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ARTICLE / ARAŞTIRMA

Investigation of Walking Behaviours in Terms of Physical Activity: Gölbaşı District, Kızılcaşar Neighbourhood

Yürüme Davranışlarının Fiziksel Aktivite Açısından İncelenmesi: Gölbaşı İlçesi, Kızılcaşar Mahallesi

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ABSTRACT

Physical activities such as walking have numerous health benefits proven by various studies. In this context, urban design projects should include implementations aimed at encouraging people to walk, and these projects should also be created considering the residents' demographic characteristics. This study aimed to determine the built environment features that affected individuals' walking frequency and duration while also looking into the impact of personal factors on walking behaviours. The study examined sample studies evaluating the importance of environmental and individual characteristics on walking behaviours, and a questionnaire was designed in line with the results obtained. The questionnaire was conducted with a total of 400 neighbourhood residents, consisting of adult women and men, living in the Kızılcaşar neighbourhood of the Gölbaşı district located in Ankara. The data obtained from the questionnaires were analysed with descriptive statistics, T-test, ANOVA, and Regression analysis. As a result of the analyses, environmental characteristics such as safety, landscape density, flat terrain and comfort, and visual diversity had significant relationships with the participants' walking frequency and duration. Additionally, the study confirmed that personal factors like gender, income and educational status impact individuals' walking frequency and duration.

Keywords: Built environment; personal factors; walkability; walking duration; walking frequency.

ÖZ

Yürüme gibi fiziksel aktivitelerin, çeşitli araştırmalarla kanıtlanmış sağlık üzerinde çok sayıda yararı bulunmaktadır. Bu bağlamda kentsel tasarım projeleri, insanları yürümeye teşvik etmeye yönelik uygulamaları içermeli ve bu projeler, yaşayanların demografik özellikleri de dikkate alınarak oluşturulmalıdır. Bu çalışma, bireylerin yürüme sıklığı ve süresini etkileyen yapılı çevre özelliklerinin belirlenmesi ve kişisel faktörlerin yürüme davranışları üzerindeki etkisini incelemeyi amaçlamıştır. Çalışmada çevresel ve bireysel özelliklerin yürüme davranışları üzerindeki önemini değerlendiren örnek araştırmalar incelenmiş ve elde edilen sonuçlar doğrultusunda bir anket tasarlanmıştır. Anket Ankara ili Gölbaşı ilçesi Kızılcaşar Mahallesi'nde yaşayan yetişkin kadın ve erkeklerden oluşan toplam 400 mahalle sakini ile gerçekleştirilmiştir. Anketlerden elde edilen veriler betimsel istatistikler, T-testi, ANOVA ve Regresyon analizi ile incelenmiştir. Yapılan analizler sonucunda güvenlik, peyzaj yoğunluğu, düz arazi ve konfor, görsel çeşitlilik gibi çevresel özelliklerin katılımcıların yürüme sıklığı ve süresi ile anlamlı ilişkilere sahip olduğu görülmüştür. Ek olarak, çalışma cinsiyet, gelir ve eğitim durumu gibi kişisel faktörlerin bireylerin yürüme sıklığını ve süresini etkilediğini ispatlamıştır.

Anahtar sözcükler: Yapılı çevre; kişisel faktörler; yürünebilirlik; yürüme sıklığı; yürüme süresi.

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TMMOB Şehir Plancıları Odası

1. Introduction

Urban design projects include purposes such as increasing people's quality of life and satisfaction levels. In urban design research, the perceived quality of the environment is an essential factor influencing people's preferences and behaviours (Nasar, 2008). One of the important criteria of urban space quality is the existence of walkable environments. People often use the streets and walkways, as an essential part of the urban space, in their daily life. Designing cities on a pedestrian scale and creating walkable routes is necessary for sustainable urban development. Also, the positive effect of physical activity, such as walking, on health has been proven by some researchers. Determining which street and route pedestrians prefer to walk leads to the emergence of successful urban design criteria. In this context, the parameter that indicates how a route is suitable for walking is defined as walkability in urban design studies. The walkability principle, an important component of sustainable urban design, includes many dimensions, such as physical, financial, social, and environmental. So, urban designers should reveal walkable path qualities to encourage individuals to walk. In recent years, due to technological developments, modern cities have been designed to be vehicle-oriented rather than human-oriented with the rapid development of the construction and automobile industry.

In today's cities, there are only single-scale designs, such as wide roads and gigantic structures; thus, human-scale environmental components, dimensional hierarchy, and visual diversity are lost in urban walkways. These factors have led to weak people's perceptual and sensory links with space and loss the feelings such as security, comfort, and belonging. Individuals' motivation to walk weakens or disappears due to this sensory and perceptual negative. This study aimed to determine the environmental features that positively affect the individuals' walking frequency and duration and also reveal the effect of personal factors on their walking tendencies. People walk in urban areas for different purposes. In this study, walking behavior for sports and physical activity is discussed. As a result of the literature review, few studies have been found that examine the relationship between the design components of the neighbourhood and walkability in the field of the urban design discipline. This study sought answers to this question: "Which environmental features affect the residents' walking frequency and walking duration of individuals?". As a result of the literature review, few studies were found that associate walking frequency and duration with environmental factors and personal characteristics, which is considered the originality of this study. Figure 1 illustrates the study structure.

In the study, within the scope of the literature, the concept of walkability was explained, and the effects of environmental features and personal factors on route preferences and walking tendencies were evaluated. According to the findings, a questionnaire survey was prepared. The questionnaire survey was conducted with the 400 residents of the Kızılcaşar neighbourhood located in the Gölbaşı district of Ankara province. In the questionnaire, the socio-demographic characteristics of the residents, environmental characteristics of the walkways in their neighbourhood, monthly walking frequency, and average walking duration in each walk were questioned. The questionnaires were analysed with the help of IBM SPSS 24 program. The obtained data were interpreted and concluded with the help of descriptive statistics, T-test, ANOVA, and Regression analyses. As a result, suggestions and strategies were developed to design walkable paths and contribute to urban design projects.

2. Walkability

Walking is an important mode of transportation in urban spaces and a necessary part of public transport travel. The walkability principle reflects how attractive and interesting city pathways and streets are and their potential to encourage people to walk. Environmental variables, functions, individuals, and their connections all impact this trait (Knapskog et al., 2019; Newman & Kenworthy, 2015; Yin, 2017). In a nutshell, walkability is a measurement of a space's suitability for walking. According to the walkability criterion, people, not cars, should be in the centre of the design scale to create a livable built environment. Even though there has been a lot of research on walkability in recent years, there is still considerable ambiguity about what it implies. As a result, investigating this idea necessitates a comprehensive and multidisciplinary approach (Dovey & Pafka, 2020).

Walkability is an empirical characteristic as well as a normative perspective on urban life, creating a link between data, planning and the complex structures of urban life. Recognising walkability's normative origin as a conceptual ordering of disparate components of urban life puts its usage as a proxy for effective urban planning in context. Aspirations and needs influence walkability. In other words, walkability is a parameter that reveals the qualities of adequate walking facilities (Shields et al., 2021). According to Southworth (2005), walkability is becoming increasingly valuable and important in today's society for various reasons. Pedestrian transportation serves as a social and recreational activity as well as a means of reducing automobile traffic and environmental impacts. Numerous recent research studies have demonstrated that walking benefits mental and physical health. People should be encouraged to walk rather than drive if pedestrian pathways are of good quality (Southworth, 2005). Because of the important effects of physical activities such as walking on health and well-being, it is essential to understand the basic factors that affect the walking behaviour of individuals. In this sense, it is important to reveal and classify the factors affecting the walking tendencies of individuals. Studies on walkability should take a holistic and comprehensive approach that includes large and small-scale studies (Brown et al., 2007).

