

Original Article

Green Exercise Scale: Development and Validation

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What is already known on this topic?

- Green exercise refers to regular physical activity performed in natural environments.
- Research comparing the health outcomes of green exercise with those of indoor exercise is gaining increasing importance.
- However, studies on green exercise exhibit several methodological limitations that restrict the strength of their findings.
- Most research focuses on short-term effects, and the lack of longitudinal studies hinders the evaluation of long-term benefits.
- Many studies rely on experimental interventions with small participant groups, which limits the generalizability of the findings.

What does this study add to this topic?

- The Green Exercise Scale is the first validated and reliable instrument specifically developed to measure green exercise behavior.
- Rather than measuring general physical activity or environmental attitudes, it directly targets participants' green exercise behaviors.
- It can be easily integrated into comprehensive research models and repeated or longitudinal field studies.
- Its concise structure reduces participant fatigue and significantly increases response rates.

Abstract

This study aims to develop and validate a scale for measuring green exercise behavior. Five hundred twenty-three participants were included in this study. Exploratory factor analysis was conducted with 204 participants and confirmatory factor analysis was conducted with 319 participants. The Green Exercise Scale had a 7-item, one-factor structure. The explained variance of the scale was 60%. The model fit indices were $\chi^2/df=3.708$, Comparative Fit Index (CFI) = .983, Tucker-Lewis Index (TLI) = .968, and Standardized Root Mean Square Residual (SRMR) = .022. Configural, metric, and scalar invariance across gender was confirmed. The Cronbach's alpha value of the scale was .93. The correlation between the Green Exercise Scale and the Satisfaction with Life Scale was .21 ($p < .001$). This study makes a significant contribution to the methodological development of outdoor recreation, physical activity, and health-related fields by introducing a brief but comprehensive tool for measuring green exercise behavior.

Keywords: Green exercise, life satisfaction, measurement invariance, outdoor recreation, scale development, validity and reliability

Introduction

Physical inactivity among adults increased by 5% globally between 2010 and 2022, with one-third of adults (31%), approximately 1.8 billion people, failing to meet recommended levels of physical activity by 2022 (Strain et al., 2024). This poses a silent threat to global health and contributes considerably to the burden of chronic diseases. Physical inactivity constitutes a significant modifiable risk factor for non-communicable diseases (NCDs) and mental health disorders, encompassing stroke, hypertension, type 2 diabetes, coronary heart disease, various cancers, dementia, depression, and overall mortality, particularly from cardiovascular diseases (Katzmarzyk et al., 2022). If the prevalence of physical inactivity does not change, it is estimated that there will be 499.2 million new preventable cases of major NCDs worldwide by 2030, with direct healthcare costs of INT\$520 billion (Santos et al., 2023).

In response to this global challenge, the World Health Organization's (WHO) Global Action Plan on Physical Activity 2018-2030 (GAPPA) presents a comprehensive strategy to increase physical activity levels worldwide. The main goal of the plan is to reduce the global prevalence of physical inactivity by 15% by 2030. To achieve this goal, GAPPA has developed four strategic goals and twenty policy actions defined as creative active societies, environments, people, and systems. These strategies will raise awareness of the health and well-being benefits of physical activity to encourage people of all ages to be regularly active and improve physical and social environments such as safe infrastructure, footpaths, cycle paths, and green spaces to support and encourage physical activity. They will also increase opportunities for physical activity in schools, workplaces, and communities to help individuals adopt active lifestyles and strengthen leadership, governance, multi-sectoral collaboration, financing, and monitoring mechanisms to effectively implement policies that promote physical activity (WHO, 2019).

One of the World Health Organization's key strategies for promoting physical activity is the development of green spaces, which serve as vital physical and social environments. Strong evidence suggests that

simply having access to green spaces is linked to both physical and mental well-being (Sugiyama et al, 2018). Exposure to green spaces, both physically and visually, has been associated with reduced stress (Hazer et al., 2018) and positive physiological responses that indicate a relaxed state (Tsunetsugu et al., 2013). Furthermore, a growing body of evidence suggests that natural environments, such as green spaces, facilitate and encourage physical activity (Calogiuri & Chroni, 2014; Flowers et al., 2016), thereby supporting behavioral change and enhancing public health (Wolch et al., 2014).

