

Araştırma Makalesi

A Comparison of Cognitive Function, Physical and Mental Fatigue, and Dual-Task Difficulties in Physically Active and Inactive Young Adults

Fiziksel Aktivite Yapan ve Yapmayan Genç Erişkinlerde Bilişsel Durum, Fiziksel ve Zihinsel Yorgunluk ve İkili Görev Zorluklarının Karşılaştırılması

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ABSTRACT

Purpose: Physical activity is associated with cognitive function, fatigue, and dual-task difficulties; however, these variables have not been sufficiently examined together in young adults. This study aimed to compare cognitive status, physical and mental fatigue, and dual-task difficulties between physically active and inactive young adults. **Material and Methods:** A total of 181 young adults were included. Data were collected online using a sociodemographic form, Cognitive Failures Questionnaire (CFQ), Fatigue Severity Scale (FSS), Mental Fatigue Scale (MFS), and Dual-Task Questionnaire (DTQ). Participants were divided into physically active (≥ 3 days/week) and inactive (< 3 days/week) groups. **Results:** The study was conducted with 174 participants (134 females, 40 males; mean age: 24.82 ± 5.59 years). Physically active individuals ($n=81$) had significantly better cognitive function and experienced fewer dual-task difficulties than inactive individuals ($p<0.05$). No significant differences were found between the groups in physical or mental fatigue ($p>0.05$). **Discussion:** Physically inactive young adults demonstrated poorer cognitive function and experienced more dual-task difficulties than their physically active counterparts. However, no significant differences were observed in physical or mental fatigue. These findings suggest that regular physical activity may be associated with better cognitive function and fewer dual-task difficulties in everyday life. The use of objective assessment methods is recommended in future studies.

Keywords: Physical Activity; Cognition; Fatigue; Young Adult.

ÖZ

Amaç: Fiziksel aktivite, bilişsel işlevler, yorgunluk ve ikili görev zorluklarıyla ilişkili bir kavramdır. Ancak genç yetişkinlerde bu değişkenlerin birlikte incelendiği çalışmalar sınırlıdır. Bu çalışmada, fiziksel aktivite yapan ve yapmayan genç yetişkinlerde bilişsel durum, fiziksel ve zihinsel yorgunluk ile ikili görev zorluklarının karşılaştırılması amaçlandı. **Gereç ve Yöntem:** Çalışmaya 181 genç yetişkin dahil edildi. Sosyo-demografik bilgi formu, Bilişsel Durum Ölçeği (BDÖ), Yorgunluk Şiddet Ölçeği (YŞÖ), Zihinsel Yorgunluk Ölçeği (ZYÖ) ve İkili Görev Anketi (İGA) kullanılarak veriler çevrimiçi olarak toplandı. Katılımcılar, fiziksel olarak aktif (haftada ≥ 3 gün) ve inaktif (haftada < 3 gün) olmak üzere iki gruba ayrıldı. **Sonuçlar:** Çalışma 174 genç yetişkin (134 kadın, 40 erkek; yaş: $24,82 \pm 5,59$ yıl) ile tamamlandı. Fiziksel olarak aktif bireyler ($n=81$), inaktif bireylere kıyasla anlamlı düzeyde daha iyi bilişsel fonksiyona sahipti ve ikili görev sırasında daha az güçlük yaşadı ($p<0.05$). Gruplar arasında fiziksel veya mental yorgunluk açısından ise anlamlı bir farklılık bulunmadı ($p>0.05$). **Tartışma:** Fiziksel olarak inaktif genç yetişkinler, aktif olanlara kıyasla daha düşük bilişsel fonksiyona sahipti ve ikili görev sırasında daha fazla güçlük yaşadı. Buna karşın, fiziksel ve mental yorgunluk açısından gruplar arasında anlamlı bir farklılık bulunmadı. Bu bulgular, düzenli fiziksel aktivitenin daha iyi bilişsel fonksiyonla ve günlük yaşamda ikili görev sırasında daha az güçlük yaşanmasıyla ilişkili olabileceğini göstermektedir. Gelecek çalışmalarda objektif değerlendirme yöntemlerinin kullanılması önerilmektedir.

Anahtar Kelimeler: Fiziksel Aktivite; Biliş; Yorgunluk; Genç Erişkin.