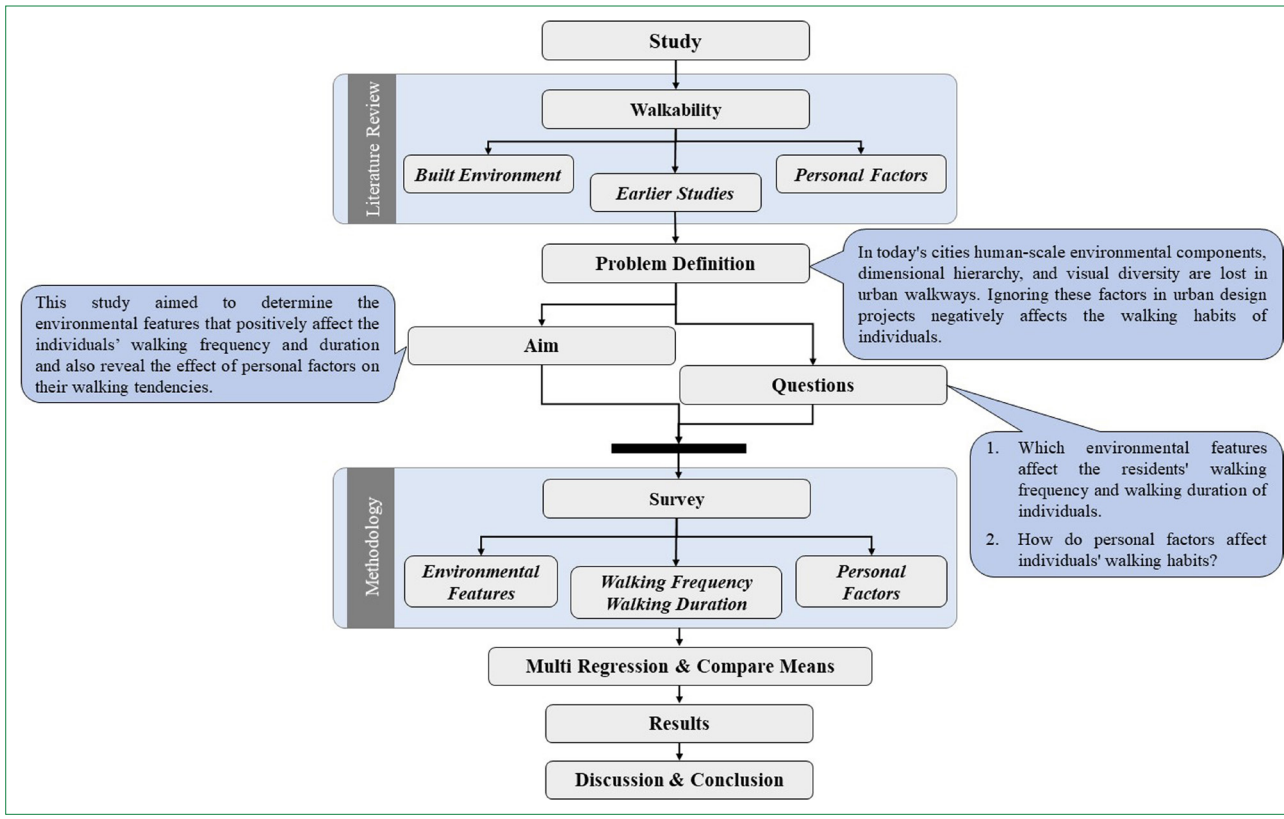

Figure 1. Study structure.

Source: Author.

According to Halu (2010), the factors affecting the individual's desire and tendency to walk can be evaluated under four headings: Regional, Individual, Social, and Spatial. While the first three features are directly related to the individual's perception, the spatial feature is related to the qualities of the physical environment (Halu, 2010). The model proposed by Halu (2019) defines the parameters that support walking in the urban environment in two groups; macro-scale and micro-scale, and draws attention to the importance of user perception in the connection between the two scales. In this holistic model that affects walkability, there are features such as "knowledge/experience" and "design/implementation" at the macro scale, while there is the "evaluation process" at the micro-scale. However, the perception and thoughts of users gain importance in the transition from macro-scale to micro-scale (Halu, 2019). In addition to human factors such as personal and social factors, it is well known that natural and built environment characteristics also significantly affect an individual's level of physical activity (Wang et al., 2016).

Consequently, natural elements, built environment, social and personal factors designate the quality of walkability. A thorough, interdisciplinary viewpoint is required to investigate walkability in depth because each element has a number of subheadings, demonstrating that it is a multifaceted and vast concept. The built environment and individual factors affecting walkability were explored as part of this study, and similar studies and their findings were summarized in the subsections.

2.1. Walkability, Built Environment, and Similar Studies

The environmental features perceived objectively during the walking impact individuals' willingness to walk. The absence of a pleasant and aesthetic view negatively affected the people's desire to walk in the urban space (King et al. 2000; Giles-Corti et al. 2005; Hoehner et al. 2005; Owen et al. 2007; Shigematsu et al. 2009; Inoue et al. 2010; Van Dyck et al. 2013; Jia and Fu 2014; Heesch, Giles-Corti, and Turrell 2014). Many built environment features, particularly relevant to urban planners and designers, positively affect individuals' walking tendencies. Regardless of individual perceptions, walking routes' environmental characteristics and objective qualities are universal. It is possible to evaluate the environmental factors affecting walkability within the scope of natural factors such as coast, hill, and weather conditions and built environment factors such as land use, safety, aesthetics, accessibility, connectivity and recreation (Wang et al., 2016). According to Cervero and Kockelman (1997), the three variables that affect walkability the most are defined as 3 D: design, density, and diversity, among which the 'de-

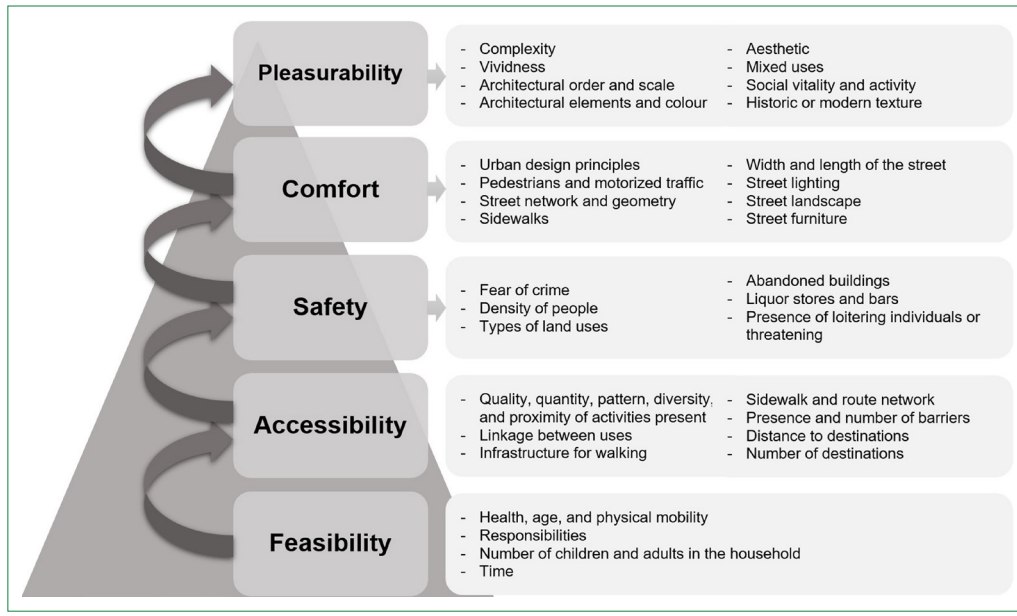

Figure 2. Walking needs hierarchy.

