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Perceived Built Environment and Domain-Specific Physical Activity Among Adult Women: A Cross-Cultural Comparison Between Amman and Budapest

A lakókörnyezet észlelt jellemzői és a fizikai aktivitás területei közötti összefüggések nők körében Jordániában és Magyarországon

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Abstract
This study examined the relationship between perceived built environment characteristics and domain-specific physical activity among adult women living in Amman and Budapest. A cross-sectional comparative study included 800 women aged 18–45 years from Jordan (n = 399) and Hungary (n = 401). Physical activity was assessed using the International Physical Activity Questionnaire–Short Form (IPAQ-SF), while perceived built environment characteristics were evaluated using the Physical Activity Neighborhood Environment Survey (PANES). Data were analyzed using Mann–Whitney U, Kruskal–Wallis, Chi-square, and Spearman correlation tests. Women from Budapest reported significantly more favorable built environment perceptions than women from Amman ($p < 0.001$). Hungarian participants reported higher participation in active transport and leisure-time physical activity, whereas Jordanian participants reported higher occupational and domestic activity. In Amman, transport-related and leisure-time physical activity were significantly associated with more favorable built environment perceptions, whereas in Budapest only leisure-time physical activity showed a significant association. Leisure-time physical activity demonstrated the strongest relationship with total physical activity in both cities ($p < 0.001$). Weak positive correlations between perceived built environment and total physical activity were observed in Amman ($\rho = 0.14$, $p = 0.005$), while moderate positive correlations were found in Budapest ($\rho = 0.32$, $p < 0.001$). The findings indicate that the relationship between the built environment and physical activity differs across urban and socio-cultural contexts. In addition to environmental characteristics, social and cultural factors may influence women's opportunities for physical activity. Culturally appropriate, gender-sensitive urban planning and public health strategies may help promote active lifestyles among women.

Keywords:
built environment, physical activity, female adults, physical activity domains, cross-cultural

Absztrakt
A tanulmány célja az észlelt lakókörnyezeti jellemzők és a doménspecifikus fizikai aktivitás kapcsolatának vizsgálata volt Ammánban és Budapesten élő felnőtt nők körében. A keresztmetszeti összehasonlító vizsgálatban összesen 800, 18–45 éves nő vett részt Jordániából (n = 399) és Magyarországról (n = 401). A fizikai aktivitást a Nemzetközi Fizikai Aktivitás Kérdőív rövid változatával (IPAQ-SF), a lakókörnyezeti jellemzőket pedig a Physical Activity Neighborhood Environment Survey (PANES) kérdőívvel mértük. Az adatok elemzéséhez Mann–Whitney U-próbát, Kruskal–Wallis-próbát, Khi-négyzet próbát és Spearman-féle rangkorrelációt alkalmaztunk. A budapesti résztvevők szignifikánsan kedvezőbb lakókörnyezeti percepcióról számoltak be, mint az ammáni résztvevők ($p < 0,001$). A magyar nők nagyobb arányban végeztek aktív közlekedést és szabadidős fizikai aktivitást, míg a jordániai nők magasabb foglalkozási és háztartási aktivitást mutattak. Ammánban a közlekedési és a szabadidős fizikai aktivitás kedvezőbb lakókörnyezeti percepcióval társult, míg Budapesten csak a szabadidős fizikai aktivitás mutatott szignifikáns összefüggést. Mindkét városban a szabadidős fizikai aktivitás állt a legerősebb kapcsolatban az összes fizikai aktivitással ($p < 0,001$). Gyenge pozitív korrelációt találtunk Ammánban ($\rho = 0,14$; $p = 0,005$), míg Budapesten közepes erősségű pozitív korreláció volt megfigyelhető ($\rho = 0,32$; $p < 0,001$). Az eredmények arra utalnak, hogy a lakókörnyezet és a fizikai aktivitás kapcsolata eltérhet különböző városi és szociokulturális környezetekben. A környezeti tényezők mellett társadalmi és kulturális hatások is befolyásolhatják a nők fizikai aktivitási lehetőségeit. A kulturálisan megfelelő, nemérzékeny várostervezési és népegészségügyi stratégiák hozzájárulhatnak a nők aktív életmódjának elősegítéséhez.

Kulcsszavak:
lakókörnyezet, fizikai aktivitás, felnőtt nők, fizikai aktivitási területek, kulturális összehasonlítás

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Introduction

Regular physical activity plays a crucial role in maintaining physical and mental health and contributes significantly to the prevention of chronic diseases. Insufficient physical activity has been identified as a major risk factor for several non-communicable diseases, including cardiovascular diseases, obesity, type 2 diabetes, and certain cancers (Lee et al., 2012; World Health Organization, 2020). Increasing levels of physical activity within populations has therefore become a major public health priority worldwide. Despite widespread recognition of the benefits of an active lifestyle, a substantial proportion of adults still do not meet recommended physical activity levels (Guthold et al., 2018). Understanding the factors that facilitate or hinder participation in physical activity is therefore an important focus of contemporary public health research. Previous research has also highlighted notable gender disparities in physical activity participation, with women generally reporting lower levels of physical activity than men across many regions of the world (Guthold et al., 2018; Bauman et al., 2012). Social, cultural, and environmental factors, including concerns related to safety, accessibility of recreational facilities, and time constraints associated with household responsibilities, may contribute to these differences and influence women's opportunities to engage in regular physical activity.

Adult females' physical activity behavior is influenced by a wide range of determinants operating at individual, social, and environmental levels (Bauman et al., 2012). In recent years, increasing attention has been directed toward the role of the built environment in shaping health-related behaviors. The built environment refers to human-made surroundings that provide the setting for daily activities, including residential areas, transportation infrastructure, and recreational facilities (Sallis et al., 2016). Environmental characteristics such as the availability of sidewalks, crime safety, traffic safety, accessibility of public transportation, proximity of shops and services, and the presence of recreational spaces may influence individuals' opportunities and motivation to engage in physical activity (Sugiyama et al. 2014).