Engagement in physical activity in green spaces has been conceptualized as green exercise in recent decades. Green exercise can be defined as regular physical activity performed in green spaces where individuals can connect with nature. It refers to a behavioral construct that integrates nature into health-oriented practices. Green exercise moves beyond merely engaging in exercise or interacting with nature to promote physical health; it emphasizes the integration of physical activity in green environments into one's lifestyle.

Green exercise significantly contributes to mental health. For instance, Barton and Pretty (2010) conducted a meta-analysis of studies in the UK, demonstrating substantial positive effects of green exercise on various measures of mood and self-esteem. Woods et al. (2017) reported that providing adequate public green spaces in local neighborhoods and within walking distance is crucial for promoting positive mental health. Beyond reducing stress, depression, and blood pressure, green exercise can also boost self-esteem and enhance mood. Additionally, it improves heart rate variability, a key marker of cardiovascular health (Wood & Smyth, 2020). Moreover, a systematic review by Tsokani et al. (2024) suggests that green exercise is a safe and effective intervention for improving various chronic health conditions. Additionally, studies suggest that exercise in green spaces can offer greater health benefits, particularly in enhancing participants' mood, compared to exercise in indoor or urban environments (Bowler et al., 2010; Richardson et al., 2013). One of the main explanations for this advantage is that outdoor physical activity is often perceived as more enjoyable than indoor exercise, a perception supported by strong evidence indicating that natural environments significantly enhance feelings of pleasure, motivation, and psychological well-being (Peddie et al., 2024). However, it is argued that further research with larger sample sizes is needed to strengthen these findings (Noseworthy et al., 2023).

Despite extensive evidence supporting the benefits of green exercise, there is still limited information on how individuals' thoughts and feelings about it influence participation and subsequent outcomes (Flowers et al., 2016). Moreover, most existing studies are short term, neglect the influence of environmental context, focus on narrow demographic groups, and suffer from methodological inconsistencies and a lack of standardized measurement tools (Laezza et al., 2024). This gap could restrict our ability to develop effective interventions or policies that encourage green exercise. Accordingly, the development of a standardized and reliable instrument to assess individuals' experiences with green exercise addresses a critical need in both research and practice. Such a tool would not only enhance the rigor of future research but also provide valuable insights for health professionals, urban designers, and policymakers aiming to promote nature-based physical activity as a public health strategy.

Therefore, the purpose of this study is to develop and validate a scale for measuring green exercise behavior. To ensure conceptual clarity, it is necessary to delineate the distinguishing features of the Green

Exercise Scale (GES) in relation to other established constructs in environmental psychology. In the present study, green exercise is conceptualized as a measurable behavioral pattern of regular, deliberate physical activity performed in green spaces. The construct measured by the GES does not measure psychological identification with nature or pro-environmental attitudes. Even though the GES has items emphasizing lifestyle integration, the items refer to the habitual incorporation of this behavior into daily routines rather than a stable environmental identity. This operationalization considers green exercise as a behavioral construct focused on the regularity of nature-based physical activity, thereby distinguishing it from concepts that assess subjective bonds or self-identity. For instance, "nature connectedness" or "connectedness to nature" refers to the extent to which a person incorporates nature as part of their identity, experiences a sense of belonging to a larger whole, and recognizes similarities between themselves and other living beings (Schultz, 2002). Similarly, "environmental identity" defines a sense of collective belonging, akin to national or ethnic identity (Clayton, 2003). The GES, on the other hand, does not measure these psychological or identity-based dimensions; it measures regular engagement in green exercise.

Material and Methods

Initial Scale Generation

Following DeVellis' (2017) scale development guidelines, the initial scale generation phase began with a clear conceptualization of the target construct. Green spaces were conceptualized as places surrounded by natural elements such as walking paths, parks, gardens, forests, and mountains. Exercise was conceptualized as regular and planned physical activities such as walking, jogging, cycling, and yoga. To identify key themes and theoretical foundations related to green exercise, an extensive literature review was conducted. Concepts such as habitual physical activity in natural settings, the integration of nature-based exercise into daily routines, and the use of green spaces for physical and mental well-being were centered in the construct (Barton & Pretty, 2010; Calogiuri et al., 2016; Calogiuri & Elliott, 2017; Hunter et al., 2019; Shanahan et al., 2016; Thompson Coon et al., 2011; White et al., 2019). The initial scale included 12 items written from a first-person perspective and designed to reflect green exercise behavior. Each item was carefully generated to reflect the habitual and embedded nature of green exercise in one's life, while avoiding complex, double-barreled, and multiple negative statements.