Source: Alfonzo, 2005.

sign' factor has the most important effect (Cervero & Kockelman, 1997). Spatial regularity, but also, some heterogeneity, is required in terms of built environment features that affect individuals' walkability tendencies. This heterogeneity defines more street blocks and potentially a more diverse environment in terms of the street network configuration (Tribby et al., 2016: 203). According to Southworth (2005), for the design of a good pedestrian network, there are six criteria that should be met: (1) connectivity, (2) connectivity with other modes of transportation, (3) land-use patterns, (4) safety, (5) route visual quality, and (6) route condition and maintenance (Southworth, 2005). Alfonzo (2005) determines the hierarchy of walking needs of individuals within the socio-ecological conceptual model (Fig. 2).

This model describes five levels of walking needs. In the hierarchy of walking needs, feasibility has been identified as the most fundamental demand level. Time, mobility, and other responsibilities are among the elements that affect the requirement for feasibility. The quality, quantity, pattern, diversity, and proximity of available activities, the linkage between uses, and the infrastructure for walking are included in the accessibility level. Safety, which is at the third level of the hierarchy of walking needs, is affected by the crime rate in the neighborhood, the density of people and uses, the kind of the uses (Liquor stores and bars), the characteristics of the users and the street furniture such as lighting. Comfort refers to a person's level of satisfaction. Environmental features that either make walking simpler or difficult may have impacts on a person's satisfaction with walking comfort. At the last level of the hierarchy, pleasurability is defined. Pleasurability is influenced by features such as complexity, vividness, architectural characteristics, aesthetics, uses, texture, and socialization opportunities (Alfonzo, 2005). The hierarchy of walking needs model can be more practical when a person decides on living in a neighbourhood than when he or she chooses whether or not to walk in that neighbourhood.

Speck (2012) states that the four essential walkability features are safety, comfort, usefulness, and interest. A centre that includes the main roads and public spaces, the population density that provides socialisation and mobility, mixed uses, parks and public spaces, pedestrian-priority designs, schools and workplaces where most residents can walk from their houses, and streets that are mostly designed for cyclists, pedestrians, and public transportation are all characteristics of walkable neighbourhoods (Speck, 2012). According to Hsieh and Chuang (2021), residential density, land use mix diversity and access, pedestrian-traffic-crime safety, aesthetics, access, and street connections affect walking activity for different purposes (Hsieh & Chuang, 2021). Micro-scale urban elements are taken into account while evaluating urban spaces. This evaluation is related to how walkable that urban space is. Halu (2019) listed the micro-scale features affecting walkability in hierarchical order. In this model, which is arranged as a pyramid, there are "Feasibility", "Safety", "Accessibility", "Usefulness", "Physical Comfort", and "Sociability" principles in order from the bottom of the pyramid to the top (Halu, 2019). According to this model, when security, accessibility, usefulness, physical comfort and social environment/socialisation needs are met in conjunction with each other, the walkability and usage level of the space will increase. Also, this

hierarchical structure states that the next step should not be taken if the initial condition is unmet. For example, no matter how good the accessibility is, it will not affect the walking decisions of individuals without providing safety (Halu, 2019).

Safety is closely related to other features of walkable routes, and the lack of safety is one of the most critical barriers to walking. The desire to be protected from people as much as traffic safety is valid within the scope of the safety of walking paths (McCormack et al., 2004; Wang et al., 2016; Forsyth, 2015; Inoue et al., 2010). However, a walkable route requires more than just being safe. Facilities such as trees and green buffers (Al-Hagla, 2009; Agrawal et al., 2008; Ferrer et al., 2015; Heesch et al., 2014; Wang et al., 2016), wide and well-maintained pavements, pedestrian-oriented infrastructure and pedestrian-scale designs, lighting, and wayfinding signs can be defined among the features of walkable routes (Giles-Corti et al., 2005; Owen et al., 2004; Suminski & Dominick, 2022).

Jamei et al. (2021) also state that population density and socialisation opportunities, functional diversity, designs that create a sense of comfort and security, hierarchical connections between streets, the design of routes that appeal to everyone and can be used comfortably by all age groups can be listed among the basic principles of walkability in urban areas (Jamei et al., 2021).

The characteristics of walkable environments for transportation and recreation sometimes overlap but often do not. But whatever the purpose of walking, short walkways enriched with various visual details are inviting for pedestrians with their perceptible destinations. In addition, the differentiation of the scales of the buildings on the streets creates a harmonious contrast; thus, these varying scales attract pedestrians' attention, resulting in an exciting walking experience. Some research focuses on certain characteristics in certain regions. However, it needs to be emphasized that the priority of factors affecting walkability may vary in different regions, depending on different natural patterns and social structures.

2.2. Walkability, Personal Factors, and Similar Studies

Among the numerous types of physical exercise, walking and cycling activities have recently gained much attention for increasing people's physical activity levels. Walkability is significant for various reasons: 1) Walking and cycling are acceptable for people of all ages because they do not require any special skills or equipment. 2) Walking and cycling allow people to select their activity level. 3) Walking and cycling can assist low-income persons in living away from their sedentary habits (Brownson et al., 2000). The person's level of perception is between the macro and micro scale characteristics of the environment that affect walking and is crucial in determining which feature is more effective in making decisions for walking (Halu, 2019). Determining the route's walkability depends on individuals' perceptions resulting from the subjective evaluation (Ewing & Handy, 2009). According to many studies, demographic characteristics and socioeconomic statuses, such as gender, age, income, education, or occupation, affect individuals' physical activity tendencies. For example, low socioeconomic status groups do not engage in sufficient recreational physical activity to benefit their health (Cauley et al., 1991; Droomers et al., 1998; Giles-Corti & Donovan, 2002; Hoehner et al., 2005; Yen & Kaplan, 1998). Socioeconomic status, which is generally measured by education and income parameters, is associated with individuals' physical activity levels, and low socioeconomic status groups have low physical activity levels (Bauman et al., 2009; Cauley et al., 1991; Hoehner et al., 2005; Mäkinen et al., 2009). Additionally, education provides information for people to develop healthy lifestyle habits (Lindström et al., 2001). But this relationship varies according to gender and type of urban physical activity. In different socioeconomic groups, the frequency of physical activity is inversely proportional to age, and the activity rate is higher in men than in women (Cauley et al., 1991). According to the study by Cauley et al., 1991, physical activity frequency and age have an inverse relationship. As age increases, physical activity decreases. In addition, according to this study, men participate in physical activities at a higher rate than women (Cauley et al., 1991).

Conclusively, personal factors such as age, gender, and socioeconomic status influence people's walking habits. Specially, the factors such as low-level education and income status, unemployment, and financial problems negatively affect physical activity. However, individual characteristics aside, it is important for neighborhood residents to be aware of the benefits of walking as a physical activity and to include walking as a lifestyle in their daily schedules. However, this may be related to cultural background rather than education.

3. Methodology

According to the literature, socioeconomic status and also, the quality of the walking environment influence walking behaviour. In this respect, ignoring one of these two factors when evaluating walking behaviour in urban studies may result in non-comprehensive results. This study aimed to determine the environmental features and personal factors that affect individuals' walking habits together. In general, the approach used in this study was quantitative research and, ultimately, the interpretative approach. This study's basic approach was a questionnaire survey conducted as a subjective evaluation method. As a result of the literature review, similar studies were examined, and a questionnaire survey was designed in line with the results obtained. As a result of the literature review, it is determined that walkability is a subjective parameter rather than an objective parameter. Therefore, many similar studies used a questionnaire survey