The present study was guided by the socio-ecological model, which proposes that physical activity behavior is influenced by interactions between individual, interpersonal, environmental, and policy-level factors (Sallis et al., 2008). Within this framework, the built environment represents an important contextual determinant that may either facilitate or hinder engagement in physical activity. Environmental characteristics such as walkability, accessibility of recreational facilities, transportation infrastructure, and neighborhood safety may shape opportunities for active living, particularly among women whose mobility behaviors are often more sensitive to environmental conditions.

A growing body of research suggests that supportive environmental characteristics are positively associated with physical activity participation. Features such as walkable neighborhoods, connected street networks, and access to parks and recreational facilities may facilitate both transport-related and leisure-time physical activity LTPA (Saelens & Handy, 2008; Kaczynski & Henderson, 2007). Conversely, environments characterized by limited pedestrian infrastructure, heavy traffic, or lack of accessible recreational spaces may discourage participation in physical activity (Humpel et al., 2002). Perceptions of safety, accessibility, and neighborhood design also play an important role in shaping individuals' willingness to engage in outdoor physical activity (Sallis et al., 2012).

Previous studies have also demonstrated that individuals living in walkable neighborhoods tend to accumulate higher levels of physical activity compared with those living in less supportive environments (Owen et al., 2007). Urban environments that support walking and cycling can encourage active transportation and contribute to higher daily energy expenditure. Research conducted across multiple international cities has also demonstrated that urban design features such as residential density, street connectivity, and land-use diversity are associated with increased levels of physical activity among adults (Sallis et al., 2016; Adams et al., 2014).

Another important consideration in physical activity research is that physical activity occurs across several domains of daily life. These domains typically include LTPA, transport-related activity, occupational activity, and household activity (Bauman et al., 2012). Each of these domains may be influenced by different environmental and contextual factors. For example, LTPA is often associated with access to recreational facilities, parks, and green spaces, while transport-related activity may depend more strongly on pedestrian infrastructure and public transportation systems (Cerin et al., 2017). Occupational and household activities are generally influenced more by work demands and domestic responsibilities than by environmental characteristics.

Examining physical activity according to domains can therefore provide a more comprehensive understanding of behavioral patterns and the environmental factors that support active lifestyles. Studies have shown that perceived neighborhood characteristics such as accessibility, safety, and availability of recreational spaces may influence participation in LTPA (Van Dyck et al., 2013).

Safety perceptions represent a particularly important environmental determinant of physical activity among women (Beenackers et al., 2011). Women are more likely than men to modify their mobility behaviors in response to perceived crime, harassment, and traffic-related risks (Stark & Meschik, 2018). Concerns about personal safety may discourage women from engaging in outdoor physical activities such as walking, jogging, or cycling, particularly during evening hours or in environments lacking adequate lighting and pedestrian infrastructure (Foster & Giles-Corti, 2008; Krenichyn, 2004). Research conducted in both Western

and non-Western contexts has demonstrated that women who perceive their neighborhoods as safe from crime and traffic are more likely to walk for transportation and participate in outdoor recreational activities (Cerin et al., 2017; Van Dyck et al., 2013). Conversely, environments characterized by heavy traffic, unsafe crossings, or perceived risk of crime may limit women's willingness to use public spaces or active transportation modes. These findings highlight the importance of environmental safety and urban design in shaping women's opportunities to engage in regular physical activity. Accordingly, improving neighborhood safety and accessibility may contribute to reducing gender disparities in physical activity and support more active lifestyles among female populations.

Although substantial evidence supports the relationship between built environment characteristics and physical activity, most previous studies have been conducted in high-income Western countries. International projects such as the International Physical Activity and Environment Network (IPEN) have demonstrated important associations between neighborhood design and physical activity across multiple urban settings (Sallis et al., 2016). However, evidence from Middle Eastern countries remains comparatively limited, particularly among women. In addition, relatively few studies have examined domain-specific physical activity across culturally distinct urban environments. Consequently, it remains unclear whether perceived built environment characteristics influence physical activity domains similarly among women living in cities with different urban structures, transportation systems, and socio-cultural contexts.

Jordan and Hungary represent two countries with differing urban structures, transportation systems, and recreational patterns. Variations in infrastructure development, availability of public recreational spaces, and perceptions of neighborhood safety may influence how individuals interact with their environments and how they engage in physical activity across different domains. These factors may be particularly relevant for women, whose participation in physical activity is often more sensitive to environmental and social conditions. Previous research has shown that women tend to report greater concerns related to neighborhood safety, accessibility of recreational facilities, and the availability of supportive environments for outdoor physical activity (Foster & Giles-Corti, 2008; Van Dyck et al., 2013). In Middle Eastern contexts such as Jordan, environmental and cultural factors may further influence opportunities for physical activity participation, particularly among women. For example, research conducted in Jordan has shown that perceived characteristics of the built environment, including access to places for walking or recreational activity, are associated with levels of physical activity among adults (Saadeh et al., 2022). Cultural expectations, mobility patterns, and perceptions of safety in public spaces may therefore shape women's opportunities to engage in physical activity differently across countries such as Jordan and Hungary. Investigating these relationships across countries may contribute to a better understanding of the environmental determinants of physical activity and how they influence participation across different population groups. In addition to examining physical activity across domains, it is also important to assess overall physical activity levels. Total physical activity can be expressed using metabolic equivalent units, which provide a standardized method for estimating energy expenditure across different intensities of activity (Ainsworth et al., 2011). This measure allows researchers to evaluate the total amount of physical activity accumulated during a typical week and provides an indicator of overall physical activity levels within a population.
Understanding how perceived built environment characteristics relate to both domain-specific physical activity and total physical activity levels may provide valuable insights for public health promotion and urban planning. Identifying environmental features that support active lifestyles can contribute to the development of interventions aimed at increasing physical activity participation and improving population health.
Amman and Budapest were selected because both represent major urban capitals with high population density, diverse transportation systems, and substantial variation in neighborhood infrastructure and accessibility. Despite important socio-cultural and urban differences, comparing the two cities provides an opportunity to examine how perceived built environment characteristics relate to physical activity among women across distinct urban contexts.

