

The Complexity of Relationship between the Physical Environment and Residents' Walking in Tehran, Iran: A Qualitative Study

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ABSTRACT: We know little about the physical environment-walking relationship in middle-east countries. There is also a need for qualitative approaches to studying this relationship. This study aimed to understand the physical contextual factors influencing the everyday walking experience of middle-aged residents in an area of Tehran, Iran. It utilized an inductive qualitative content analysis along with Constant Comparative Analysis (CCA). The main themes and categories explored were safety and security (sense of insecurity, sense of inadequate safety), comfort and convenience (lack of physical comfort, accessibility to destinations and amenities, the possibility to do rhythmic walking, sense of overcrowding), and aesthetics and attractiveness (variety and harmony, cleanliness and maintenance, natural elements). The subset concepts of the categories were also explored, including lighting, presence of others, air pollution, crossing streets, the surface of sidewalks, walking on the side of streets roadway, thermal comfort, stepping stairs, noise nuisance, distances to the neighborhood facilities, sitting places, characteristics of paths, overloaded streets, non-local offices and stores, variety and harmony of building facades, old buildings, a variety of colors, various stores, enclosure, upkeep of buildings, greenery, presence of water and birds, and natural sounds. Narrow and uneven sidewalks influenced walking in multiple aspects. This study proposed considerations and details to the general urban policies and interventions to encourage walking. The results of this study can facilitate urban designers and planners in creating community built environments, which promote clean transportation and public health.

Keywords: *Walking experience, Built environment, Qualitative content analysis, Constant Comparative Analysis.*

INTRODUCTION

In Iran, there is a high prevalence of insufficient physical activity among adults (Fakhrzadeh et al., 2016). Physical inactivity is an important risk factor for Non Communicable diseases, including ischemic heart disease and stroke, the first and second leading causes of death in Iran, respectively (Prüss-Üstün et al., 2016). It is also the major contributing factor for the rapid growth and high prevalence of overweight and obesity in the country (Esteghamati et al., 2010).

Usage of a car is the most prevalent mode of travel among middle and high-income residents in Iran's urban areas. Vast car usage has caused heavy traffic congestion in the Central Business District (CBD) of Tehran with an average speed of about 15 km per hour during pick hours (Soltani, 2017). The daily vehicle trips also strongly contribute to high-energy

consumption and serious air quality problems in Tehran. There is a need for urgent action to reduce the adverse health outcomes of air pollution in Tehran. Besides, Iran has one of the highest crash-related death rates in the world. In 2012, crash-related death was the third cause of death in Iran, and it accounted for the death of 32 thousand people (WHO, 2015).

The broad influence of walking as the most common type of physical activity and a type of active transportation on public physical and mental health and sustainable urban development has been well documented (Giles-Corti et al., 2016; Sallis et al., 2015). Also, walking could enforce an area's social environment (Kim & Yang, 2017) and economic competitiveness (Prüss-Üstün et al., 2016).

Studies have indicated that an individual's physical environment is associated with physical activity and active

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travel (Kärmeniemi et al., 2018; Stevens, 2017). The physical environment factors, which influence walking, are different from other physical activities or active transportation modes like cycling (Kerr et al., 2016; Wang et al., 2016). The physical environment includes the condition, function, structure, or aesthetics of public open spaces and buildings (Sallis et al., 2012; Sawyer et al., 2018). It also encompasses the absence or presence of people, and the natural features of a place such as weather (Davison & Lawson, 2006; Sallis et al., 2012).

One of the health directives of Iran's recent national plan prioritized physical activity to improve public health with a focus on prevention (WHO, 2017). Also, one of the objectives of Tehran's municipality is to promote walking as a public sport and a clean transportation mode (Tehran Municipality Sports Organization, 2020; Tehran Municipality Transport and Traffic Organization, 2020). Nevertheless, the relationship between the physical environment and walking is far less known in Iran compared with western and developed countries.

There is a substantial body of quantitative research about the impact of the physical environment on walking. Using qualitative research design as a new viewpoint and a different approach in investigating the physical environment-walking relationship can help to better comprehend this context-bound phenomenon. Qualitative studies can also provide a deep understanding of this phenomenon by explaining not only what but also why physical environmental factors influence walking (Khankeh et al., 2015; Sallis et al., 2006). Only a handful of qualitative studies have concentrated on the influence of the environment on walking (Dadpour et al., 2016; Dean et al., 2020).