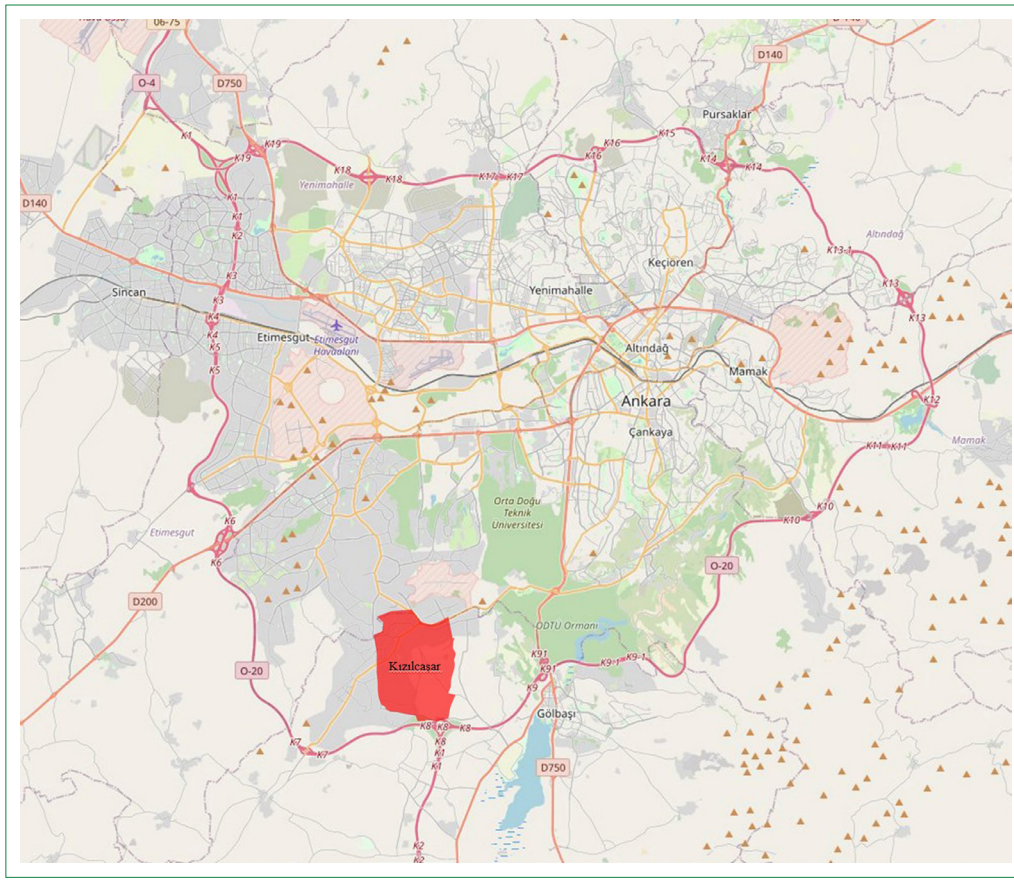

Figure 3. Geographical location.

Source: Open Street Map, n.d.

as the subjective evaluation method. In the questionnaire survey, besides the socio-demographic characteristics and Personal Factors (PF), the Environmental Features (EF) that affect the individuals' Walking Frequency (WF) and Walking Duration (WD) to do sports and leisure were questioned. Unlike similar studies with an indirect method, the relationships of WF and WD with Environmental Features (EF) were questioned in the questionnaire survey. Environmental Features (EF) were defined as the independent variables, WF and WD as the dependent variables. The data obtained were analysed in the IBM SPSS 24 program, and the cause-effect relationship was examined by multiple regression analysis. Also, it was examined whether the differentiation of Personal Factors (PF) such as gender, age, education, and income affected their WF and WD. The T-test and ANOVA tests were used to analyse whether there was a significant difference between the means of WF and WD according to the participants' socio-demographic characteristics.

3.1. Case Study

The questionnaire survey was conducted with a total of 400 adult participants living in the Kızılcaşar neighbourhood of Gölbaşı district, located in Ankara province. The neighbourhood has an area of approximately 1300 hectares and is located in the Southwest of Ankara. The geographical location of the neighbourhood is shown in Figure 3.

While the population of Kızılcaşar neighbourhood was 779 in 2007, it reached 8,581 people in 2022, 4,175 men and 4,406 women (Türkiye Nüfusu İl ilçe Mahalle Köy Nüfusları, 2022). The neighbourhood has social facilities such as Atılım University, Maya college, hospital and other educational institutions. Due to the presence of various social facilities, and public and commercial areas in the nearby neighbourhoods, the neighbourhood's residents are predominantly students and people working in the public-private sector. Figure 4 shows the Implementary Development Plan of the neighbourhood.

As seen in the Implementary Development Plan, a large part of the neighbourhood has been determined as a development residential area. Today, the Northwest region of the neighbourhood has converted into a predominantly residential area. The neighbourhood has detached houses with 2–3 floors, low-rise apartments, and high-rise buildings. The transportation infrastructure has been designed at the

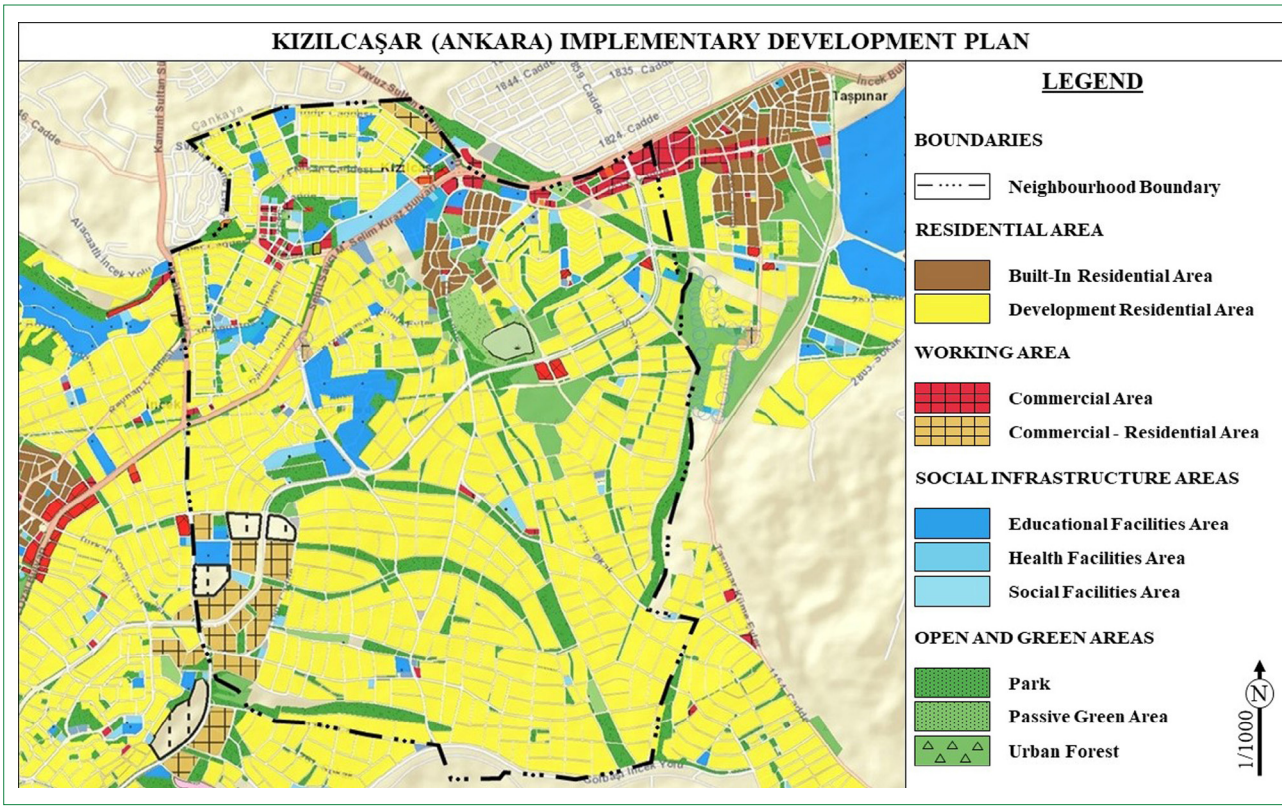

Figure 4. Implementary development plan.

Source: Gölbaşı Belediyesi, n.d.

neighbourhood scale. There are commercial units, parks and landscaping, street furniture, and social reinforcement such as schools, hospitals, and cargo companies. Figure 5 presents the images from various spaces of the neighbourhood.