Based on previous literature, the following hypotheses were proposed:
H1: Women living in Budapest would report more favorable perceived built environment characteristics than women living in Amman.
H2: Higher perceived built environment scores would be positively associated with transport-related and leisure-time physical activity.
H3: Women with higher total physical activity levels would report more supportive built environment perceptions.
H4: Perceived built environment scores would demonstrate a positive correlation with total physical activity (MET-min/week).
Therefore, the aim of the present study was to examine the associations between perceived built environment characteristics and domain-specific physical activity among adult women living in Amman and Budapest, and to explore the relationship between perceived built environment and total physical activity levels measured in MET-min/week.

Methods

Study Design

A cross-sectional comparative design was used to examine the relationship between perceived built envi-

ronment characteristics and physical activity patterns among adult women in two national contexts, Amman (Jordan) and Budapest (Hungary). Data were collected through a self-administered online survey distributed via social media and university mailing lists between July 2024 and February 2025.

Participants

Participants were adult women aged 18–45 years residing in either Amman or Budapest. Eligibility criteria included: (1) identifying as female, (2) being between 18 and 45 years of age, (3) residing in Amman or Budapest and identifying as Jordanian or Hungarian, and (4) providing informed consent. Participants were excluded if they were pregnant, reported medical conditions that limited physical activity, or declined participation.

The minimum required sample size was estimated using a standard sample size formula for large populations with a 95% confidence level, 5% margin of error (Israel, 2003), and an assumed response distribution of 50%. The estimated minimum sample size was approximately 384 participants per group. Therefore, the final sample of 800 participants (Jordan: n = 399; Hungary: n = 401) was considered adequate for statistical analysis.

However, because convenience sampling and online recruitment methods were used, the sample may not fully represent the broader populations of women living in Amman and Budapest. Therefore, selection bias and limited generalizability cannot be excluded. Therefore, the findings should be interpreted as reflecting perceptions and physical activity patterns among urban women participating in online recruitment within Amman and Budapest rather than nationally representative female populations.

Measures

Physical Activity

Physical activity was assessed using the International Physical Activity Questionnaire – Short Form (IPAQ-SF)**.** The instrument records the frequency and duration of vigorous, moderate, and walking activities performed during the previous seven days. Weekly physical activity was calculated in metabolic equivalent minutes per week (MET-min/week) using the official IPAQ scoring protocol. Participants were classified into low, moderate, or high physical activity categories according to the standard IPAQ classification criteria. The IPAQ-SF has demonstrated acceptable reliability and validity across multiple countries (Craig et al., 2003).

Physical Activity Domains

Participants were asked to identify the domains in which they were most physically active, Domain definitions were adapted from previous research on domain-specific physical activity (Bauman et al., 2012). The domains included:

- Occupational activity: physical activity performed during work or study-related tasks.
- Transport-related activity: walking or cycling used for transportation, such as commuting to work, university, or other daily destinations.
- Domestic activity: physical activity related to household tasks and responsibilities.
- Leisure-time physical activity: recreational or sport-related physical activity performed during free time.

Each domain was coded as a binary variable (yes/no) for statistical analysis. This approach was used to simplify comparisons across physical activity domains and improve interpretability within the cross-cultural design. However, binary coding may have reduced variability and limited the ability to examine differences in activity intensity or duration within each domain.

Built Environment

Perceived built environment characteristics were assessed using the Physical Activity Neighborhood Environment Survey (PANES). The instrument evaluates individuals' perceptions of neighborhood features that may influence physical activity, including accessibility of recreational facilities and outdoor parks, pedestrian infrastructure, cycling facilities, walkability, public transport access, and perceptions of neighborhood crime and traffic safety. The scale consisted of 15 Likert-type items measuring environmental attributes related to opportunities for physical activity. Reverse scoring was applied where appropriate so that higher values consistently reflected more supportive environmental conditions.

To provide an overall indicator of environmental support for physical activity, responses to the PANES items were averaged to create a composite Total Built Environment score. Higher scores indicated a more favorable built environment for engaging in physical activity.

Internal consistency reliability of the built environment scale was assessed using Cronbach's alpha**,** calculated separately for the Jordanian and Hungarian samples. The reliability analysis indicated acceptable internal consistency ($\alpha = 0.70$ for the Jordanian sample and $\alpha = 0.67$ for the Hungarian sample). Although the alpha coefficient in the Hungarian sample was slightly below the conventional 0.70 threshold, values above 0.60 are often considered acceptable in exploratory social and behavioral research, particularly for multidimensional environmental perception scales (Mohajan & Mohajan, 2017).

Anthropometric and Sociodemographic Variables

Participants reported age, marital status, education level, and employment status. Body mass index (BMI) was calculated using self-reported height and weight (kg/m²) and categorized according to World Health

Organization classifications.