Many quantitative studies about the impact of the physical environment on walking reported a positive relationship between built environment "D" features and walking (Ewing & Cervero, 2010; 2017; Stevens, 2017; Zhao & Wan, 2020). The three original Ds included Density, land use Diversity, and Design (Cervero & Kockelman, 1997). Studies also added other Ds to the original ones such as Distance to transit and Destination accessibility (Ewing & Cervero, 2010). However, some studies especially from Asian countries revealed a contrary relationship between the three original Ds and walking (Adlakha et al., 2017; Day 2016; Lu et al., 2017). Also, studies found pedestrian infrastructures, security, aesthetics, greenery, and safety as factors influencing the extent to which people engage in walking (Cain et al., 2014; Dadpour et al., 2016; Dean et al., 2020; Kerr et al., 2016).

Few studies investigated the relationship between the built environment and walking in Iran. These studies emphasized that sidewalk characteristics, security, safety, accessibility to facilities, temperature, and slope influenced walking (Bahraini & Khosravi, 2010; Hesam & Aghaeizadeh, 2017; Moeni, 2012; Reza Zadeh et al., 2011). These studies also found that cleanliness of sidewalks (Moeini, 2012), visual diversity of the environment (Bahraini & Khosravi, 2010), landscape, and

enclosure (Hesam & Aghaeizadeh, 2017) had an impact on walking.

According to a national survey, adults between 45 to 64 years old recorded higher rates of overweight or obesity compared to other adult age groups. This was mostly because of insufficient physical activity (Kelishadi et al., 2008). In turn, considering the importance of reducing the health risks of low physical activity in middle-aged populations (Bellavia et al., 2013; Hu et al., 2005), we chose to study 35-65 year-olds.

To address the scarcity of studies on the physical environment-walking relationship in urban contexts of Iran and the need for qualitative approaches in studying this relationship; the current study aimed to identify the physical environment factors influencing the everyday walking experience of middle-aged adults residing in a community area (Sattar Khan) of Tehran, Iran using a qualitative research design.

MATERIALS AND METHODS

This study used a constructivist epistemology. The research methods applied in this study are the inductive qualitative content analysis (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004) and CCA (Corbin & Strauss, 2015). Inductive qualitative content analysis and CCA are not mutually exclusive (Cho & Lee, 2014). The reasons for using CCA were to engage deeply with data and reach higher levels of advance through data analysis (Fram, 2013; Holt, 2016). CCA is performed by comparing data with data and concepts as well as comparing each concept with other concepts for similarities and differences, and by grouping similar concepts together under higher-level descriptive concepts (Corbin & Strauss, 2015; Holt, 2016).

Setting

Sattar Khan in district two of Tehran city was selected as the study area. The boundaries of Sattar Khan were defined based on residents' perception of their community. The area of Sattar Khan, which consisted of four neighborhoods, is almost 5.4 square kilometers. It is located in the southeast of district two, near the central traffic restricted zone and adjacent to the low emission zone. The construction began about 60 years ago in Sattar Khan (Tehran Municipality, 2020). Regarding economic, social, physical, and recreational factors, district two has above-average development among the 22 districts of Tehran (Mirzaei et al., 2015). The population density of district two is almost 15000 people in square kilometers that is higher than that of Tehran city (12117). From 1976 to 2019, the populations of Tehran and district two have become approximately double and triple, respectively (Tehran Municipality, 2020; Tehran Municipality Transport and Traffic Organization, 2019).

Participants

The criteria considered for the inclusion of residents in the study were being middle-aged, have been living in Sattar

Khan for at least six months, and being able to walk without help. In initial sampling, participants were selected to provide sufficient diversity in their socio-demographic characteristics and the public places they usually walked. Theoretical sampling (Corbin & Strauss, 2015; Robinson, 2014) was used after the initial sampling. The reason was to comprehensively, and deeply explore the properties and dimensions of emerging concepts, categories, and themes during the fieldwork.