However, as seen in the images, although the neighbourhood has developed rapidly physically, functionally, and socially in recent years, pedestrian access is not developed, and the walking and recreation routes that appeal to pedestrians are very unqualified. As a result of this problem, this neighbourhood was chosen as the case study.

3.2. Questionnaire

Survey questions were prepared within the scope of the literature and the necessary ethics committee permission was obtained for the survey study. The questionnaire survey consisted of three parts. The Personal Factors (PF), such as participants' age, gender, education, and income levels, were asked in the first part. In the second part, there were two questions: mean monthly Walking Frequency (WF) and Walking Duration (WD), and in the third part, they were asked to rate the Environmental Features (EF) of the paths they preferred for sports walking from 1 to 7 (1: the worst; 7: the best). The survey questions are described in Table 1 within the scope of dependent and independent variables.

3.3. Participants

Based on participants' volunteering, the questionnaire survey was conducted with 400 people over 18 years old, including men and women. According to the population age distribution data of Gölbaşı district for 2020, approximately 72% of the district consists of people over 18 (CSB, 2020: 6). Since the population of Kızılcaşar neighbourhood is 8,581, the research population of the study is 6,178. Statistically, at least 370 samples are required for a research population of 10,000 people. Because the research population of the study is less than 10,000, 400 samples are statistically sufficient. The socio-demographic characteristics of the participants are given in Figure 6.

As presented in Figure 6, 47.75% of the participants were adult women, 52.25% were adult men, and the average age was calculated as 35.70. The participants' education status was determined as high school with the highest 38.75% and postgraduate with the lowest 9.25%. Income levels were determined under 5000₺ with 13,5%, between 5001–10000₺ with 38.75%, between 10001–15000₺ with 25.25%, between 15001–20000₺ with 15.75%, and over 20000₺ with 6,75%. Also, the descriptive analysis of the participants' walking frequency and walking duration is given in Table 2.

Figure 5. Images.

Source: Author.

According to Table 2, 20,8% of the participants walk in their neighbourhoods for sports purposes between 21–25 times per month. Also, 18,8% of the participants walk between 11–15 times, 16,8% of them walk between 6–10 times, 15,8% of them walk between 16–20 times, 12,5% of them walk between 26–30 times, 10,5% of them walk between 0–5 times and 5% of them walk 30 times and more per month. The walking duration of 47.3% of the participants is between 30 and 60 minutes. Also, 30% of them walk between 60 and 120 minutes for sports purposes in the neighbourhood.

4. Results

4.1. EF-WF and EF-WD

After the reliability analysis of the data obtained from the questionnaire surveys, the data's normal distribution and the variances' homogeneity were examined. Then, two multiple-regression analyses were performed: Model #1 and Model #2. The multiple-regression analysis is an analysis method used to measure the relationship between more than two quantitative variables, revealing the cause-effect

Table 1. Dependent and independent variables

		Questions
Dependent variable	Walking frequency (WF)	How many times a month do you walk for sports in your neighbourhood on average? (0–5=1; 6–10=2; 11–15=3; 16–20=4; 21–25=5; 26–30=6; Over 30=7)
	Walking duration (WD)	How long time do you walk for sports in your neighbourhood on average? (0–15 min=1; 16–30 min=2; 31–45 min=3; 46–60 min=4; 61–90 min=5; 91–120 min=6; Over 120 min=7)
Independent variable	Environmental features (EF)	Rate the environmental features of the routes you prefer for sports walking in your neighbourhood. (1: Worst, 10: Best). 1. Landscape density 2. Landscape diversity 3. Visual diversity 4. Functional diversity 5. Lighting 6. Calmness and silence 7. Safety (human, animal, and vehicle) 8. Sidewalks 9. Flat terrain and comfort 10. Adequacy of open green spaces 11. Accessibility of open green spaces 12. Length of walkways 13. Width of walkways 14. Cleanliness and maintenance 15. Street furniture 16. Aesthetics of building facades 17. Socialisation opportunities

relationship. In Model #1, WF was defined as the dependent variable and EF as the independent variable, and in Model #2, WD was defined as the dependent variable and EF as the independent variable. Models were interpreted at $p<0.05$ significance level. This means that there is a statistically significant relationship between the independent and dependent variables in the 95% confidence interval, and the independent variable affects the dependent variable.

The R^2 value of the predicted model #1 was calculated as 0,73, and The R^2 value of the predicted Model #2 was calculated as 0,68. These values indicated that the models are meaningful and interpretable. Tables 2 and 3 describe the regression analysis results of Models #1 and #2 (Tablo 4).

The coefficients of the independent variables, which had a statistically significant effect on the dependent variables, were interpreted at the $p<0.05$ significance level. Figure 7 shows the models' significant coefficients.

As seen in Figure 7, it has been determined that the adequacy of "Safety", "Landscape density" and "Sidewalks", respectively, as the first three important variables that increase the participants' walking frequency. Other variables, on the other hand, had a positive effect on WF as "Cleanliness and maintenance", "Calmness and silence", "Flat terrain and comfort", "Visual diversity" and "Lighting", respectively. The environmental features that affect WD were determined as "Safety" and "Visual diversity", "Flat terrain and comfort" and "Landscape density" respectively. As a particularly outstanding result, safety impacted the WF and WD as the top environmental feature in the first place.

4.2. PF and WF

The physical activity habits such as walking are affected by personal factors (PF) as well as by the environment's perceived and visual characteristics. This section examined the relationship between the participants' gender, age, education, and income levels and their walking frequency.