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Human health is a multidimensional construct encompassing physical, mental, and social well-being, with lifestyle behaviors representing key determinants of these domains (Bull et al., 2020; Kujala, 2018). These behaviors include physical activity—defined as any skeletal muscle movement that results in energy expenditure—which plays a fundamental role in determining cognitive, physical, and psychological health (Warburton & Bredin, 2017). Regular engagement in physical activity contributes not only to the maintenance of metabolic and cardiovascular health but also to the preservation of neurocognitive function and psychological well-being (Stamatakis et al., 2019). On the other hand, physical inactivity has been identified as a major modifiable risk factor for multiple adverse health outcomes, such as cardiovascular disease, type 2 diabetes, certain types of cancer, cognitive disorders, and premature death (Bull et al., 2020). The WHO recommends that adults engage in 150–300 minutes of moderate-intensity or 75–150 minutes of vigorous-intensity physical activity per week (Bull et al., 2020).

Physical activity plays an important role in maintaining health during young adulthood, a period in which physical activity habits are often established or disrupted, with lasting implications for health later in life (Bonnie et al., 2015; Vanhelst et al., 2023). However, global data show that approximately 31% of adults do not meet the recommended levels of physical activity, and this percentage has been increasing in recent years (Strain et al., 2024). In Turkey, this issue is even more pronounced, with 43.6% of individuals not achieving WHO-recommended levels of physical activity (Republic of Turkey Ministry of Health, 2019). An increasing amount of evidence suggests that physical activity has beneficial effects on cognitive processes, such as executive function, attention, speed of processing, and short- and long-term memory (Kekäläinen et al., 2023). These effects are mediated by several neurophysiological mechanisms, such as increased cerebral blood flow and enhanced oxygen delivery to brain tissues (Stillman et al., 2020; Martín-Rodríguez et al., 2025).

In addition to cognitive benefits, regular physical activity may reduce fatigue perception by improving energy metabolism, modulating central nervous system activity, and enhancing muscular endurance (Lane et al., 2025). However, the relationship between physical activity and fatigue is complex and not always consistent, as it may be influenced by various physiological and psychosocial factors (Barakou et al., 2023; Runge et al., 2023). Fatigue is a multidimensional construct that negatively affects both physical and cognitive performance. While physical fatigue is primarily

associated with impairments in energy metabolism and muscle function, mental fatigue is characterized by reductions in attention, motivation, and cognitive efficiency (Lane et al., 2025; Zhang et al., 2026).

Cognitive functions are essential for planning daily activities, decision-making, responding appropriately to environmental stimuli, and effectively managing everyday life (Diamond & Ling, 2020). Many activities of daily living require the simultaneous performance of motor and cognitive tasks, a phenomenon commonly referred to as dual-tasking (Wollesen et al., 2020). Dual-task performance is closely associated with higher-order cognitive processes, including executive function, attention, and working memory (Moreira et al., 2021). The simultaneous performance of motor and cognitive tasks imposes additional demands on the central nervous system, leading to performance variability depending on cognitive capacity, attentional control, and motor coordination (Lim et al., 2025). Emerging evidence suggests that physical activity may enhance dual-task performance through improvements in motor control, postural stability, and executive functioning (Feng & Chen, 2025; Wang et al., 2026).

Although many studies have examined the relationship between physical activity and cognitive function (Erickson et al., 2019; Herold et al., 2019; Chen et al., 2020), research examining the combined associations of physical activity with cognitive status, physical and mental fatigue, and dual-task difficulties remains limited. Most of the available evidence comes from studies conducted in older adults or clinical populations, such as individuals with stroke. Therefore, these findings should be interpreted cautiously, as they may not be directly applicable to healthy young adults. To the best of our knowledge, no studies in Turkey have compared cognitive function and dual-task difficulties according to physical activity levels in young adults, a population with relatively low levels of physical activity. Given the high prevalence of physical inactivity in Turkey (Guthold et al., 2018), there is a critical need for research that informs interventions aimed at promoting active lifestyles. Therefore, the present study was designed to compare cognitive status, physical and mental fatigue, and dual-task difficulties between physically active and inactive young adults. This study hypothesizes that physically active young adults have better cognitive status, experience fewer dual-task difficulties, and report lower levels of physical and mental fatigue than physically inactive young adults.