To facilitate the first in-depth interviews, the interviewer exercised with members of the largest exercise group in the main local park of Sattar Khan for several months at the open space in the mornings. Doing exercise in the group was free of charge and anyone could participate without limitation. Becoming acquainted with potential participants by face-to-face interactions caused the development of trust with the interviewer and they felt relaxed during the interviews. The first 13 interviewees except one were members of the exercise group. Face-to-face advertisement (Robinson, 2014) was also used to recruit other resident participants. They were recruited from the main Sattar Khan mosque, the main cultural center, local parks, bus stations, and stores from different streets. The first author conducted qualitative interviews. Thirty-four residents were selected (Table 1). In addition to residents, two local municipality employees were interviewed about environmental factors affecting walking in Sattar Khan. These two respondents were male, married, and had higher education. Their age (mean± SD) was 35±5.66 years. The reason for interviewing them was their informative data about built environment problems affecting residents' walking.

Data Gathering

A combination of both descriptive methods (e.g. sitting interviews) and spatial methods (e.g. observations, mapping, and walk-along interviews) for data gathering can provide

a comprehensive, in-depth understanding of the physical environment -walking relationship (Moran et al., 2014; Yoo & Kim, 2017). Usage of various methods for data gathering can also improve trustworthiness. In turn, this study employed various descriptive and spatial methods to gather data including in-depth sitting and walking interviews (as the major method), mapping exercises, short interviews, and field observations.

Face-to-face in-depth semi-structured interviews (Dicicco-Bloom & Crabtree, 2006) were conducted 39 times with 36 main participants. To obtain more concepts and clarify vague data, each of the first three participants were interviewed twice. From 39 in-depth interviews, 24 performed outdoors, and from which six were walk-along based on the participants' choice. All in-depth interviews except one carried out during the daytime.

Follow-up interviews were performed to capture new concepts and revise the obtained ones, with the first 11 participants about a week after in-depth interviews. A respondent mapping exercise (Adkins, 2012) was used as an interview aid. The participants were encouraged to mark their preferred, avoided, and usually used paths on a map of the study area and talk about their choice differences. Short interviews were also conducted with 12 eligible resident respondents who were not the main participants. Besides, plenty of field observations were used to gather more data and verify data from interviews and maps. The physical environment and residents' walking were observed at various hours of the day and night, days of the week, and seasons. The researcher acted as a participant (Flick, 2014) in the field. Field notes were taken during observations and as soon as possible after in-depth interviews. Thick descriptions were also regularly recorded along with data collection and analysis.

Data collection and analysis were conducted in parallel, so the analyzed data-guided subsequent data collection (Corbin & Strauss, 2015). Therefore, both prepared and ad hoc questions

Table 1: Characteristics of resident participants

Resident participants (N=34)	
Gender, Female, %	67.65
Age, mean (SD)	50.62 (8.85)
Higher education, %	35.29
Married, %	82.35
Years of residence in Sattar Khan, mean (SD)	20.71 (13.03)
Car ownership in household, %	91.18
Occupation, %	
Employed	41.18
Retired or Housewife	58.82
Daily walking time (on five days of the week), %	
Less than 30 minutes	44.12
More than 30 minutes	55.88

were used from the second interview onwards. Benefits were achieved from using place comparison in the interviews to obtain deep and detailed data. For example, participants were persuaded to contrast their current community area with their former one and the one that they perceived as the best for walking in the city. Follow-up questions and probing techniques (Boyce & Neale, 2006; Corbin & Strauss, 2015) were also employed. Also, conversational statements were applied instead of direct questions (Yungblut et al., 2012) such as “Would you please speak about your walking”. The sample size was determined by data saturation.

Data Analysis

The method of CCA was used to analyze the data. Whole interviews and field notes (Graneheim & Lundman, 2004) were selected as the unit of analysis. Data analysis for each interview

was performed in three phases. In the first phase, the recorded voice has listened to several times, and the main points were extracted. In the second phase, the recorded voice was transcribed verbatim. Then, open coding (Corbin & Strauss, 2015; Elo & Kyngäs, 2008) was employed to identify initial codes through line-by-line and paragraph to paragraph analysis (Corbin & Strauss, 2015). We utilized the MAXQDA software only in the second phase. We used the program as an extension of self to store and organize initial ideas about the data (Corbin & Strauss, 2015), and handle the large data sets.

