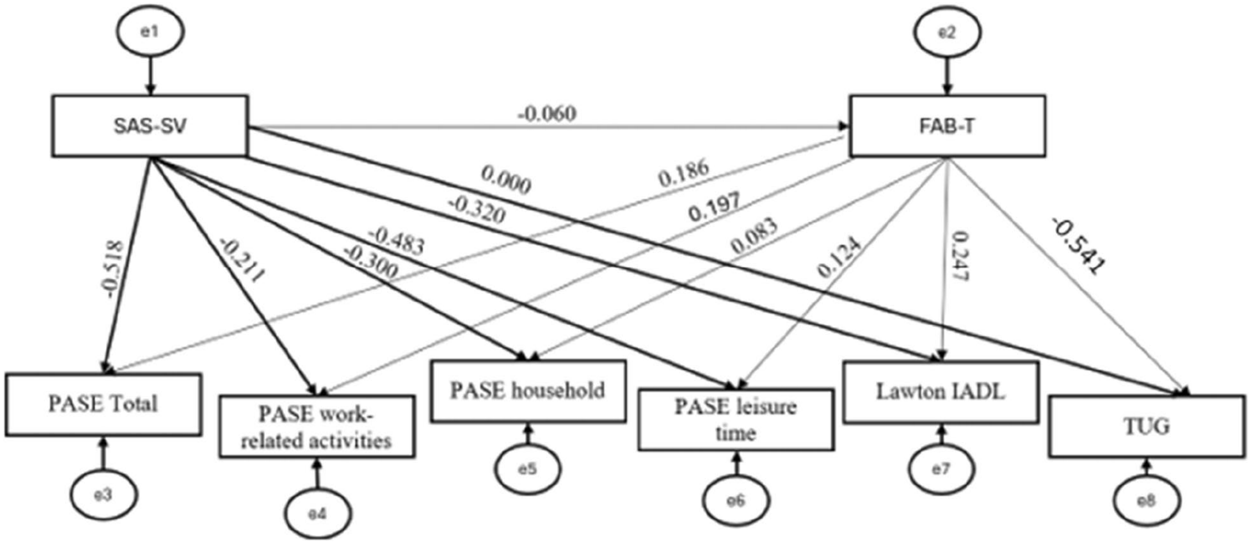


**Fig 2.** Path graph for standardized beta regression. *e1-e8: Standard error, FAB-T: Fullerton Advanced Balance Scale, Lawton IADL: The Lawton Instrumental Activities of Daily Living Scale, PASE: Physical Activity Scale for The Elderly, SAS-SV: Smartphone Addiction Scale-Short Version, SE: Standard error, TUG: Timed Up and Go Test

**Table 4** Results of structural equation modeling (*N*=94)

| Exogenous variables | Path | Endogenous variables | β | SE | *P* value | Critical ratio | Lover (95% CI) | Upper (95% CI) |
|---|---|---|---|---|---|---|---|---|
| SAS-SV | → | FAB-T | -0.060 | 0.090 | 0.560 | -0.583 | -0.238 | 0.118 |
| FAB-T | → | PASE Total | 0.186 | 0.852 | **0.030** | 2.169 | 0.084 | 0.285 |
| FAB-T | → | PASE work-related activities | 0.197 | 0.345 | **0.046** | 1.991 | 0.095 | 0.882 |
| FAB-T | → | PASE household | 0.083 | 0.524 | 0.398 | 0.846 | -0.957 | 1.123 |
| FAB-T | → | PASE leisure time | 0.124 | 0.520 | 0.167 | 1.380 | -0.908 | 1.156 |
| FAB-T | → | Lawton IADL | 0.247 | 0.017 | **0.009** | 2.619 | 0.213 | 0.280 |
| FAB-T | → | TUG | -0.541 | 0.048 | **<0.001** | -6.197 | -0.636 | -0.445 |
| SAS-SV | → | PASE Total | -0.518 | 0.744 | **<0.001** | -6.025 | -1.995 | -0.959 |
| SAS-SV | → | PASE work-related activities | -0.211 | 0.301 | **0.033** | -2.132 | -0.808 | -0.386 |
| SAS-SV | → | PASE household | -0.300 | 0.458 | **0.002** | -3.041 | -1.209 | -0.609 |
| SAS-SV | → | PASE leisure time | -0.483 | 0.454 | **<0.001** | -5.392 | -1.384 | -0.041 |
| SAS-SV | → | Lawton IADL | -0.320 | 0.015 | **<0.001** | -3.390 | -0.349 | -0.290 |
| SAS-SV | → | TUG | 0.000 | 0.042 | 0.998 | 0.002 | -0.083 | 0.083 |