Statistical Analysis
Data were analyzed using IBM SPSS Statistics version 29. Normality of continuous variables was tested using the Shapiro–Wilk test, which indicated non-normal distributions. Therefore, non-parametric statistical tests were applied.
Descriptive statistics were reported as:

- frequencies and percentages for categorical variables
- medians and interquartile ranges for continuous variables

Group differences between Jordanian and Hungarian participants were assessed using the Mann–Whitney U test for continuous variables and Pearson Chi-square tests for categorical variables. Associations between built environment perceptions and physical activity levels were examined using the Kruskal–Wallis test. Spearman rank correlation analysis was used to examine the relationship between perceived built environment scores and total physical activity (MET-minutes per week).
Statistical significance was set at ($p < 0.05$).

Ethical Considerations
The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the researchers' institution ethics committee (Approval No: XXX). Participation was voluntary and anonymous, and all participants provided electronic informed consent before completing the survey.

Results

Participant Characteristics

CHARACTERISTIC	CATEGORY	HUNGARY (N=401) N (%)	JORDAN (N=399) N (%)
Age (years), Median (IQR)	–	28 (10)	27 (9)
Sitting time (hours/day), Median (IQR)	–	6 (4)	10 (4)
Religion	Christian	346 (86.3)	30 (7.5)
	Muslim	2 (0.5)	366 (91.7)
	None	53 (13.2)	3 (0.8)
Marital status	Married	136 (34.0)	113 (28.3)
	Single	264 (66.0)	286 (71.7)
Children	Yes	68 (17.0)	61 (15.3)
	No	333 (83.0)	337 (84.7)
Education level	Secondary school	51 (12.7)	13 (3.3)
	University (Bachelor)	263 (65.6)	296 (74.2)
	Master's degree	80 (20.0)	82 (20.6)
	PhD	7 (1.7)	8 (2.0)
Employment status	Employed	356 (89.0)	268 (67.2)
	Unemployed	44 (11.0)	131 (32.8)
Financial status	Poor / Below average	21 (5.2)	23 (5.8)
	Average	277 (69.1)	246 (61.8)
	Quite good / Excellent	103 (25.6)	129 (32.4)

Table 1. Sociodemographic characteristics of participants by country

Table 1 presents the sociodemographic characteristics of the study participants. The final sample included 800 adult women from Hungary (n = 401) and Jordan (n = 399). Median age was comparable between the two groups. Hungarian participants reported significantly lower daily sitting time than Jordanian participants 6 vs 10 hours/day, ($U = 46978.0$, $p < .001$). Differences were also observed across several sociodemographic variables, particularly employment status and religious affiliation.

Physical Activity Domains by Cities

DOMAIN	NATIONALITY	ENGAGED N (%)	DID NOT ENGAGE N (%)	TOTAL N	X^2	CRAMER'S V	DF	P
ACTIVE TRANSPORT	Jordanian	48 (12.0)	351 (88.0)	399	191.49	0.49	1	<0.001
	Hungarian	236 (58.9)	165 (41.1)	401				
DOMESTIC ACTIVITY	Jordanian	121 (30.3)	278 (69.7)	399	10.87	0.12	1	0.001
	Hungarian	81 (20.2)	320 (79.8)	401				
OCCUPATIONAL ACTIVITY	Jordanian	279 (69.9)	120 (30.1)	399	71.64	0.30	1	<0.001
	Hungarian	161 (40.1)	240 (59.9)	401				
LEISURE-TIME PHYSICAL ACTIVITY (LTPA)	Jordanian	264 (66.2)	135 (33.8)	399	79.04	0.31	1	<0.001
	Hungarian	368 (91.8)	33 (8.2)	401				

Table 2: Detailed Crosstabulation and Chi-Square Test Results for Physical Activity Domains by Nationality
**Pearson Chi-square tests were used to examine differences in participation across physical activity domains between Jordanian and Hungarian participants. Cramer's V values indicate effect size strength of associations.

Differences in participation across physical activity domains between Jordanian and Hungarian participants are presented in Table 2. Significant differences were observed across all physical activity domains ($p < 0.01$). Hungarian participants reported substantially higher participation in active transport and leisure-time physical activity, whereas Jordanian participants demonstrated higher participation in occupational and domestic activity domains. The strongest association was observed for active transport ($\chi^2 = 191.49$, Cramer's $V = 0.49$, $p < 0.001$).

Perceived Built Environment by Country

COUNTRY	N	BE MEDIAN (IQR)
Hungary	401	3.77 [3.59–3.96]
Jordan	399	2.60 [2.46–2.88]

Table 3. Perceived built environment score differences by country
Note. Values are presented as median and interquartile range (IQR). Differences between countries were assessed using the Mann–Whitney U test due to the non-normal distribution of the data. Hungarian participants reported significantly higher perceived built environment scores compared with Jordanian participants
($U = 8056.5$, $p < 0.001$).

Differences in perceived built environment scores between Hungarian and Jordanian participants are presented in Table 3. Participants from Budapest reported notably higher perceived built environment scores compared with participants from Amman ($U = 8056.5$, $p < 0.001$).

Perceived built environment scores across physical activity domains

CITY	PHYSICAL ACTIVITY DOMAIN	PARTICIPATION	N	MEDIAN BE SCORE (IQR)	U	P
Amman	Active travel	Yes	48	2.80 [2.32–3.20]	11166.0	<0.001
		No	351	2.33 [2.20–2.60]		
	Domestic activity	Yes	121	2.40 [2.27–2.73]	18441.5	0.125
		No	278	2.33 [2.20–2.67]		
	Occupational activity	Yes	279	2.33 [2.20–2.63]	15096.5	0.119
		No	120	2.40 [2.20–2.73]		
	Leisure-time PA (LTPA)	Yes	264	2.33 [2.20–2.53]	14259.0	0.001
		No	135	2.40 [2.27–3.07]		
Budapest	Active travel	Yes	236	3.73 [3.47–3.93]	20234.5	0.503
		No	165	3.67 [3.47–3.87]		
	Domestic activity	Yes	81	3.67 [3.40–3.87]	11369.5	0.087
		No	320	3.73 [3.53–3.93]		
	Occupational activity	Yes	161	3.67 [3.47–3.93]	18631.0	0.544
		No	240	3.73 [3.47–3.93]		
	Leisure-time PA (LTPA)	Yes	368	3.73 [3.53–3.93]	8727.5	<0.001
		No	33	3.40 [2.87–3.67]		

Table 4. Perceived built environment scores across physical activity domains by city
Values are presented as median and interquartile range (IQR). Differences between groups were assessed separately for each city using the Mann–Whitney U test due to non-normal distribution of the data.