Scale Purification

Eight subject matter experts were invited to review the initial item pool of the Green Exercise Scale. These experts were selected based on their academic expertise in relevant fields, including recreation and leisure studies, exercise and health sciences, and environmental psychology. Each expert was provided with the definition of the target construct and asked to evaluate the clarity, relevance, and representativeness of each item in relation to the construct, using a structured evaluation form.

Following the expert evaluation, necessary revisions were made to improve the linguistic clarity of certain items and ensure conceptual alignment across the scale. Items that were found to overlap or were ambiguously worded were revised or merged. For instance, the initial item was revised from "I regularly exercise in nature" to "I regularly exercise in green spaces." The initial wording was considered ambiguous, as the term "nature" could also be interpreted as including blue

spaces (such as seas, rivers, or lakes) in addition to green environments. Based on expert recommendation, the more precise term “green spaces” was adopted to prevent this conceptual overlap and ensure alignment with the green exercise literature. Suggestions regarding cultural context and behavioral specificity were also integrated. In addition, the item “*I make time to exercise outdoors whenever I have the opportunity*” was excluded because the term “outdoors” is too broad and may include non-green environments such as streets or urban spaces. Moreover, the phrase “whenever I have the opportunity” emphasizes situational availability rather than actual behavior. To maintain conceptual clarity and ensure the scale measures exercise specifically in green spaces, the item was removed. This procedure resulted in a refined set of 10 items. At the final stage, the exploratory factor analysis was conducted, and three items with communalities below .40 were removed from the scale. The final version of the Green Exercise Scale consisted of seven items measured on a five-point Likert scale, ranging from 1 “*strongly disagree*” to 5 “*strongly agree*.”

Participants and Procedure

The survey was administered to undergraduate and graduate students enrolled at three large public universities located in different regions of Turkey (western, central, and southern) during April 2025. Participants were recruited through announcements made in classrooms, and participation was voluntary. To mitigate the threat of mono-method bias, the study employed technological medium separation across the two phases of the data collection. Specifically, data for the exploratory factor analysis (EFA) were collected through a paper-based, face-to-face format, while data for the confirmatory factor analysis (CFA) were collected via an online survey platform (Google Forms). According to Podsakoff et al. (2024), using different methods of data collection introduces methodological separation, which can reduce the likelihood of response tendencies tied to a specific medium. Prior to completing the survey, participants were informed about the purpose of the study and assured that there were no right or wrong answers. They were also informed that their participation was voluntary and that they could withdraw at any time without penalty. To minimize social desirability bias, no personal identifiers were collected, and the anonymity of responses was emphasized. Ethical approval was granted by the University Research Ethics Committee, and informed consent was obtained from each participant.

Following data screening for incomplete or invalid responses, 204 appropriate questionnaires were included in the EFA dataset. The EFA sample comprised 71 females (34.8%) and 133 males (65.2%). Participants’ ages ranged from 18 to 45 years ($M=22.21$, $SD=5.62$). The CFA sample group consisted of 319 participants. 195 of them were female (61.1%) and 124 were male (38.9%). Their ages ranged from 18 to 48 years ($M=29.03$, $SD=5.87$). The concurrent validity analysis was conducted using the combined dataset from both the EFA and CFA samples.

Measure

Satisfaction with Life Scale (Diener et al., 1985) was used to measure life satisfaction. The unidimensional scale consists of five statements. Participants were asked to indicate the degree to which they agreed with each statement using a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Diener et al. (1985) reported that the scale had an internal consistency of .87. The psychometric evaluation of the Turkish version of the scale was conducted by Durak et al. (2010). In the present study, the internal consistency was .85.