*CI* Confidence Intervals, *FAB-T* Fullerton Advanced Balance Scale, *Lawton IADL* The Lawton Instrumental Activities of Daily Living Scale, *PASE* Physical Activity Scale for The Elderly, *SAS-SV* Smartphone Addiction Scale-Short Version, *SE* Standard error, *TUG* Timed Up and Go Test, β: a standardized regression coefficient.

addiction occurred. In the literature, there are no studies in which the relationship between smartphone use/addiction and physical activity in elderly individuals has been examined. However, there are studies in the literature in which it has been found that smartphones motivate elderly individuals to increase physical activity [35, 36]. In general, the emergence of medical problems such as orthopedic, arthritis, and heart disease in individuals with increasing age may limit participation in physical activity [13]. In addition to these situations, the decrease in physical activity of elderly individuals due to smartphone addiction may further negatively impact the physical health of individuals. The finding obtained from this study revealed that physical activity was overlooked in elderly individuals due to smartphone addiction. However, this finding may be attributed to the fact that elderly individuals may not be aware of health indicator features of smartphones.

In elderly individuals, the ability to perform ADL is one of the factors affecting the quality of life of the individual. In the study, it was found that participants with smartphone addiction had lower ADL scores compared to those without addiction, and it was determined that instrumental ADL decreased as addiction increased. In the literature, there are no studies in which the direct relationship between smartphone use and ADL in elderly individuals has been examined. However, in another study conducted in Türkiye, it was determined that smartphone addiction impaired sleep quality, which is a part of ADL [37]. In a study conducted in Germany with individuals with a mean age of 30, it was determined that individuals experienced a decrease in productivity in their lives due to smartphone addiction and that their daily non-work activities were negatively affected [18]. Despite these studies, in a systematic review, it was emphasized that mobile technology-based applications supported the physical and mental well-being of elderly individuals and that the use of technology devices met cognitive, visual, and hearing needs and facilitated daily life [38]. In a study conducted with elderly individuals living in a nursing home in Türkiye, the effect of physical and cognitive characteristics on smartphone use was examined, and no relationship was reported between the duration of smartphone use and physical functions [12]. In this study, it was determined that elderly individuals had difficulty in performing activities such as cooking, shopping, household, and laundry due to smartphone addiction. The old age period can affect an individual's ADL due to decreases in physical functions [39]. When smartphones are used appropriately, they can be a facilitator in organizing individuals' daily lives [40]. However, becoming unable to meet their own needs due to smartphone addiction may bring the risk of care dependency. In this respect, preventive interventions for smartphone addiction may need to be implemented for elderly individuals.