MATERIAL AND METHODS

Study Design and Participants

This cross-sectional observational study was conducted in accordance with the ethical principles of the Declaration

of Helsinki. Data collection occurred between December 2025 and March 2026. Ethical approval was obtained from the Gülhane Scientific Research Ethics Committee (approval date: December 18, 2025; decision number: 2025-038).

The study sample comprised individuals aged 18–45 years who were native Turkish speakers, literate, and able to use a smartphone. Participants were recruited through a snowball sampling method. An online survey was created using Google Forms and sent out via social media platforms (such as WhatsApp and Telegram). All of the participants got detailed information about the study and gave their informed consent electronically before taking part.

The data were collected using a structured socio-demographic information form developed by the researchers, along with the Cognitive Failures Questionnaire, Fatigue Severity Scale, Mental Fatigue Scale, and Dual-Task Questionnaire.

The exclusion criteria were neurological, psychiatric, or orthopedic history, or oncological disorders; systemic diseases associated with widespread musculoskeletal pain or increased fatigue; regular use of sedatives, high-dose antidepressants, opioid analgesics, or neuroleptics; major surgery within the previous three months; and professional athlete status.

Data Collection Tools

Sociodemographic Information Form

A structured questionnaire developed by the researchers was used to obtain participants' sociodemographic characteristics. The form included items on age, sex, height, weight, educational status, and average daily sleep duration.

Participants were divided into two groups: physically active (Group I) and physically inactive (Group II). Individuals were classified as active if they engaged in vigorous physical activity for at least 30 minutes on three or more days per week. Those who performed vigorous physical activity for less than 30 minutes three times per week were classified as inactive (Victor et al., 2023).

Cognitive Failures Questionnaire (CFQ)

The Cognitive Failures Questionnaire, developed by Broadbent et al., is a 25-item Likert-type self-report instrument that assesses lapses in attention, memory, and motor functioning in daily life (Broadbent et al., 1982). Each item is rated on a five-point scale ranging from 0 (never) to 4 (very often), with higher total scores indicating greater frequency of cognitive failures. The Turkish validity and reliability study of the CFQ was conducted by Ekici et al. (2016). As the scale does not have a defined cutoff value, total scores were used for analysis in the present study.

Fatigue Severity Scale (FSS)

The Fatigue Severity Scale, developed by Krupp et al. (1989), is a 9-item self-report instrument used to evaluate the impact of fatigue on daily functioning. Each item is rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), and the total score is calculated as the sum of all items. A mean score ≥ 5 indicates clinically significant fatigue, with higher scores reflecting greater fatigue severity. The Turkish version of the FSS has demonstrated high internal consistency and reliability (Armutlu et al., 2007), with reported Cronbach's alpha values ranging from 0.89 to 0.91 across studies.

Mental Fatigue Scale (MFS)

The Mental Fatigue Scale, developed by Johansson et al. (2010), is a multidimensional instrument designed to assess mental fatigue. It includes items related to attention, concentration, mental endurance, and sensory sensitivity. Each item is scored on a scale ranging from 0 to 3, with higher total scores indicating greater levels of mental fatigue. The original cutoff score for the scale is 10.5. The Turkish validity and reliability study conducted by Kılınc et al. (2021) reported good internal consistency (Cronbach's $\alpha = 0.86$).

Dual-Task Questionnaire (DTQ)

Dual-task performance was assessed using the Dual-Task Questionnaire developed by Evans et al. (2009). This self-reporting instrument evaluates difficulties encountered during the simultaneous performance of cognitive and motor tasks in daily life. The questionnaire consists of 10 items addressing domains such as divided attention, task prioritization, and cognitive–motor interaction. Items are rated on a Likert-type scale ranging from 0 (never) to 4 (most of the time), with higher total scores indicating greater dual-task-related difficulties. The Turkish version of the DTQ has been evaluated in different populations, demonstrating acceptable internal consistency, with a Cronbach's alpha of 0.78 in individuals with multiple sclerosis and approximately 0.70 in the general population (Eldemir et al., 2022). Additionally, international studies report internal consistency coefficients exceeding 0.80, supporting the validity and reliability of the instrument.