Data Preparation

First, it was ensured that there were no missing values in the data set. Then, outliers were assessed through standardized z-scores. No values exceeding ± 4 were found (Hair et al., 2019). The normality of item distributions was evaluated using skewness and kurtosis values. All items were within acceptable ranges of ± 2 (George & Mallery, 2019). Multicollinearity was assessed using the Variance Inflation Factor (VIF). For all the items, VIF values were below the threshold of 5 (Hair et al., 2019).

Ethical Consideration

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of İstanbul Yeni Yüzyıl University (Approval No: 2025/04-1515; Date: April 08, 2025) prior to data collection. All participants were informed about the purpose and procedures of the study and provided their voluntary and informed consent. Participation was anonymous, and all data were treated confidentially and used solely for scientific purposes. No personally identifiable information was collected.

Results

Exploratory Factor Analysis

In the initial stage of exploratory factor analysis, parallel analysis based on 1000 randomly generated correlation matrices using Monte Carlo simulations was employed to determine the number of factors to retain. A parallel analysis was performed using Monte Carlo PCA for Parallel Analysis software (Watkins, 2006). This method is recognized as the most precise technique for determining factor retention (Hayton et al., 2004; Steger, 2006). In the analysis, all items were used to generate random eigenvalues for comparison with those obtained from the EFA. Factors were retained if their eigenvalues from the actual data were higher than those obtained from randomly generated data. The analysis showed that only the first eigenvalue from the actual data ($\lambda=5.53$) exceeded the corresponding eigenvalue from the random data ($\lambda=1.36$). Since all remaining eigenvalues were below their corresponding simulated thresholds, the analysis clearly supported a one-factor solution.

Exploratory factor analysis was conducted using IBM SPSS version 26 (IBM SPSS Corp.; Armonk, NY, USA), employing principal axis factoring with Promax rotation to identify the underlying factor structure. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy exceeded the recommended threshold of 0.50 (KMO=0.88) and Bartlett’s test of sphericity was significant ($\chi^2(21)=874.795$, $p < .001$), indicating adequate sample and sufficiently factorable data. As seen in Table 1, factor loadings for the items ranged from 0.68 to 0.85, well above the minimum threshold of 0.40. The unidimensional scale explained 60% of the total variance, which is consistent with acceptable thresholds for social science research (Hair et al., 2019).

Confirmatory Factor Analysis

A confirmatory factor analysis was conducted using AMOS to test the measurement model (Figure 1). Following Kenny et al. (2015) simulation study that RMSEA performs poorly in models with small degrees of freedom and falsely indicates poor fit, the RMSEA value was ignored. Instead, main fit indices including χ^2/df , Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR) were reported.

The initial model fit indices indicated a need for improvement. In line with Byrne (2016) and Kline (2016), when there is conceptual

Table 1.
EFA Factor Loadings for the Green Exercise Scale (n = 204)

Item	Loading	Communality
1. I regularly exercise in green spaces	.770	.594
2. I make time to exercise in green spaces at least once a week	.815	.664
3. Exercising in green spaces is a part of my daily routine	.767	.589
4. I create opportunities to exercise in green spaces	.767	.589
5. When I don't exercise in green spaces, I feel its absence	.739	.545
6. I have made exercising in green spaces a part of my lifestyle	.851	.723
7. I have adopted exercising in green spaces as a healthy way of living	.675	.455

Note: EFA = exploratory factor analysis.

overlap among item contents, it is acceptable to allow for covariance of error terms, which may lead to shared method variance that is not fully explained by the latent construct. Therefore, based on the

modification indices and theoretical justification, three error covariances were added between items within the same factor to account for shared method variance. After incorporating these modifications, the model demonstrated an improved fit: $\chi^2/df=3.708$, CFI=.983, TLI=.968, and SRMR=.022. As shown in Table 2, all standardized factor loadings were statistically significant and ranged from .71 to .89. The scale demonstrated good convergent validity with an average variance extracted (AVE) of .66 and a composite reliability (CR) of .93.