In the study, it was determined that participants with and without smartphone addiction did not differ in terms of balance and that balance was not directly affected by smartphone use. Similar to the findings of this study, in a study conducted with children aged 8-12 years, it was determined that there was no correlation between screen addiction and static/dynamic balance [34]. Despite these studies, Laatar et al. (2017) evaluated the balance status of individuals when using and not using a mobile phone and reported that mobile phone use impaired the standing balance of elderly and young adults and that talking on a mobile phone had a serious effect on postural balance disorders. In the same study, it was highlighted that dialing a phone number caused impairment in movement in elderly individuals and that elderly adults should be careful while walking and using mobile phones [22]. In a study in which the effect of smartphone addiction on dynamic balance control in healthy physical therapy students was examined, it was revealed that the dynamic balance status of the group with smartphone addiction was impaired compared to the group without smartphone addiction [41]. In a study conducted with healthy adolescents, it was reported that dynamic balance decreased immediately after 30 minutes of consecutive smartphone use; however, these changes in dynamic balance after smartphone use were not permanent and could disappear after one hour of non-use [42]. In another study, it was found that using a smartphone while walking or working complicated dynamic balance [43]. In other studies, it was noted that balance was negatively affected in participants who used their smartphones for more than four hours a day [14, 16]. This study finding, which is not consistent with the literature, suggested that more studies are needed to reveal the effect of smartphone use on balance in elderly individuals.

While this study provides valuable insights into smartphone addiction in elderly individuals, it is important to consider how the findings might apply to elderly populations outside of Türkiye. Cultural and technological differences [44, 45] could impact the extent to which smartphone addiction influences physical activity, ADL, and balance. For example, in countries where smartphone penetration is lower, the effects of addiction on elderly individuals might be less pronounced. Additionally, cultural attitudes towards technology use, physical activity, and aging could shape the relationship between smartphone addiction and its impact on daily life. Further research in diverse settings will help determine the generalisability of these findings across different populations.

### Limitations of the study

This study has several limitations. Since the study was conducted with elderly individuals who applied to a single center in Türkiye in a specific period, the data obtained cannot be generalized to all elderly individuals. Elderly individuals' ability to perform ADL and their participation in physical activity were assessed based on their self-reports. Potential confounders (e.g., baseline physical fitness, socioeconomic status, cognitive impairment) can also be included in structural equation modeling in future studies.

## Conclusion and recommendation

In the study, it was determined that smartphone addiction had a direct effect on the maintenance of physical activity and ADL in elderly individuals but did not lead to a change in balance status. Considering the characteristics of the aging period, in which a decline in physical functioning is also seen, it is important to control the factors that prevent the ability to perform ADL and limit physical activity in elderly individuals. In this context, it may be necessary to teach elderly individuals the features of smartphones that will increase physical activity and manage ADL, and to evaluate the implementation of these activities in certain periods. Furthermore, factors that may cause smartphone addiction in elderly individuals should be identified, information to prevent addiction should be provided, and reminders should be used. A qualitative study based on interviews with elderly people about smartphone addiction is recommended for future studies.

### Abbreviations

| | |
|---|---|
| ADL | Activities of Daily Living |
| CFI | Comparative Fit Index |
| CR | Critical Ratio |
| CMIN/sd | Chi-square/SD |
| FAB-T | Fullerton Advanced Balance Scale |
| GFI | Goodness of Fit Index |
| Lawton IADL | Lawton Instrumental Activities of Daily Living Scale |
| NFI | Normed Fit Index |
| PASE | Physical Activity Scale for the Elderly |
| RMSEA | The Root Mean Square Error of Approximation |
| SAS-SV | Smartphone Addiction Scale-Short Version |
| SEM | Standard Error of Measurement |
| STROBE | The Strengthening the Reporting of Observational Studies in Epidemiology |
| TUG | Timed Up and Go Test |
| YADEM | Sakarya Metropolitan Municipality Elderly Support and Coordination Center |

## Supplementary Information

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Supplementary Material 1.

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### Authors' contributions

Oğuzhan Bahadır Demir: Conceptualization, Methodology, Data curation, Investigation, Writing – review & editing. Aylin Bilgin: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review &editing. Feride Taskin Yilmaz: Conceptualization, Methodology, Writing – original draft, Writing – review &editing.

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### Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

This study received ethical approval from the Ethics Committee of Sakarya University of Applied Sciences (Decision No: 14/03/2024-42/05). This study was performed in accordance with the Helsinki Declaration of 2013.

### Consent for publication

Not applicable.

### Competing Interests

The authors declare no competing interests.

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## Publisher's Note