Differences in perceived built environment scores across physical activity domains stratified by city are shown in Table 4. In Amman, significant differences in perceived built environment scores were observed for active transport ($U = 11166.0$, $p < 0.001$) and leisure-time physical activity ($U = 14259.0$, $p = 0.001$). While in Budapest, significant differences were identified only for leisure-time physical activity ($U = 8727.5$, $p < 0.001$). No significant differences were observed for domestic or occupational activity domains in both cities.

Built Environment and Physical Activity Levels

CITY	PA LEVEL	N	MEDIAN BE SCORE (IQR)	H	P
Amman	Low	265	2.33 [2.20–2.53]	13.47	0.001
	Moderate	106	2.47 [2.20–2.98]		
	High	28	2.47 [2.32–3.15]		
Budapest	Low	151	3.60 [3.40–3.80]	26.22	<0.001
	Moderate	196	3.80 [3.53–4.00]		
	High	54	3.77 [3.47–3.93]		

Table 5. Perceived built environment score by physical activity level among women in Amman and Budapest
Values are presented as median and interquartile range (IQR). Differences between physical activity levels were assessed separatly for each city using the Kruskal–Wallis test due to non-normal distribution of the data.

Differences in perceived built environment scores across physical activity levels (low/moderate/high) among cities are presented in Table 5. Significant differences across physical activity categories were observed in both Amman ($H = 13.47$, $p = 0.001$) and Budapest ($H = 26.22$, $p < 0.001$). In both cities, participants with higher physical activity levels reported more favorable built environment perceptions. Across all physical activity categories, participants from Budapest consistently demonstrated higher perceived built environment scores than participants from Amman.

Association Between Physical Activity Domains and Total Physical Activity

CITY	PHYSICAL ACTIVITY DOMAIN	PARTICIPATION	MEDIAN MET-MIN/WEEK (IQR)	MANN–WHITNEY U	P-VALUE
Amman	Active transport	Yes	594.0 (132–1404)	7713.5	0.587
		No	344.3 (0–1287)		
	Domestic activity	Yes	344.3 (0–960)	13992.0	0.006
		No	480.4 (99–1440)		
	Occupational activity	Yes	344.3 (0–1200)	14895.5	0.081
		No	492.8 (99–1440)		
	Leisure-time physical activity (LTPA)	Yes	492.8 (132–1440)	12132.5	<0.001
		No	240.0 (0–693)		
Budapest	Active transport	Yes	918.0 (264–1956)	18871.5	0.561
		No	974.3 (297–1836)		
	Domestic activity	Yes	810.0 (198–1680)	10428.0	0.004
		No	974.3 (330–2016)		
	Occupational activity	Yes	884.3 (240–1812)	17157.0	0.033
		No	974.3 (330–2016)		
	Leisure-time physical activity (LTPA)	Yes	974.3 (330–2016)	2924.0	<0.001
		No	288.0 (0–810)		

Table 6. Total physical activity across physical activity domains stratified by city
**Values are presented as median and interquartile range (IQR). Differences between participants engaging and not engaging in each physical activity domain were assessed separately for each city using the Mann–Whitney U test due to non-normal distribution of MET-min/week values.

Associations between physical activity domains and total physical activity (MET-min/week) stratified by city are presented in Table 6. In both Amman and Budapest, leisure-time physical activity demonstrated significant associations with higher total physical activity levels ($p < 0.001$). In contrast, active transport was not significantly associated with total physical activity in either city. Domestic activity demonstrated inverse associations with total physical activity in both cities, whereas occupational activity was significantly associated with total physical activity only in Budapest ($p = 0.033$).

Correlation Between Built Environment and Total Physical Activity by METs

Spearman correlation analyses examining the relationship between perceived built environment scores and total physical activity stratified by city are presented in Table 7. Weak positive correlations were observed in Amman ($\rho = 0.14$, $p = 0.005$), whereas moderate positive correlations were identified in Budapest ($\rho = 0.32$, $p < 0.001$). Thus, the strength of the association was notably greater in Budapest than in Amman.

Discussion

The present study examined the relationship between perceived built environment characteristics and physical activity among adult women living in Amman and Budapest. The findings revealed substantial differences between the two urban contexts in both environmental perceptions and physical activity patterns. Women living in Budapest consistently reported more favorable built environment perceptions, higher participation in active transport, and greater engagement in leisure-time physical activity compared with women living in Amman.

One of the clearest findings of the study was the large difference in perceived built environment scores between the two cities. Participants from Budapest reported considerably more supportive neighborhood environments across all physical activity categories. This difference may reflect variations in urban design, pedestrian infrastructure, public transportation systems, accessibility of recreational spaces, and neighborhood walkability between the two capitals. Previous studies have shown that environments characterized by accessible sidewalks, connected streets, public recreational facilities, and safe pedestrian infrastructure are positively associated with physical activity participation (Carroll-Scott et al., 2013; Mabry et al., 2013; Sallis et al., 2019), In contrast, environmental barriers such as traffic congestion, limited walkability, lack of recreational accessibility, or perceptions of unsafe public spaces may reduce opportunities for physical activity participation, particularly among women (Hong & Chen, 2014).