Measurement Invariance

To test the measurement invariance of the Green Exercise Scale across gender, a multi-group confirmatory factor analysis was conducted (Table 3). Model fit indices were acceptable at each level of invariance (configural: $\chi^2/df=2.786$, CFI=.978, TLI=.958, SRMR=.026; metric: $\chi^2/df=2.282$, CFI=.980, TLI=.970, SRMR=.028; scalar: $\chi^2/df=2.211$, CFI=.980, TLI=.972, SRMR=.029). The configural invariance test showed that the baseline model configuration was equivalent for both genders, indicating that female and male respondents understand the construct similarly. Metric invariance was then tested by restricting factor loadings to be equal across groups. The change in fit indices according to the configural model was minimal ($\Delta CFI=0.002$; $\Delta SRMR=0.002$). These findings supported the equality of factor loadings across genders and suggested that both groups interpret the relationships between the observed indicators and the latent construct similarly. Scalar invariance was further evaluated by additionally constraining item intercepts to be equal across groups. A model in which item intercepts were allowed to vary was compared with a model in which they were forced to be equal. Model fit remained acceptable with slight changes from the previous metric model ($\Delta CFI=0.000$; $\Delta SRMR=0.001$). This result confirmed that the items functioned equivalently across genders, which validated the comparison of latent means.

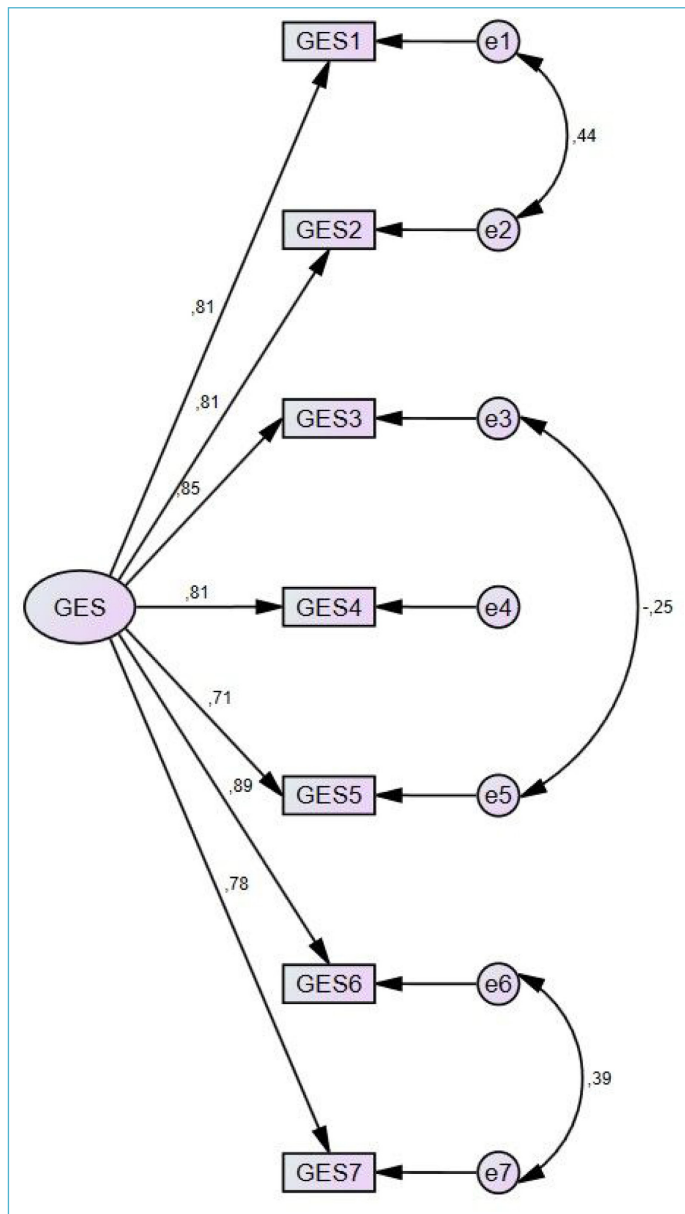


Figure 1.
Path Diagram of the Green Exercise Scale.

Table 2.
Confirmatory Factor Analysis (n = 319)

Item	Loading	Alpha	Omega	CR	AVE
Item 1	.812	.932		.931	.659
Item 2	.812				
Item 3	.852				
Item 4	.814		.934		
Item 5	.710				
Item 6	.893				
Item 7	.779				

Note: AVE = average variance extracted; CR = composite reliability.