In the third phase, we utilized axial coding to classify the concepts and develop them in terms of their properties and dimensions. Therefore, we did not count the frequency of use for each code (Leech & Onwuegbuzie, 2008). The initial codes were compared with each other regarding their similarities and differences. The initial codes that appeared to be conceptually

Table 2: Physical factors influencing residents' walking experience in three levels of themes, categories, and concepts

	Sense of insecurity	<ul style="list-style-type: none"> - Poor lighting conditions - Lack of presence of others
Safety and security	Sense of inadequate safety	<ul style="list-style-type: none"> - Becoming exposed to air pollution - Crossing streets and intersections - Streets without a separated sidewalk - Uneven surface of sidewalks - Walking on the side of streets roadway
	Lack of physical comfort	<ul style="list-style-type: none"> - Thermal comfort - Difficulty of stepping stairs or ramps - Noise nuisance (lack of silence, irritating sounds of vehicles)
Comfort and convenience	Accessibility to destinations and amenities	<ul style="list-style-type: none"> - Distances to stores, parks, mosques, and public transportation stations - Presence and material of sitting places
	Possibility to do rhythmic walking	<ul style="list-style-type: none"> - Continuity of paths - Changing the movement direction in paths - Legibility of paths
	Sense of overcrowding	<ul style="list-style-type: none"> - Narrow effective width of paths - Overloaded streets (Traffic congestion, lack of parking spaces for cars) - Perceived increase in non-local offices and stores
Aesthetics and attractiveness	Variety and harmony	<ul style="list-style-type: none"> - Lack of variety in a building façade (colors, materials, design) - Insufficient harmony of building facades (colors, materials, heights, setbacks, designs) - Old buildings - A variety of colors in natural elements, wall arts, sidewalk materials and, store windows - Various stores in strip malls and shopping centers - Routes enclosure
	Cleanliness and maintenance	<ul style="list-style-type: none"> - Insufficient upkeep of buildings facades (uncleanliness, fixing fall of tiles) - Uncleanliness of urban spaces (presence of refuse, presence of mice in some runnels, the odor of dirty runnels)
	Natural elements	<ul style="list-style-type: none"> - Greenery (quantity and maintenance of green spaces) - Presence and movement of water - Presence of birds - Desirability of natural sounds

similar were grouped under a conceptual label. The emerged concepts also were compared with each other. From the second interview onward, the concepts from an interview were compared with each other and the other concepts from the previous interviews and were classified regarding their similarities and differences. Therefore, higher-level concepts, including categories and themes, emerged gradually. The researchers constantly updated and revised the concepts. We continued to gather and analyze data until conceptual saturation (Corbin & Strauss, 2015) was reached. The coding process and concepts, categories, and themes are discussed between researchers constantly. Two Ph.D. researchers who had experience in qualitative analysis also conducted a peer check. Member reflections were also carried out during the data collection.

Ethics

Before interviews, the interviewer introduced herself, explained the aims of the study, permitted for digitally recording the voice of the potential participants. The interviewer also promised to keep the names of potential participants anonymous. Also, potential participants were informed that whenever they preferred, they could deny continuing the interview. If potential participants consented to take part in the study, they were interviewed.

RESULTS AND DISCUSSION

The three themes derived from the analysis were safety and security, comfort and convenience, and environmental aesthetics and attractiveness. Table 2 shows these themes with their subset categories and concepts. We also found an interaction between derived physical factors in influencing walking. Also, this study did not differentiate between transportation and recreational walking. This is because our participants usually integrated different purposes in a single

walking such as shopping, exercising, and socializing.

Safety and Security

Sense of Insecurity

Darkness due to poor lighting, and the absence of others especially pedestrians and storekeepers (rather than drivers) created a sense of insecurity. Some women avoided walking in empty allies even during the daytime.

“If it is night, it is dark; I try not to walk in lonely allies because of security. Also, early in the mornings, if I want to come [to the park], I try to walk through the main street, Sattar Khan Street. I try not to come through allies or empty places.” (Female, aged 50-55 years)

Sense of Inadequate Safety

The sense of inadequate safety included the danger of physical damage due to air pollution, accident, and trip. Participants strongly emphasized air pollution. High air pollution was a barrier to walk. Some respondents pointed out lung damage or headache as consequences of walking in polluted air.