The findings also demonstrated that the relationship between perceived built environment and physical activity domains differed between the two cities. In Amman, active transport and leisure-time physical activity were associated with more favorable built environment perceptions, whereas in Budapest only leisure-time physical activity demonstrated significant associations with perceived built environment. This may suggest that women's participation in active transportation within Amman is more dependent on supportive environmental conditions such as walkability, accessibility, traffic safety and car use reliance. In Budapest, however, supportive infrastructure for walking and transportation may already be more integrated into the urban environment, reducing the impact of individual environmental perceptions on active transportation behaviors (Budapest Transport Center (BKK), 2023; Husqvarna Urban Green Space Index (HUGSI), 2025).

At the same time, the relatively weaker associations observed between built environment and physical ac-

tivity in Amman suggest that environmental characteristics alone may not fully explain women's physical activity participation within this context. Additional social and cultural factors may play an important role in shaping activity behaviors among women in Jordan. Family responsibilities, social support, cultural expectations, time constraints, transportation dependence, and concerns related to safety or comfort in public spaces may influence opportunities for engaging in physical activity regardless of neighborhood environmental quality (Coackly, 2015; Poduval & Poduval, 2009). Previous studies conducted in Middle Eastern populations have similarly highlighted the importance of social and cultural influences on women's physical activity participation (Saadeh et al., 2022). Therefore, improving environmental infrastructure alone may not be sufficient without simultaneously addressing broader social and cultural barriers to physical activity.

Another important finding was the consistent role of leisure-time physical activity in both cities. Women engaging in leisure-time physical activity accumulated significantly higher total physical activity levels compared with non-participants in both Amman and Budapest. This finding suggests that recreational and sport-related activities contribute substantially to overall physical activity accumulation among women regardless of urban context. Leisure-time physical activity may therefore represent an important target for public health interventions aimed at increasing physical activity levels within female populations. Our results agree with previous findings which investigated the role of LTPA on over all health (Andersen et al., 2000; Ekenga et al., 2015; Steinbach & Graf, 2008).

In contrast, domestic and occupational activity demonstrated weaker or inconsistent associations with both perceived built environment and total physical activity. These domains are likely influenced more strongly by work-related obligations, household responsibilities, and socioeconomic factors than by neighborhood environmental characteristics (Ekenga et al., 2015; Krause et al., 2007; Thomsen et al., 2025). The findings therefore support the idea that different physical activity domains are shaped by different contextual determinants and should not be interpreted as equally influenced by environmental conditions.

The correlation analyses further demonstrated that perceived built environment was positively associated with total physical activity in both cities, although the relationship was stronger in Budapest than in Amman. This finding may indicate that supportive neighborhood environments play a more direct role in facilitating physical activity within the Budapest context. In contrast, the weaker correlation observed in Amman again suggests that other determinants beyond environmental characteristics may contribute substantially to women's activity behaviors. Similar findings have been reported in previous international studies showing that supportive neighborhood environments are positively associated with women's physical activity participation (Cerin et al., 2017; O'Brien et al., 2019; Teixeira et al., 2023).

From a public health perspective, the findings emphasize the importance of creating urban environments that support active lifestyles among women. Improving neighborhood walkability, pedestrian safety, accessibility of recreational facilities, and transportation infrastructure may help encourage participation in physical activity. However, the findings also suggest that effective physical activity promotion strategies, particularly in Middle Eastern urban settings, should consider broader social and cultural influences in addition to environmental improvements. Rather than focusing solely on constructing new urban environments, public health and urban planning efforts should also invest in adapting existing environments to better meet the social and cultural needs of women within each community. Designing culturally appropriate recreational spaces, safe pedestrian areas, women-friendly facilities, and socially supportive environments may represent important strategies for promoting physical activity across different cultural contexts. Community-based initiatives, women-only recreational opportunities, social support programs, and culturally sensitive interventions may therefore play an important role in supporting active lifestyles among women. In addition, utilizing existing indoor environments such as shopping malls and community centers may provide culturally comfortable and climate-appropriate opportunities for walking and recreational activity, particularly in regions where extreme weather conditions or social norms may limit outdoor physical activity among women.

Limitations

Several limitations should be considered when interpreting the findings of the present study. First, the cross-sectional design does not allow causal conclusions regarding the relationship between perceived built environment characteristics and physical activity. Second, physical activity, sitting time, height, and weight were self-reported, which may have introduced recall bias or reporting inaccuracies.

In addition, participants were recruited through convenience sampling using online distribution methods. Consequently, the sample may not fully represent the broader populations of women living in Amman and Budapest, particularly women with limited internet access or lower engagement with online platforms. Therefore, the findings should be interpreted as reflecting the perceptions and activity patterns of urban women participating in online recruitment rather than nationally representative female populations. Accordingly, the statistical findings are valid for the study sample of women aged 18–45 years residing in Amman and Budapest. Because convenience sampling and online recruitment were used, caution is warranted when generalizing these findings to the broader female populations of Jordan and Hungary.

Another limitation relates to the assessment of physical activity domains using binary (yes/no) variables. Although this approach simplified comparisons across domains, it reduced variability and did not allow examination of differences in activity duration or intensity within each domain. Furthermore, while the anal-

yses were stratified by city to better examine cross-cultural differences, multivariable regression analyses controlling for potential confounding variables were not performed. The present study primarily aimed to compare perceived built environment and physical activity patterns between women living in two urban and socio-cultural contexts rather than to establish independent predictive models. In addition, the study focused on a relatively restricted age group (18–45 years) to reduce variability related to age-associated physiological and metabolic differences. Nevertheless, the absence of multivariable analyses limits the ability to determine independent associations between environmental factors and physical activity outcomes..