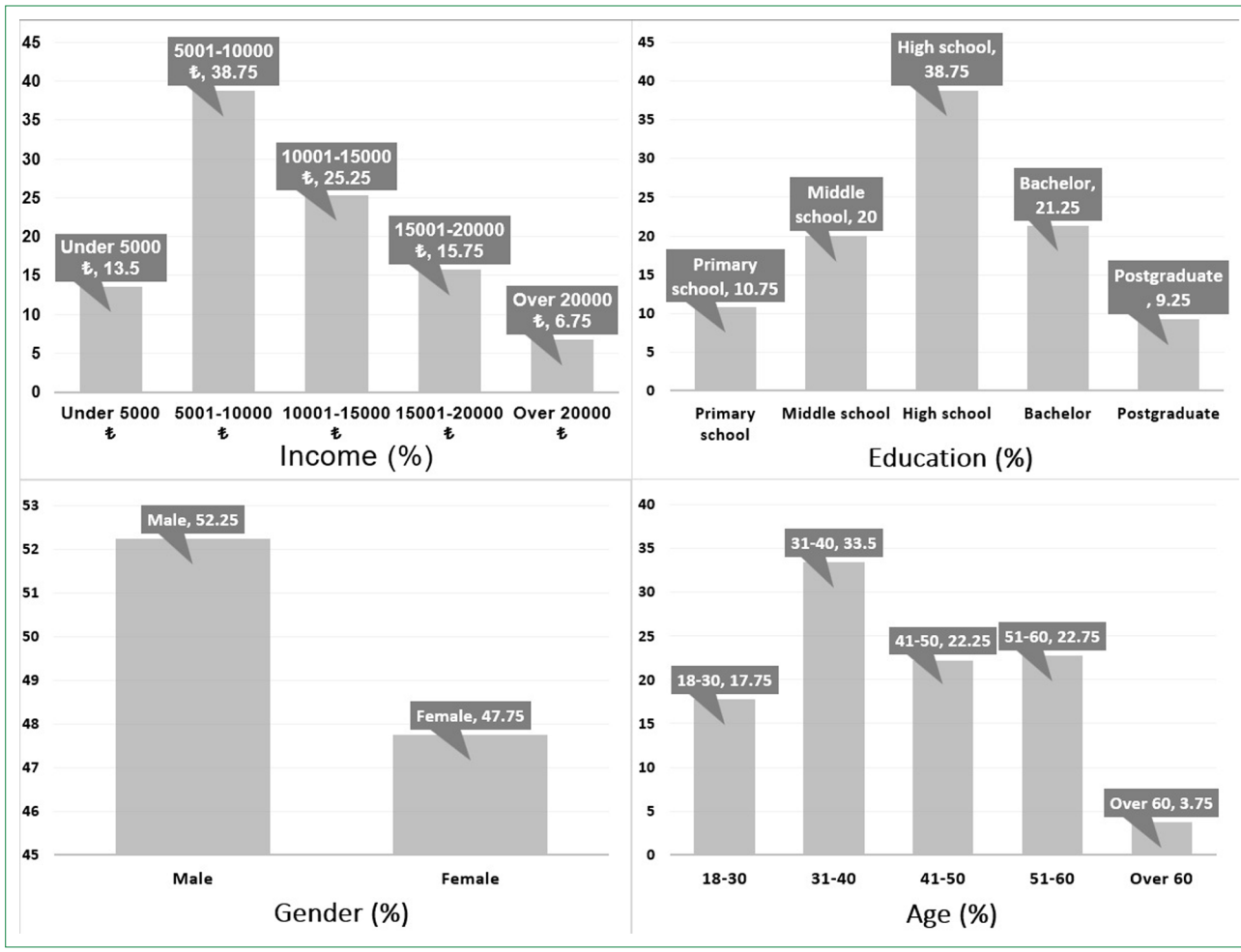

Figure 6. Socio-demographic characteristics of the participants.

4.2.1. Gender and WF

For examining whether WF differed by gender, the statistical significance of the means between two independent groups (man-woman) was analysed with the T-test. T-test is an analysis used to test whether two independent variables have statistically different means from each other in terms of a certain dependent variable. Two independent variables were defined as man and woman, and the dependent variable as WD. T-test results are given in Table 5.

According to the results of the T-test analysis, the difference in the mean walking frequency of men and women is statistically significant at the $p<0.05$ significance level. As a result, women tend to walk more than men.

4.2.2. Age-Education-Income and WF

At this study stage, the effects of personal factors' differentiation, such as age, education, and income level, on individuals' walking tendencies were examined. After testing the normal distribution of the groups, ANOVA analysis was used to examine whether the walking frequency of the participants differed according to their age, education, and income. ANOVA (Analysis of Variance) is used to determine whether the means of more than two (Group) independent variables are statistically different from each other in terms of a particular dependent variable. The descriptive statistical analysis of WF between the groups regarding the participants' age, education, and income levels, also the results of the ANOVA analysis are shown in Table 6.

According to Table 6, the ANOVA analysis result for the age variable was not statistically significant at the $p<0.05$ significance level. Thus, there is no significant difference between the WF's mean of different age groups. However, the result of ANOVA analysis for education and income variables was statistically significant at the $p<0.05$ significance level. Therefore, there is a significant difference between the WF's mean of different education and income groups. To determine between which groups these differences were, Post-Hoc analysis was performed. Games-Howell analysis was done since the variance was not equal for both variables. The Games-Howell analysis is a non-parametric Post-

Table 2. Descriptive analysis of WF and WD

WF (How many times a month do you walk for sports in your neighbourhood on average?)	Frequency	Percent	WD (How long time do you walk for sports in your neighbourhood on average?)	Frequency	Percent
0–5	42	10.5	0–15 min	25	6.3
6–10	67	16.8	16–30 min	35	8.8
11–15	75	18.8	31–45 min	86	21.5
16–20	63	15.8	46–60 min	103	25.8
21–25	83	20.8	61–90 min	56	14.0
26–30	50	12.5	91–120 min	64	16.0
Over 30	20	5.0	Over 120 min	31	7.8
Total	400	100.0	Total	400	100.0

WF: Environmental features, WD: Walking duration.

Table 3. Model #1 coefficients

Coefficients[a]					
	B	Std. error	t	Sig.	VIF
(Constant)	–1.348	0.573	–2.536	0.004*	
Landscape density	0.769	0.075	6.734	0.000*	1.959
Landscape diversity	0.209	0.095	2.475	0.249	1.471
Visual diversity	0.371	0.085	3.184	0.017*	1.276
Functional diversity	0.016	0.147	0.162	0.813	1.592
Lighting	0.339	0.094	3.614	0.012*	1.185
Calmness and silence	0.565	0.073	4.055	0.001*	1.579
Safety (human, animal and vehicle)	0.794	0.064	7.319	0.000*	1.935
Sidewalks	0.689	0.133	5.328	0.000*	1.495
Flat terrain and comfort	0.538	0.064	4.544	0.001*	1.569
Adequacy of open green spaces	0.163	0.125	1.001	0.253	1.095
Accessibility of open green spaces	0.208	0.131	1.649	0.102	1.337
Length of walkways	0.176	0.114	1.132	0.729	1.361
Width of walkways	0.154	0.095	1.094	0.639	1.072
Cleanliness and maintenance	0.582	0.173	4.219	0.001*	1.451
Street furniture	0.101	0.083	0.753	0.698	1.421
Aesthetics of building facades	0.213	0.129	1.923	0.115	1.439
Socialisation opportunities	0.036	0.109	0.396	0.872	1.591

[a]: Dependent variable; WF, *: Significance level ($p<0.05$). B: Unstandardized coefficient, Std.: Standard, t: T-test, Sig.: Significance level, VIF: Variance inflation factor

Hoc analysis approach to make multiple comparisons for two or more variables. Analysis results are given in Table 7.

According to Table 7, there is a significant difference in comparing education groups' WF. The WF of the participants with bachelor's education is statistically higher than those with middle and high school education at the $p<0.05$ significance level (Table 6). This result proves that education has a positive effect on walking habits.

Also, there is a significant difference in comparing income groups' WF. The WF of the participants with an income of more than 20000₺ was statistically lower than the groups with an income less than 5000₺ and income

Table 4. Model #2 coefficients

Coefficients[a]					
	B	**Std. error**	**t**	**Sig.**	**VIF**
(Constant)	–1.572	0.491	–2.729	0.005*	
Landscape density	0.312	0.067	2.734	0.010*	1.773
Landscape diversity	0.178	0.065	1.57	0.243	1.567
Visual diversity	0.437	0.061	3.184	0.004*	1.534
Functional diversity	0.282	0.079	0.172	0.343	1.732
Lighting	0.156	0.083	0.653	0.539	1.694
Calmness and silence	0.035	0.081	0.055	0.713	1.569
Safety (Human, Animal and Vehicle)	0.522	0.094	3.619	0.001*	1.822
Sidewalks	0.054	0.082	1.001	0.364	1.298
Flat terrain and comfort	0.423	0.091	3.044	0.005*	1.162
Adequacy of open green spaces	0.022	0.056	1.871	0.936	1.273
Accessibility of open green spaces	0.398	0.095	1.291	0.537	1.458
Length of walkways	0.142	0.032	1.291	0.293	1.579
Width of walkways	0.298	0.179	1.723	0.132	1.487
Cleanliness and maintenance	0.098	0.073	1.239	0.285	1.510
Street furniture	0.074	0.065	0.819	0.211	1.632
Aesthetics of building facades	0.065	0.085	1.723	0.429	1.398
Socialisation opportunities	0.144	0.072	0.786	0.431	1.387

[a]: Dependent variable; WD, *: Significance level (p<0.05). B: Unstandardized coefficient, Std.: Standard, t: T-test, Sig.: Significance level, VIF: Variance inflation factor

between 10001–15000₺ at the p<0.05 significance level (Table 6). This result shows that high-income individuals do not prefer urban environments for walking for sports and leisure purposes.

4.3. PF and WD

The association between the participants' gender, age, education, income levels, and WD was investigated in this section of the study.