“When I want to go shopping in our neighborhood bazaar, [I] go either on foot or by bicycle. Ninety percent of the times, my wife asks me to go by car: [it's] hazardous, the air is polluted, your lungs [would] be irritated, [and] a car [may] crash onto you. When I think logically, I see she is right.” (Male, aged 45-55 years)

Participants did not feel adequate safety when crossing the streets at crosswalks. This was because of the high speed of cars in the streets and intersections. The presence of frequent one-steps due to different levels of sidewalk surfaces attached to each building, holes, bumps, and urban infrastructure's pipes amidst the sidewalks raised trip hazards (Fig. 1).

Comfort and Convenience of the Environment

Lack of Physical Comfort

Lack of air temperature balance during winter and summer especially winter reduced the extent of participants' walking.



Fig. 1: The presence of frequent one-steps enhanced trip hazards.

However, some participants emphasized that despite cold weather, they continued their daily walking.

“The cold remains in my body until evening, but I come again.” (Female, aged 45-55 years, Morning)

Slope limited participants' route choice to walking. Our participants also rarely utilized crossing footbridges because of their several stairs or steep ramps. Also, participants emphasized the negative influence of environmental noise because of traffic congestion. Auto-related stores also heightened the occurrence of irritating loud sounds.

Accessibility to Destinations and Amenities

Long-distance to a destination prevented its selection for daily activities. It was more important than the quality of the destination. Participants did not choose far parks for their daily exercise albeit they had better quality in their opinion compared to close ones.

“It can't be said that here [the main local park] is very good. Because we neither have a path dedicated to pedestrians nor are we comfortable ... We have nothing ... there are some special places that it is difficult [for pedestrians] to commute to them. Therefore, we adapted to this... because it is near the residence.” (Female, aged 35-45 years)

Participants emphasized short distances from home to local groceries and shopping centers to comfortably fulfill their daily routine or urgent needs. Close distance to the public transportation stations, especially metro stations, encouraged walking in combination with public transportation. Some participants emphasized sitting places such as benches in the parks and shopping centers. Regarding bench material, they preferred wood to metal. It was because wood provided more temperature balance, especially in cold weather.

Possibility to Do Regular Rhythmic Walking

Participants preferred to maintain a regular rhythm of walking. The regular rhythm of walking facilitated thinking during walking. Overloaded stimuli continually got the attention of participants during walking and prevented an automatic way of walking. Having to stop, change the movement direction, or go up and down frequently deteriorated the regular rhythm of walking. Several intersections with roadways destroyed the connectivity of the sidewalks and the rhythm of walking.

“During walking, you are speeding up, you do not want anything to stop you, for example, the first one kilometer is warm-up, you are warming up, then you go further, suddenly you see an obstacle, suddenly the sidewalk disconnects, suddenly a street appears, suddenly something happens, and all your energy decreases.” (Male, aged 45-55 years)

Participants experienced that large parks are better than the small local ones for walking partly because they preferred to walk along sufficiently long straight paths instead of turning repeatedly around short bendy paths.

“The parks are so small that when [you] turn around twice,

your head loses balance. It does not put you in a good mood.” (Female, aged 45-55 years)

Lack of legibility because of not having enough order of alleys' numbering arrangement or presence of cul-de-sacs made some participants confused and disturbed their regular rhythm of walking.

Sense of Overcrowding

Participants strongly emphasized the sense of crowding and its increase, especially in the last decade. Participants experienced increases in residents' population, non-local or incompatible offices and stores (such as auto-related stores), overcrowding in walking spaces, traffic congestion, and lack of parking spaces simultaneously in the area.

The narrow effective width of sidewalks or footpaths increased the sense of overcrowding. During afternoons, overcrowding prevented some participants from walking in local parks. The presence of obstacles such as the entrance stairs of buildings, parked vehicles, and objects of street vendors and stores decreased the effective width of sidewalks. Auto-related stores (i.e. motor repair, oil change, car stereo, and auto part) also occupied the spaces of sidewalks.

The area's location (near the central traffic restricted zone and adjacent to the low emission zone) exacerbated the shortage of parking spaces. Some participants emphasized that the increase in non-local offices and stores especially on local streets enhanced the sense of overcrowding and negatively influenced their walking.