Conclusion

This study explored how perceived neighborhood environments relate to physical activity among women living in Amman and Budapest. Clear differences emerged between the two cities in both environmental perceptions and patterns of physical activity participation. Women from Budapest generally perceived their neighborhoods as more supportive for active living and reported greater engagement in leisure-time and transport-related physical activity.

The findings also showed that the relationship between the built environment and physical activity was not identical across the two urban contexts. In Budapest, supportive environmental perceptions were more consistently linked with overall physical activity, whereas weaker associations were observed in Amman. This suggests that women's physical activity behaviors may be shaped not only by neighborhood design and accessibility, but also by social and cultural influences that affect opportunities for active living.

Leisure-time physical activity appeared to contribute most strongly to overall activity levels in both cities, highlighting the importance of accessible recreational opportunities for women. At the same time, the findings indicate that improving physical activity participation requires more than infrastructure alone. Urban and public health strategies should consider how environments are experienced within different cultural settings and how existing spaces can be adapted to better support women's daily mobility, safety, comfort, and social needs.

The findings are most directly applicable to the study sample of women aged 18–45 years residing in Amman and Budapest and should not be considered representative of all women in Jordan and Hungary.

References

Adams, Marc A., Lawrence D. Frank, Jasper Schipperijn, Gina Smith, Jeff Chapman, Lasse B. Christiansen, et al. 2014. "International Variation in Neighborhood Walkability, Transit, and Recreation Environments Using Geographic Information Systems." *International Journal of Health Geographics* 13: 43. https://doi.org/10.1186/1476-072X-13-43.

Andersen, L. B., Schnohr, P., Schroll, M., & Hein, H. O. (2000). All-Cause Mortality Associated With Physical Activity During Leisure Time, Work, Sports, and Cycling to Work. *Archives of Internal Medicine*, *160*(11), 1621–1628. https://doi.org/10.1001/archinte.160.11.1621

Ainsworth, Barbara E., William L. Haskell, Stephen D. Herrmann, Nathanael Meckes, David R. Bassett, Catrine Tudor-Locke, et al. 2011. "Compendium of Physical Activities." *Medicine & Science in Sports & Exercise* 43 (8): 1575–1581. https://doi.org/10.1249/MSS.0B013E31821ECE12

Bauman, Adrian E., Rodrigo S. Reis, James F. Sallis, Jonathan C. Wells, Ruth J. F. Loos, and Brian W. Martin. 2012. "Correlates of Physical Activity: Why Are Some People Physically Active and Others Not?" *The Lancet* 380 (9838): 258–271. https://doi.org/10.1016/S0140-6736(12)60735-1

Beenackers, Marieke A., Carlijn B. M. Kamphuis, Alex Burdorf, Johan P. Mackenbach, and Frank J. van Lenthe. 2011. "Sports Participation, Perceived Neighborhood Safety, and Individual Cognitions: How Do They Interact?" *International Journal of Behavioral Nutrition and Physical Activity* 8: 76. https://doi.org/10.1186/1479-5868-8-76.

Budapest Transport Center (BKK). (2023). *Budapest Cycling and Pedestrian Development Strategy 2030. Budapest: BKK Centre for Budapest Transport; 2023*.

Carroll-Scott, A., Gilstad-Hayden, K., Rosenthal, L., Peters, S. M., McCaslin, C., Joyce, R., & Ickovics, J. R. (2013). Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: The role of built, socioeconomic, and social environments. *Social Science and Medicine*, *95*, 106–114. https://doi.org/10.1016/j.socscimed.2013.04.003

Cerin, Ester, Andrea Nathan, Jelle Van Cauwenberg, David W. Barnett, and Adrian Barnett. 2017. "Neighbourhood Physical Environment and Active Travel." *International Journal of Behavioral Nutrition and Physical Activity* 14: 15. https://doi.org/10.1186/s12966-017-0463-9

Coackly, J. (2015). sports in society issues and controversies. *McGraw Hill Education*, 170–210.

Ekenga, C. C., Parks, C. G., Wilson, L. E., & Sandler, D. P. (2015). Leisure-time physical activity in relation to occupational physical activity among women. *Preventive Medicine*, *74*, 93–96. https://doi.org/10.1016/j.ypmed.2015.03.003

Eyler, Amy A., Ross C. Brownson, Stephanie J. Bacak, and Richard A. Housemann. 2003. "The Epidemiology of Walking for Physical Activity in the United States." *Medicine & Science in Sports & Exercise* 35 (9): 1529–1536. https://doi.org/10.1249/01.MSS.0000084622.39122.0C.

Foster, Sarah, and Billie Giles-Corti. 2008. "The Built Environment, Neighborhood Crime and Constrained Physical Activity: An Exploration of Inconsistent Findings." *Preventive Medicine* 47 (3): 241–251. https://doi.org/10.1016/j.ypmed.2008.03.017.

Guthold, Regina, Gretchen A. Stevens, Leanne M. Riley, and Fiona C. Bull. 2018. "Worldwide Trends in Insufficient Physical Activity." *The Lancet Global Health* 6 (10): e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7

Hong, J., & Chen, C. (2014). The role of the built environment on perceived safety from crime and walking: examining direct and indirect impacts. *Transportation*, *41*(6), 1171–1185. https://doi.org/10.1007/S11116-014-9535-4

Humpel, Nancy, Neville Owen, and Eva Leslie. 2002. "Environmental Factors Associated with Adults' Physical Activity." *American Journal of Preventive Medicine* 22 (3): 188–199. https://doi.org/10.1016/S0749-3797(01)00426-3

Husqvarna Urban Green Space Index (HUGSI). (2025). *How green is Budapest? Find out at HUGSI.green*. https://hugsi.green/cities/Budapest

Israel, G. D. (2003). *Determining Sample Size 1*. http://edis.ifas.ufl.edu.