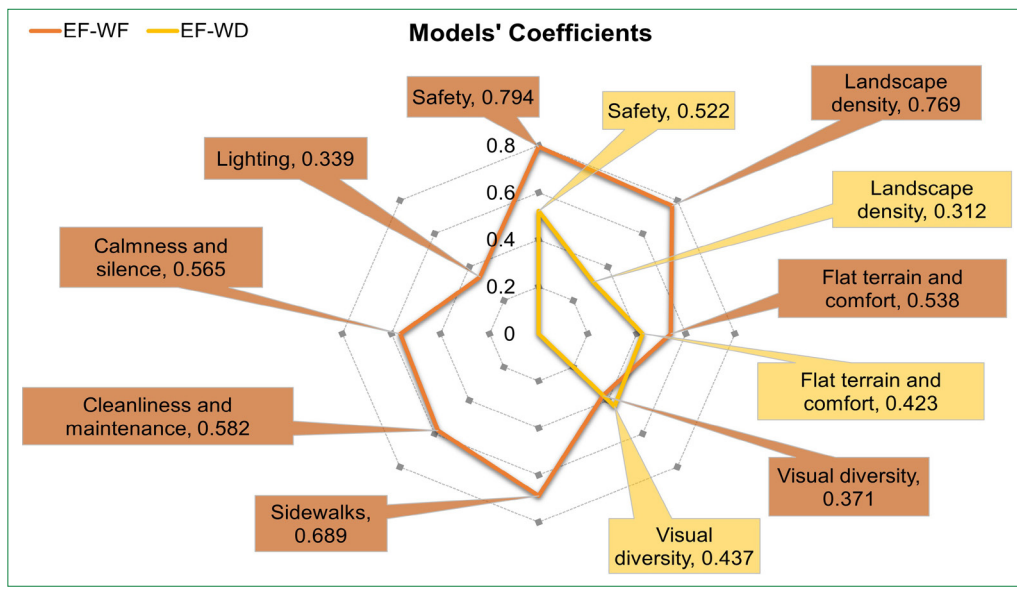

Figure 7. Models coefficients.

EF-WF: Environmental features-Walking frequency, EF-WD: Environmental features-Walking duration.

Table 5. T-test analysis (WF)

Variable	Gender	Mean	SD	Std. error (mean)	t	Sig.	Mean difference	Std. error difference
WF	Man	3.10	1.651	0.114	–6.220	0.000*	–1.083	0.174
	Woman	4.18	1.830	0.132				

*: Significance level (p<0.05). WF: Environmental features, SD: Standard deviation, Std.: Standard

Table 6. Statistical analysis of age, education, income and ANOVA (WF)

Age	N	Mean	SD	Std. error	ANOVA[a]	
					F	Sig.*
18–30	71	3.42	1.685	0.199	1.642	0.163
31–40	134	3.73	1.782	0.154		
41–50	89	3.98	1.725	0.181		
51–60	91	3.55	1.653	0.176		
Over 60	15	3.13	1.685	0.435		
Education	**N**	**Mean**	**SD**	**Std. error**	**ANOVA[a]**	
					F	**Sig.***
Primary school	43	3.67	1.706	0.263	4.172	0.003
Middle school	80	3.35	1.815	0.203		
High school	155	3.64	1.746	0.138		
Bachelor	85	4.29	1.478	0.163		
Postgraduate	37	4.22	1.456	0.243		
Income	**N**	**Mean**	**SD**	**Std. error**	**ANOVA[a]**	
					F	**Sig.***
Under 5000₺	54	4.22	1.860	0.253	3.595	0.007
5001–10000₺	155	3.56	1.640	0.132		
10001–15000₺	101	4.08	1.765	0.176		
15001–20000₺	63	3.70	1.700	0.214		
Over 20000₺	27	3.07	1.141	0.220		

[a]: Dependent variable: Walking Frequency (WF), *: Significance level (p<0.05). SD: Standard deviation, Std.: Standard, ANOVA: Analysis of Variance, F: F-test, Sig.: Significance level

4.3.1. Gender and WD

T-test analysis was used to determine if the WD changed by gender and if the means' differences between two independent groups (man and woman) were statistically significant. T-test results are given in Table 8.

According to the results of the T-test analysis, the difference between the WD's mean of men and women is not statistically significant at the p<0.05 significance level. In conclusion, there is no significant difference between men and women regarding WD.

4.3.2. Age-Education-Income and WD

The effects of personal characteristics such as age, education, and income level on WD were investigated in this study section. After evaluating the groups' normal distributions, ANO-

Table 7. Games-howell analysis results

Education (I)	Education (J)	Mean difference (I-J)	Std. error	Sig.*
Primary school	Middle school	0.317	0.332	0.875
	High school	0.029	0.297	1.000
	Bachelor	–0.626	0.310	0.266
	Postgraduate	–0.556	0.358	0.533
Middle school	Primary school	–0.317	0.332	0.875
	High school	–0.288	0.245	0.768
	Bachelor	–0.943*	0.260	0.004
	Postgraduate	–0.872	0.316	0.054
High school	Primary school	–0.029	0.297	1.000
	Middle school	0.288	0.245	0.768
	Bachelor	–0.655*	0.214	0.021
	Postgraduate	–0.585	0.279	0.236
Bachelor	Primary school	0.626	0.310	0.266
	Middle school	0.943*	0.260	0.004
	High school	0.655*	0.214	0.021
	Postgraduate	0.070	0.292	0.999
Postgraduate	Primary school	0.556	0.358	0.533
	Middle school	0.872	0.316	0.054
	High school	0.585	0.279	0.236
	Bachelor	–0.070	0.292	0.999
Income (I)	**Income (J)**	**Mean difference (I-J)**	**Std. error**	**Sig.***
Under 5000₺	5001–10000₺	0.661	0.285	0.150
	10001–15000₺	0.143	0.308	0.990
	15001–20000₺	0.524	0.332	0.514
	Over 20000₺	1.148*	0.335	0.009
5001–10000₺	Under 5000₺	–0.661	0.285	0.150
	10001–15000₺	–0.518	0.219	0.131
	15001–20000₺	–0.137	0.251	0.982
	Over 20000₺	0.487	0.256	0.330
10001–15000₺	Under 5000₺	–0.143	0.308	0.990
	5001–10000₺	0.518	0.219	0.131
	15001–20000₺	0.381	0.277	0.645
	Over 20000₺	1.005*	0.281	0.006
15001–20000₺	Under 5000₺	–0.524	0.332	0.514
	5001–10000₺	0.137	0.251	0.982
	10001–15000₺	–0.381	0.277	0.645
	Over 20000₺	0.624	0.307	0.260
Over 20000₺	Under 5000₺	–1.148*	0.335	0.009
	5001–10000₺	–0.487	0.256	0.330
	10001–15000₺	–1.005*	0.281	0.006
	15001–20000₺	–0.624	0.307	0.260

*: Significance level ($p<0.05$). Dependent variable: WF (monthly).

Table 8. T-test analysis (WD)

Variable	Gender	Mean	SD	Std. error (mean)	t	Sig.	Mean difference	Std. error difference
WF	Man	4.10	1.547	0.107	–0.250	0.802*	–0.040	0.162
	Woman	4.14	1.683	0.122				

*: Significance level (p<0.05). WD: Walking duration, SD: Standard deviation, Std.: Standard

Table 9. Statistical analysis of age, education, income and ANOVA (WD)

Age	N	Mean	SD	Std. error	ANOVA[a]	
					F	Sig.*
18–30	71	3.75	1.701	0.200	5.115	0.001
31–40	134	3.84	1.609	0.139		
41–50	89	4.60	1.577	0.165		
51–60	91	4.40	1.474	0.157		
Over 60	15	3.73	1.280	0.330		
Education	**N**	**Mean**	**SD**	**Std. error**	**ANOVA[a]**	
					F	**Sig.***
Primary school	43	4.48	1.486	0.229	1.338	0.255
Middle school	80	4.00	1.630	0.182		
High school	155	3.96	1.605	0.127		
Bachelor	85	4.22	1.491	0.165		
Postgraduate	37	4.39	1.946	0.324		
Income	**N**	**Mean**	**SD**	**Std. error**	**ANOVA[a]**	
					F	**Sig.***
Under 5000₺	54	4.17	1.634	0.222	0.524	0.718
5001–10000₺	155	4.17	1.668	0.134		
10001–15000₺	101	4.19	1.495	0.149		
15001–20000₺	63	3.92	1.697	0.214		
Over 20000₺	27	3.85	1.512	0.291		

[a]: Dependent variable: Walking duration (WD), *: Significance level (p<0.05). SD: Standard deviation, Std.: Standard, ANOVA: Analysis of Variance, F: F-test, Sig.: Significance level

VA analysis examined whether the WD varied according to their age, education, and income. The descriptive statistical analysis of WD between the groups regarding the participants' age, education, and income levels, also the results of the ANOVA analysis are shown in Table 9.