“At any one time, there is no way to escape from the crowding.” (Male, aged 45-55 years)

“It is irritating; the street has become [full of] auto repairs. It is not true at all. There were a few [auto repairs in the past]. At that time, there were two families, now they have become ten families. There were two stores, now they have become five stores. It is irritating me.” (Female, aged 55-65 years)

High traffic congestion and shortage of parking spaces made driving difficult and increased waste of time, cost, and sense of boredom when using vehicles. Overcrowded routes also made walking difficult. Besides, participants experienced the danger of high levels of air pollution and traffic noise during walking. In these conditions, they preferred to walk rather than using public or private vehicles; therefore, overcrowding increased participants walking in an unsatisfying way. Also, walking in an overcrowded route created a sense of insecurity in some participants. Some respondents also experienced crowded paths as less clean than non-crowded ones.

Aesthetics and Attractiveness

Variety and Harmony

A plain building facade consisting of only one surface with one material and color was not visually appealing. Participants preferred the composition of different matched materials and color shades in a building facade. Some of them appreciated



Fig. 2: Lack of unity between adjacent building facades decreased the aesthetics and attractiveness

warm creamy color stone as the dominant color and material of a residential building facade. While participants preferred a variety in building façades, they also appreciated unity between adjacent buildings (Fig. 2). However, one participant positively attributed the lack of harmony to the freedom in choosing a personal favorite façade.

“[Building facades] are very bad... it is like a cardboard box having some holes made for it and named window.” (Female, aged 45-55 years)

“I am not saying that all [building facades should] be uniform, but have a harmony. A house is three-story, another is five-story. A house [material] is brick; its adjacent house [material] is stone. I mean, when you enter an alley, you do not see any harmony for example in colors and those stones that are utilized. It is too mixed.” (Female, aged 45-55 years)

Some participants liked old buildings only if new materials have renewed their facades. In their opinion, old materials belong to the past and are unattractive. However, some other participants mentioned that old building facades were more attractive than new ones, partially because they recollected participants’ memories. Besides, the high enclosure of some streets and alleys (the proportion of building height to street width) influenced negatively walking and caused a sense of tightness for participants

Some participants emphasized a variety of colors of flowers and tree leaves in the fall season, whereas some other participants stressed the aesthetics of evergreen trees in winter. Some participants also preferred a variety of bright and warm colors in wall arts and sidewalk materials.

“I love colorfulness very much, as well as colorfulness in parks.” (Female, aged 45-55 years)

Various stores made shopping centers appealing to walk. Between two main local commercial streets in the study area, participants preferred the one with more variety of stores for walking. Some participants also preferred middle-sized

chain supermarkets to small ones. More stores and bigger supermarkets could provide a greater sense of free comparison and selection between options and fulfill more needs.

Cleanliness and Maintenance

Participants highlighted the presence of refuse in public spaces. Dirty, smudged building facades appeared to be ugly. Participants believed that the existence of many fast food stores was responsible for plenty of refuse and mice in their surrounding area.

“During walking, when I see that there is refuse around a dumpster, it makes me upset. When someone brings a hand out of a car and drops refuse on the ground, it makes me upset. Why does he/she do that? I have never dropped [even] a chocolate cover on the ground; neither my children nor I [have ever done that].” (Female, aged 35-45 years)

Natural Elements

All respondents emphasized the strong positive influence of greenery on their walking. Some participants criticized destroying a large garden with many mature trees in the area and building a residential complex instead of it. They blamed the local municipality for that incident. Some respondents emphasized the negative influence of the continuous hard edge of the streets and the positive influence of open green spaces on streets during walking. Also, participants preferred paths with more greenery for walking, such as sidewalks with tall mature trees on both sides and park paths.

Parks could partially hinder the negative influences of air pollution and the noise of traffic on participants’ walking. However, one of the participants pointed out that pine trees with tall leafless trunks in the main local park could not protect the park visually and audibly from traffic around (Fig. 3).

Light rain and snowfall encouraged some participants to go outdoors and walk. Besides, listening to the natural sounds (e.g.



Fig. 3: Pine trees with tall leafless trunks could not protect the main local park visually and audibly from traffic around

birds singing, a murmur of water flow, and the rustle of leaves underfoot) during walking pleased participants. The movement of water (e.g. working fountains) was more desirable than still water because of its sound and the possibility of touching water drops especially in summer.