Kaczynski, Andrew T., and Karla A. Henderson. 2007. "Parks and Recreation Environments and Physical Activity." *Leisure Sciences* 29 (4): 315–354. https://doi.org/10.1080/01490400701544606

Krause, N., Brand, R. J., Kaplan, G. A., Kauhanen, J., Malla, S., Tuomainen, T.-P., & Salonen, J. T. (2007). Occupational physical activity, energy expenditure and 11-year progression of carotid atherosclerosis. *Scandinavian Journal of Work, Environment & Health*, *33*(6), 405–424. https://doi.org/10.5271/sjweh.1171

Krenichyn, Kira. 2004. "Women and Physical Activity in Urban Parks: Safety and Social Factors." *Women & Health* 40 (1): 27–48. https://doi.org/10.1300/J013v40n01_03.

Lee, I-Min, Eric J. Shiroma, Felipe Lobelo, Pekka Puska, Steven N. Blair, and Peter T. Katzmarzyk. 2012. "Effect of Physical Inactivity on Non-Communicable Diseases." *The Lancet* 380 (9838): 219–229. https://doi.org/10.1016/S0140-6736(12)61031-9

Mabry, R. M., Winkler, E. A., Reeves, M. M., Eakin, E. G., & Owen, N. (2013). Correlates of Omani adults' physical inactivity and sitting time. *Public Health Nutrition*, *16*(1), 65–72. https://doi.org/10.1017/S1368980012002844

Mohajan, H., & Mohajan, H. K. (2017). *Munich Personal RePEc Archive Two Criteria for Good Measurements in Research: Validity and Reliability Two Criteria for Good Measurements in Research: Validity and Reliability*.

Owen, Neville, Ester Cerin, Eva Leslie, Louwrens du Toit, Neil Coffee, Lawrence D. Frank, et al. 2007. "Neighborhood Walkability and Walking Behavior." *American Journal of Preventive Medicine* 33 (5): 387–395. https://doi.org/10.1016/j.amepre.2007.07.025

O'Brien, W. J., Shultz, S. P., Firestone, R. T., George, L., & Kruger, R. (2019). Ethnic-specific suggestions for physical activity based on existing recreational physical activity preferences of New Zealand women. *Australian and New Zealand Journal of Public Health*, *43*(5), 443–450. https://doi.org/10.1111/1753-6405.12902

Poduval, J., & Poduval, M. (2009). Working Mothers: How Much Working, How Much Mothers, And Where Is The Womanhood? *Mens Sana Monographs*, *7*(1), 63. https://doi.org/10.4103/0973-1229.41799

Saadeh, Rami, Ahmad Obaidat, and Mohammed Z. Allouh. 2022. "The Perceived Built Environment and General Physical Activity: An Exploratory Study in Jordan." *Frontiers in Sustainable Cities* 4: 962919. https://doi.org/10.3389/frsc.2022.962919.

Saelens, Brian E., and Susan L. Handy. 2008. "Built Environment Correlates of Walking." *Medicine & Science in Sports & Exercise* 40: S550–S566. https://doi.org/10.1249/MSS.0b013e31817c67a4

Sallis, James F., Myron F. Floyd, Daniel A. Rodríguez, and Brian E. Saelens. 2012. "Built Environments and Physical Activity." *Circulation* 125 (5): 729–737. https://doi.org/10.1161/CIRCULATIONAHA.110.969022

Sallis, James F., Ester Cerin, Terry L. Conway, Marc A. Adams, Lawrence D. Frank, Michael Pratt, et al. 2016. "Physical Activity in Relation to Urban Environments." *The Lancet* 387 (10034): 2207–2217. https://doi.org/10.1016/S0140-6736(16)30066-4

Stark, Jessica, and Michaela Meschik. 2018. "Women's Everyday Mobility: Frightening Situations and Their Impacts on Travel Behaviour." *Transportation Research Part F: Traffic Psychology and Behaviour* 54: 311–323. https://doi.org/10.1016/j.trf.2018.02.017.

Sugiyama, Takemi, Ester Cerin, Neville Owen, Ayo L. Oyeyemi, Terry L. Conway, David Van Dyck, et al. 2014. "Perceived Neighbourhood Environmental Attributes Associated with Adults' Recreational Walking." *Health & Place* 28: 22–30. https://doi.org/10.1016/j.healthplace.2014.03.003.

Van Dyck, Delfien, Ester Cerin, Terry L. Conway, Ilse De Bourdeaudhuij, Neville Owen, Jacqueline Kerr, et al. 2013. "Perceived Neighborhood Environment and Leisure-Time Physical Activity." *American Journal of Health Promotion* 27 (5): 312–320. https://doi.org/10.4278/ajhp.120905-QUAN-430

Teixeira, A., Gabriel, R., Martinho, J., Oliveira, I., Santos, M., Pinto, G., & Moreira, H. (2023). Distance to Natural Environments, Physical Activity, Sleep, and Body Composition in Women: An Exploratory Analysis. *International Journal of Environmental Research and Public Health*, *20*(4). https://doi.org/10.3390/ijerph20043647

Thomsen, L. B., Schmidt, E. B., Dalgas, B. W., & Elmose-Østerlund, K. (2025). The association between the frequency of physical activity and social background within and across home, occupational, transportation and leisure domains. *Frontiers in Sports and Active Living*, *7*, 1609485. https://doi.org/10.3389/FSPOR.2025.1609485/FULL

World Health Organization. 2020. *Guidelines on Physical Activity and Sedentary Behaviour*. Geneva: World Health Organization.