Table 3.
Measurement Invariance (n = 319)

	χ^2	df	χ^2/df	CFI	SRMR	ΔCFI	$\Delta SRMR$
Gender (Female/Male)							
Configural	61.289	22	2.786	.978	.026		
Metric	63.898	28	2.282	.980	.028	.002	.002
Scalar	64.127	29	2.211	.980	.029	.000	.001

Note: CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual.

Reliability

To test the reliability of the Green Exercise Scale, several methods were applied. First, Cronbach's alpha coefficient was calculated to assess internal consistency, which was found to be 0.93. Similarly, McDonald's Omega coefficient was estimated at 0.93. Supporting these findings, composite reliability, derived from the standardized factor loadings obtained through confirmatory factor analysis, was calculated as 0.93. In addition, split-half reliability was evaluated by dividing the scale into two parallel halves and then correlating their total scores. As a result, the Spearman-Brown-adjusted coefficient was 0.90, and the Guttman split-half coefficient was 0.89.

Concurrent Validity

To establish concurrent validity for the Green Exercise Scale, its relationship with the Satisfaction with Life Scale was analyzed. A positive and significant correlation ($r = .21, p < .001$) between the Green Exercise Scale and the Satisfaction with Life Scale indicates that individuals who report higher green exercise behavior tend to experience greater life satisfaction. This finding provides some support for the concurrent validity of the Green Exercise Scale.

Discussion

The aim of this study was to develop a valid and reliable scale to measure green exercise behavior. An initial item pool was generated based on a comprehensive literature review. After removing redundant and unclear items during the item purification stage, the refined version was tested with exploratory factor analysis. The EFA results revealed a unidimensional structure of seven items with strong loadings and communalities.

Both online and in-person data collection methods were employed to gather responses from participants. This multi-mode approach is believed to have likely reduced common method bias, which can arise when responses are influenced by a single data collection format. By incorporating different administration modes, potential response biases related to social desirability, familiarity with the survey platform, or environmental context were minimized.

A confirmatory factor analysis was conducted using AMOS to test the unidimensional structure of the Green Exercise Scale. Initial model fit indices indicated a need for modification. Guided by theoretical reasoning and modification indices, three error covariances were added between items. First, the covariance between item 6 ("I have made exercising in green spaces a part of my lifestyle") and item 7 ("I have adopted exercising in green spaces as a healthy way of living") was theoretically justified through the perspective of health-related identity and lifestyle internalization. Both items reflect a deeper level of commitment in which green exercise is not just a behavior but part of one's self-concept and value system. Item 6 emphasizes

lifestyle integration, suggesting that green exercise is embedded in daily living, while item 7 highlights its adoption as a health-oriented behavior and implies a belief in its value for well-being. According to identity theory (Stryker & Burke, 2000) and health lifestyle theory (Cockerham, 2005), health behaviors that are internalized as part of one's identity or lifestyle tend to become mutually reinforcing. This shared conceptual foundation of personal meaning, value alignment, and self-definition contributes to the residual correlation between the two items. Second, the covariance between item 1 ("I regularly exercise in green spaces") and item 2 ("I make time to exercise in green spaces at least once a week") was theoretically justified based on the planned behavior and scheduling perspective. While item 1 refers to the frequency of green exercise in general terms "regularly," item 2 specifically addresses the intentional allocation of time for such activity "at least once a week" Both items reflect conscious behavioral planning and consistent engagement, which are core elements of the theory of planned behavior (Ajzen, 1991). Third, the covariance between item 3 ("Exercising in green spaces is a part of my daily routine") and item 5 ("When I don't exercise in green spaces, I feel its absence") was justified based on the habit-attachment framework. According to psychological and behavioral theories of habit formation (e.g., Verplanken & Orbell, 2003), behaviors that become part of one's daily routine often develop an emotional or psychological dependency, where the absence of the behavior is consciously felt. Item 3 demonstrates the behavioral regularity of green exercise as a daily habit, while item 5 reflects the emotional response to the disruption of this habit. Therefore, both items point to interrelated constructs that are theoretically involved in the process of habit formation.