“In the fall season, while walking, a leaf falls on the ground in front of your leg with an aesthetic dance; because God allows it, and when it is placed under your leg, it makes an aesthetic sound.” (Male, aged 45-55 years)

The Importance of Paths' Attributes

Besides intensifying the sense of overcrowding and the danger of tripping and falling, narrow and uneven paths distracted the regular rhythm of walking and enhanced the danger of accidents (Fig. 4). Participants could not have a regular walking rhythm in narrow, crowded paths because they frequently changed their movement direction to avoid physical

contact with others. Besides, when participants walked on uneven sidewalks they constantly observed the ground to avoid a trip hazard. Consequently, they could not maintain a regular rhythm of walking. One of the participants also emphasized that he saw more litter on the ground of uneven sidewalks due to continually noticing the sidewalks' surface. Furthermore, uneven or narrow, crowded sidewalks made participants walk along the roadway of the street, which exposed them to accident hazards.

Discussion

This study explored the physical factors influencing walking and their interaction from the viewpoints of residents in Sattar Khan in Tehran. About comfort and convenience, this study found that the sense of overcrowding had a negative influence on walking, while the previous qualitative research (Dadpour et al., 2016; Dean et al., 2020) did not point to it. An explanation

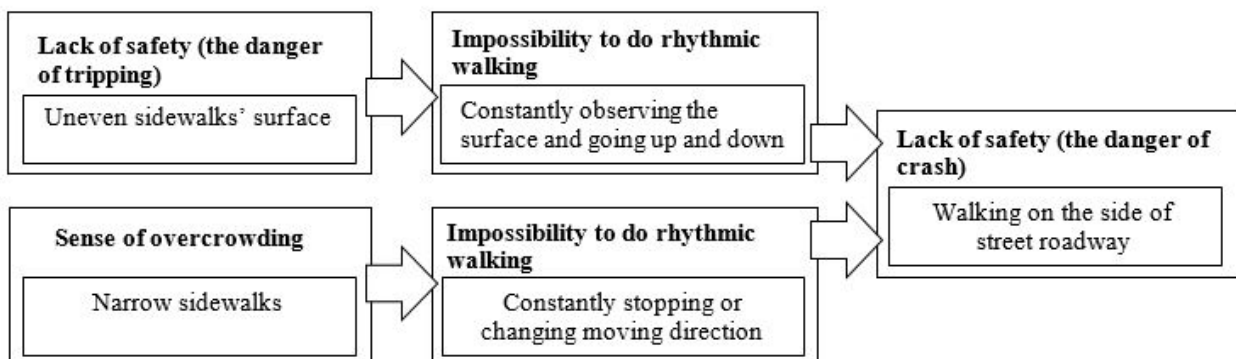


Fig. 4: The interaction between perceived physical environment factors related to sidewalks' width and surface

is that the mentioned studies are about developed countries, which did not experience fast-growing urban population density and traffic in the last recent decades. Comparing this result with findings of quantitative research about three Ds also reveals that it is in line with the results of the studies that found a negative relation between three Ds and walking (Adlakha et al., 2017; Day, 2016; Lu et al., 2017), which are from fast-growing Asian cities.

In our study, an increase in non-local offices and stores on auxiliary streets had a negative influence on walking, whereas many different stores on commercial streets and shopping centers had a positive influence on walking. In other words, participants preferred routes' hierarchy dividing residential local streets from commercial collectors. These results are in line with the study of Ewing and Clemente (2013, 94) which found that "having equal proportions of residential, retail, and office on a block face is less conducive to pedestrian activity than having a disproportionate share of retail frontage".

Our results about accessibility to destinations and amenities are consistent with previous studies that found accessible and short distances to local stores and parks facilitated walking (Kärmeniemi et al., 2018; Schipperijn et al., 2017) and the presence of benches in parks also promoted physical activity in parks (Costigan et al., 2017). The results of this study about physical comfort conditions are also in line with previous studies (Böcker et al., 2013; Ettema et al., 2017) that found cold and hot weather in winter and summer had a negative influence on walking.

Our findings of the possibility to do regular rhythmic walking corroborate previous studies (Edensor, 2010; Middleton, 2011; Wunderlich, 2008) which found that pedestrians desired to walk in a regular rhythmic and automatic way. The results of this study about the disruption of the walking rhythm are also in line with Edensor's (2010, 73) exploration of walking in a bazaar of an Indian city that found the uneven surface of sidewalks, "negotiating obstacles", frequent changes in movement direction due to "the often-labyrinthine structure of such sites" interrupted the walking rhythm of pedestrians. Also, this study indicated that legibility could affect the regular rhythm of walking. This finding is consistent with Edensor's (2010) study that pointed to the difficulty of wayfinding in an illegible path, which disrupted walking rhythm. Furthermore, our finding of continuity of paths corroborates with the results of previous studies (Bahraimi &

Khosravi, 2010; Dadpour et al., 2016; Hesam & Aghaeizadeh, 2017; Moeini, 2012) found discontinuity of sidewalks negatively influenced walking.