Statistical Analysis

All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as mean $\pm$ standard deviation or median (minimum–maximum) for continuous variables, as appropriate and as counts (n) and percentages (%) for categorical variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. For variables that did not

meet the assumption of Normal distribution, nonparametric tests were applied. Specifically, the Mann–Whitney U test was used for comparisons of two independent groups, and the chi-square test was used for categorical variables. The results were considered statistically significant if the two-tailed p-value was <0.05 . The required sample size was determined a priori using G*Power software (version 3.1.9.2; Heinrich Heine University, Düsseldorf, Germany). For between-group comparisons, a significance level (α) of 0.05, a statistical power ($1-\beta$) of 0.90, and a moderate effect size (Cohen's $d = 0.50$) were assumed. Based on these parameters, a minimum of 70 participants per group (physically active vs. physically inactive) was calculated to be sufficient.

RESULTS

A total of 181 individuals were initially recruited for the study. Seven participants were excluded due to incomplete or incorrectly completed questionnaires, resulting in a final sample of 174 healthy young adults. Participants were categorized into two groups: physically active individuals (Group I, $n = 81$) and physically inactive individuals (Group II, $n = 93$). The overall sample comprised 134 women and 40 men, with a mean age of 24.82 ± 5.59 years.

A statistically significant difference was observed between the groups with respect to average sleep duration ($p < 0.05$). No significant differences were found between the groups for other demographic characteristics, indicating that the groups were comparable in these aspects ($p > 0.05$) (Table 1).

Table 1. Comparison of descriptive characteristics of the groups

Variables		Group I (n=81) %/median [min–max]	Group II (n=93) %/median [min–max]	p
Sex	female	61 (%75.3)	73 (%78.5)	.618
	male	20 (%24.7)	20 (%21.5)	
Education	elementary and middle school	2 (%2.5)	4 (%4.3)	.509
	high school and above	79 (%97.5)	89 (%95.7)	
Marital status	single	72 (%88.9)	77 (%82.8)	.253
	married	9 (%11.1)	16 (17.2)	
Smoking	yes	24 (%29.6)	23 (24.7)	.468
	no	57 (%70.4)	70 (75.3)	
Employment status	yes	21 (%25.9)	36 (%38.7)	.073
	no	60 (74.1)	57 (61.3)	
BMI	<18.5	6 (%7.4)	8 (%8.6)	.827
	18.5-24.9	49 (%60.5)	52 (%55.9)	
	25 and older	26 (%32.1)	33 (%35.5)	
Sleep	<7 hours	39 (%48.1)	62 (%66.7)	.014
	7 hours	42 (%52.9)	31 (%33.3)	
Age	years	24.00 [22.00-27.00]	24.00 [21.00-27.50]	.617
Computer time	hours	1.50 [0.00-4.00]		.139
Mobile phone time	hours	5.00 [3.00-6.00]		.649
Television time	hours	0.50 [0.00-1.00]		.714

BMI: Body Mass Index, * $p < .05$

Comparisons between physically active and inactive participants revealed statistically significant differences in cognitive function and dual-task difficulties ($p < 0.05$), with physically active participants demonstrating better

cognitive function and experiencing fewer dual-task difficulties. In contrast, no significant differences were observed between the groups for physical fatigue or mental fatigue scores ($p > 0.05$) (Table 2).

Table 2. Comparison of groups in terms of cognitive state, physical and mental fatigue, and dual-task performance

Outcome Measures (Score Range)	Group I (n=81) Mean±SD	Group II (n=93) Mean±SD	z	p
CFQ (0-100 points)	37.20±17.18	45.43 ±15.64	-2.783	.005*
FSS (9-63 points)	39.72±11.25	41.70±11.30	-.945	.345
MFS (0-42 points)	14.79±7.45	14.88±6.69	-.193	.847
DTQ (0-40 points)	13.35±8.62	15.70±6.41	-2.804	.005*

CFQ: Cognitive Failures Questionnaire, FSS: Fatigue Severity Scale, MFS: Mental Fatigue Scale, DTQ: Dual-Task Questionnaire,

* $p < .05$ Mann-Whitney U Test

DISCUSSION

This study compared cognitive status, physical and mental fatigue, and dual-task difficulties between young adults who engage in regular physical activity and those who do not. The main finding of this study is that physically active young adults demonstrated better cognitive function and experienced fewer dual-task difficulties than physically inactive young adults. These findings support the potential role of physical activity in maintaining cognitive function and managing the simultaneous execution of cognitive and motor tasks in daily life. However, the absence of between-group differences in fatigue suggests that fatigue in healthy young adults is likely influenced by multiple factors beyond physical activity alone.