According to Table 9, the ANOVA analysis result for the age is statistically significant at the p<0.05 significance level. Thus, there is a significant difference between the WD's mean of different age groups. However, the result of ANOVA analysis for education and income variables is not statistically significant at the p<0.05 significance level. Therefore, there isn't a significant difference between the WD's mean of different education and income groups. To determine which age groups, cause the difference between the WD's mean, Post-Hoc analysis was performed. Tukey analysis was

Table 10. Tukey HSD analysis results

Age (I)	Age	(J) Mean difference (I-J)	Std. error	Sig.*
18–30	31–40	–0.086	0.231	0.996
	41–50	–0.854*	0.249	0.006
	51–60	–0.648	0.251	0.076
	Over 60	0.017	0.448	1.000
31–40	18–30	0.086	0.231	0.996
	41–50	–0.769*	0.215	0.004
	51–60	–0.562	0.217	0.074
	Over 60	0.102	0.430	0.999
41–50	18–30	0.854*	0.249	0.006
	31–40	0.769*	0.215	0.004
	51–60	0.207	0.236	0.906
	Over 60	0.871	0.440	0.278
51–60	18–30	0.648	0.251	0.076
	31–40	0.562	0.217	0.074
	41–50	–0.207	0.236	0.906
	Over 60	0.664	0.441	0.559
Over 60	18–30	–0.017	0.448	1.000
	31–40	–0.102	0.430	0.999
	41–50	–0.871	0.440	0.278
	51–60	–0.664	0.441	0.559

*: Significance level ($p<0.05$). Dependent variable: WD. WD: Walking duration, HSD: Honest significant difference

done since the variance was equal for both variables. The Tukey analysis is a parametric Post-Hoc analysis approach to make multiple comparisons for two or more variables. Analysis results are given in Table 10.

According to Table 10, there is a significant difference in comparing age groups' WD. The WD of the participants in the 41–50 age group is statistically higher than the groups between 18–30 and 31–40 at the $p<0.05$ significance level (Table 9). According to this result, middle-aged individuals walk longer.

5. Discussion and Conclusion

One of the main concerns for sustainable urban design research is the creation of walkable routes and walkways to increase walking activity. Many factors influence people's physical activity behaviours, such as walking. The built environment's physical quality is the most important element influencing people's walking habits. However, in addition to environmental characteristics, the role of individual characteristics on walking tendencies is too important to be ignored. This study aimed to reveal the relationship between people's walking habits and the characteristics of the preferred routes for leisure and sports walking. The characteristics of walkable roads were defined in the study as a result of the literature review, and a questionnaire survey form was designed in this context. The survey was carried out in the Kızılcaşar neighbourhood in Gölbaşı district of Ankara province, with 400 participants over the age of 18. Statistical analyses of the questionnaires were made in IBM SPSS 24 program.

According to the questionnaire survey results (Fig. 7), walk paths should be safe from potential dangers such as people, animals, and vehicles, provide walking comforts such as calmness, flat topography, and sidewalks, and offer aesthetic pleasantness such as landscape, maintenance and visual diversity to encourage individuals to walk at the neighbourhood scale.

The results of this study, like similar studies (Brown et al., 2007; Forsyth, 2015; Halu, 2019; Hsieh & Chuang, 2021; McCormack et al., 2004; Owen et al., 2004; Southworth, 2005; Speck, 2012; Wang et al., 2016), show that safety is an important parameter in the preferences of routes for walking. In addition, the results of this study, like similar studies, show that factors such as landscaping (Al-Hagla, 2009; Ferrer et al., 2015; Forsyth, 2015; Heesch et al., 2014; Wang et al., 2016), maintenance (Al-Hagla, 2009; Southworth, 2005), comfort (Ferrer et al., 2015; Halu, 2019; Jamei et al., 2021; Owen et al., 2004; Speck, 2012; Suminski & Dominick, 2022; Wang et al., 2016), visual diversity and attractiveness (Jamei et al., 2021; Southworth, 2005) and lighting (Al-Hagla, 2009) affect walking behaviours.

However, in some studies (Halu, 2019; Jamei et al., 2021), the social milieu and socialisation opportunities have been found to be effective on the individual's walking tendency. However, according to the results of this study, calmness and silent walking paths were preferred by individuals. This result shows that different environmental features are effective in walking for different purposes. For example, individuals may prefer silent environments when they want to walk for sports purposes, while they may prefer more social and crowded environments when they use pedestrian transportation for shopping purposes. In this respect, in walkability studies, it is important to determine the purpose of walking and make examinations accordingly.

Also, the study determined that personal factors such as gender, education, and income levels of individuals affect their walking tendencies. In this regard, to encourage more walking activities in residential areas, it is necessary to develop a more holistic decision-making tool, considering individuals' socioeconomic and sociocultural levels and the characteristics of the built environment.

According to the other results obtained in this study, the tendency to walk differs between men and women. Contrary to the results of other studies (Cauley et al., 1991), woman par-

ticipants in this study walked more frequently than men. Similar to the results of other studies (Cauley et al., 1991; Droomers et al., 1998; Giles-Corti & Donovan, 2002; Hoehner et al., 2005; Lindström et al., 2001; Yen & Kaplan, 1998), in this study, the frequency of walking increases as the education level of individuals increases. However, contrary to the results of other studies (Bauman et al., 2009; Cauley et al., 1991; Hoehner et al., 2005; Mäkinen et al., 2009), the middle-income group tends to walk more than the low and high-income groups. While the age of the participants does not affect the frequency of walking, younger individuals walk longer than the elderly, similar to the results of other studies (Cauley et al., 1991).

According to the results obtained in the study, walkability is not only an objective parameter but also a subjective parameter. As a result, in the design of neighbourhood streets and walking routes, human-oriented environmental designs that encourage people to walk as a voluntary sport and leisure activity independent of compulsory pedestrian transportation should be taken into account. Also, designing walking paths that appeal to everyone according to the profiles of the residents of the neighbourhood in the design process is important.

This study examined the walking behaviours of individuals according to socio-demographic characteristics as well as environmental features that affect walkability on a perceptual scale and thus tried to expand the scope of the study and obtain more consistent data and draw a more holistic framework within the scope of variables that positively affect walkability. In this respect, this study proposes to take a broader perspective on the concept of multi-components, such as walkability, for future research. Also, few studies have been found that examine the urban residents' behaviour toward walking as a sports or leisure activity in their neighbourhoods, in the sense of the built environment and personal factors. In this respect, it is thought that this study is original and can make a scientific contribution to future studies.

In this study, research was conducted on the tendencies of individuals to walk for sports purposes. For a broader and more comprehensive study, the walking tendencies of individuals for different purposes can be examined in future research. Furthermore, by using the method of this study, which carries out questionnaire survey research in a single neighbourhood, data from various neighbourhoods can be collected and compared, thus increasing the consistency of the obtained data. In this study, attractive characteristics of walkable routes are revealed; however, determining the repulsive properties of routes can give more consistent clues to urban designers. As a result, it is necessary to be conscious and sensitive about which physical and social features of the neighbourhood are more critical and should be included in the design and planning guidelines for residential areas in the first place.

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