Following the implementation of the modifications, confirmatory factor analysis showed that model fit improved. All standardized factor loadings remained statistically significant and exceeded the 40 threshold recommended by Hair et al. (2019). Then, the measurement invariance analysis was applied to determine whether the scale was interpreted consistently between female and male participants. Using multigroup confirmatory factor analysis, it was first established that the same overall factor structure (configural invariance) was present across gender groups. Subsequently, factor loadings (metric invariance) and item intercepts (scalar invariance) were constrained to ensure that the items were interpreted equivalently across groups. Measurement invariance analysis demonstrated that the Green Exercise Scale provided acceptable fit for configural, metric, and scalar invariance across gender (Chen, 2007). In addition, the internal consistency results revealed that the Cronbach's Alpha value was .93, the McDonald's Omega coefficient was .93, and the composite reliability value was .93. The Spearman-Brown and Guttman split-half coefficients were also measured as .90 and .89, respectively. According to the criteria suggested by Hair et al. (2019), these values represent a high level of reliability.

Evidence for the concurrent validity of the Green Exercise Scale was provided through its correlation with the Satisfaction with Life Scale. The positive correlation between green exercise behavior and life satisfaction was found. This result supports existing literature indicating that exposure to nature-based regular physical activity is a key element for well-being and life satisfaction. For instance, Bowler et al. (2010) and Peddie et al. (2024) reported that outdoor exercise yields greater mood enhancement and psychological benefits than indoor activity, supporting our result that regular engagement in green exercise is positively linked with life satisfaction. In addition, the high internal consistency and demonstrated measurement invariance support the recommendations of Laezza et al. (2024), who emphasized the need for robust and standardized instruments to strengthen green exercise research. By offering such a scale, this study not only responds to methodological gaps identified in prior systematic reviews but also enables cross-cultural comparisons and longitudinal analyses of the health outcomes of green exercise.

Strength and Limitations

The Green Exercise Scale has several important strengths as a newly developed instrument. First, it is the earliest empirically validated and reliable scale specifically developed to measure exercise behavior in green environments, rather than depending on general measures of physical activity or environmental attitudes. Second, the short and concise structure of the Green Exercise Scale offers notable advantages for both researchers and practitioners. For instance, its brevity minimizes respondent burden, reduces survey fatigue, and increases completion rates, which is an important concern in longitudinal or large-scale studies where repeated measures are required. Further, its short format facilitates easy integration into multi-topic surveys or field-based evaluations, which is particularly useful in public health screenings or program evaluations with limited time for data collection.

Despite its strengths, this study had several limitations that require further investigations. First, the scale was developed and validated with Turkish participants, which may limit its generalizability to other cultural or linguistic contexts. Future research should conduct cross-cultural validation studies to examine measurement invariance and ensure that the scale performs equivalently across languages and cultures. Since scalar invariance was established, future studies could also examine mean differences between male and female participants. This would offer valuable insights into potential gender-based variations in green exercise. Second, in the confirmatory factor analysis, error covariances were included based on theoretical justification; however, this approach carries a potential risk of overfitting. Replication in independent samples is recommended to confirm the validity of the factor structure. Third, our sampling approach includes university-educated adults, which may limit the representativeness of other socioeconomic backgrounds and age groups. It would be worthwhile for future research to collect data from individuals with diverse educational levels and age groups. In addition, CFA and multi-group CFA were performed on the same sample. Future studies are recommended to replicate the analyses on separate samples for broader validation. Lastly, the present study assessed concurrent validity using solely life satisfaction as an external criterion, which may limit the comprehensiveness of the validity evidence. To strengthen convergent validity, future studies could include additional related constructs, such as general physical activity levels, nature relatedness, or subjective vitality.

Conclusion

This study presents the Green Exercise Scale as a reliable and valid instrument to measure physical activity behavior in natural environments. The scale fills a gap in the literature by providing a brief but comprehensive tool to measure green exercise behavior. It offers researchers, public health professionals, and urban planners a practical way to assess and promote green exercise. Given the proven physical, psychological, and mental health benefits of exercising in nature, this scale can support health promotion efforts and guide interventions aimed at increasing access to green spaces.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Artificial Intelligence Usage Statement: This study used AI-assisted writing tools to grammar check and language improvement during the preparation of the manuscript.

Ethics Committee Approval: The study was approved by the Ethics Committee of Istanbul Yeni Yüzyıl University (Approval No: 2025/04-1515; Date: April 08, 2025).

Informed Consent: Written informed consent was obtained from all participants included in the study.

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