The present results showing enhanced cognitive performance in physically active individuals align with previous research indicating that physical activity positively influences executive functions, attention, and information processing speed (Ali et al., 2022; Chávez-Hernández et al., 2024). Stillman et al. reported that individuals engaging in regular physical activity exhibit improved executive functions and attentional performance compared to inactive peers (Stillman et al., 2020). These cognitive benefits are thought to be mediated by neurophysiological mechanisms, including increased cerebral blood flow and the upregulation of neurotrophic factors, which promote neuroplasticity, particularly in the prefrontal cortex and hippocampal regions.

The observed differences in dual-task difficulties are noteworthy. Physically active individuals experienced less difficulty performing cognitive and motor tasks simultaneously, which may reflect enhanced executive function, attentional control, and more efficient cognitive-motor integration (Ali et al., 2022). The literature indicates that physical activity facilitates

cognitive-motor integration by improving motor control, postural stability, and attention processes, thus enhancing dual-task performance (Aminirakan et al., 2026). Training programs incorporating simultaneous cognitive and motor tasks have been shown to provide significant improvements in both areas (Gobbo et al., 2026). Similarly, a study conducted in 2025 with healthy young adults demonstrated that motor-cognitive dual-task training significantly enhanced executive functions and dual-task performance (Surkar et al., 2025), supporting the findings of the present study.

In contrast, no significant differences were observed between physically active and inactive participants in terms of physical or mental fatigue. Although this may initially seem contradictory to the established benefits of physical activity on fatigue, the literature emphasizes that fatigue is a multidimensional construct influenced by numerous factors beyond physical activity, including sleep duration, psychological stress, academic or occupational workload, and overall lifestyle (Barakou et al., 2023; Runge et al., 2023; McGranahan & O'Connor, 2024). Recent studies highlight that, particularly in healthy young adults, the relationship between physical activity and fatigue becomes more apparent when examined in conjunction with these additional factors (Baran & Yılmaz, 2025; Uysal & Kurul, 2025).

The physically active group also reported longer sleep duration. Because sleep may affect cognitive performance and fatigue, its potential influence on the observed differences between groups cannot be excluded. Sleep duration and quality also significantly impact cognitive performance and daily functioning. Recommended sleep duration for young adults is generally 7–9 hours, with deviations associated with impairments in attention, executive functions, and processing speed (You et al., 2023; Sen & Tai, 2023; Keil et al., 2023). Moreover, emerging evidence suggests that

physical activity and sleep jointly influence cognitive performance and are associated with the structural integrity of brain regions critical for cognition, including the hippocampus and medial temporal lobe (Callow et al., 2025). Consequently, the interaction between sleep patterns and physical activity should be considered when evaluating cognitive outcomes in young adults. Therefore, the longer sleep duration observed in the physically active group may have influenced the present findings and should be considered when interpreting the results.

This study has some limitations. First, the cross-sectional study design limits causal inferences regarding the relationships between physical activity, cognitive function, and dual-task difficulties. Second, objective measures, such as accelerometry for physical activity and comprehensive neuropsychological assessments for cognitive function, were not used. Third, the Turkish version of the DTQ has been validated only in individuals with multiple sclerosis, and there is limited evidence supporting its validity in healthy young adults. Despite this limitation, to the best of our knowledge, this is the first study to simultaneously examine cognitive status, physical and mental fatigue, and dual-task difficulties in physically active and inactive young adults. These findings provide a foundation for future research and emphasize the need for objective assessments of physical activity to better understand its relationship with cognitive function and dual-task difficulties and to improve the validity and generalizability of future studies.

Ethical Approval

Ethical approval was obtained from the Gülhane Scientific Research Ethics Committee (approval date: December 18, 2025; decision number: 2025-038) and was conducted in accordance with the Helsinki Declaration.

Authors' Contribution

EA: Concept/idea development, study design, data collection/processing, literature review, writing manuscript. ÖİÖ: Concept/idea development, study design, data collection/processing, literature review, data analysis/interpretation, critical review

Conflict of Interest

The authors declare no conflict of interest.

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