Our results about the width of paths are consistent with previous studies (Bahraimi & Khosravi, 2010; Hesam & Aghaeizadeh, 2017; Moeini, 2012, Said et al., 2017) that indicated insufficient walking space had a negative influence on walking. The Institute of Transportation Engineers (2010, 65) recommended the minimum effective width of a sidewalk

("clear pedestrian travel way") to be 1.5 meters, which is enough for two pedestrians to pass one another. In the study area, most of the sidewalks' minimum effective width was less than 1.5 meters. Pedestrians also constantly changed their movement direction to avoid physical contact with others in narrow, crowded sidewalks. These results approved the concept of personal space and pedestrians' tendency to protect their personal spaces during walking (Hall, 1990). Our results are also consistent with the study of Kim et al. (2014) that found changes in the movement direction of pedestrians were sensitive to pedestrian volume and sidewalk width.

The findings of this study about security and safety are consistent with earlier studies that showed the absence of others, crowded spaces, darkness (Bahraimi & Khosravi, 2010; Dadpour et al., 2016; Hesam & Aghaeizadeh, 2017; Moeini, 2012; Wang et al., 2016), uneven pavements, and lack of safe crossings (Moeini, 2012; Wang et al., 2016) had negative influences on walking.

Concerning aesthetics and attractiveness, the current study found that the lack of harmony between the adjacent building facades influenced walking negatively. Most previous studies considered aesthetics or variety as general or limited concepts. These studies did not investigate the influence of harmony between building facades on walking (e.g. Bahraimi and Khosravi, 2010; Dadpour et al., 2016; Ewing and Clemente, 2013; Hesam and Aghaeizadeh, 2017). The study of Cain et al. (2014) evaluated the effects of building colors, materials, and design on walking and biking and found no relationship between them. There is an inconsistency between the results of our research and the study of Cain et al. (2014). The reason might be the differences in methodologies. The study of Cain et al. (2014) measured buildings' color and material objectively through observation. However, this study explored the residents' experience subjectively. The study of Cain et al. (2014) also investigated the influence of building aesthetics on walking and biking, while the current study focused on walking.

The present study also found that a sense of high enclosure had a negative influence on walking. This result is in line with previous studies (Adkins et al., 2012; Hesam & Aghaeizadeh, 2017) that found the enclosure negatively affected walking environment attractiveness. The findings of this study about natural elements are in line with previous studies that found the number of parks (Schipperijn et al., 2017), size of parks (Jansen et al., 2017), sidewalks' natural elements (Taleai & Taheri Amiri, 2017) and birdlife (Costigan et al., 2017) had a positive association with walking. The finding of this study about cleanliness also corroborates with earlier studies (Dadpour et al., 2016; Moeini, 2012; Said et al., 2017) that showed uncleanness of urban spaces harmed walking.

The strength of the current study was being in contact with the first participants for several months, which resulted in the achievement of open interviews and trust. Plenty of field

observations besides the usage of maps and short interviews provided adequate data to compare with in-depth interviews and make triangulation. Utilizing CCA and thick descriptions enabled the identification of relations between derived concepts and describing how they influence walking in some aspects. To facilitate naturalistic generalizability (Smith, 2018), the results as well as characteristics of setting and participants described in detail and supported by visual materials. It is noteworthy that the density of our study area increased rapidly during the last decades. Therefore, caution is necessary for the application of the results of this study in a different context. Also, some potential participants were reluctant to share their experiences. Therefore, the interviewer had to seek other more motivated participants.

CONCLUSION

The results of the current study were in line with previous research in Iran as well as the other countries in general. However, these results added depth and details to the previous knowledge about the relationship between the physical environment and walking. Suggested physical interventions and policies to encourage walking are limiting the increase in density and non-residential land uses on local streets of neighborhoods, minimizing traffic, widening sidewalks, and park paths, protecting small parks from traffic noise and increasing the price of parking spaces. It is also necessary to make urban design codes to level off the sidewalks and support an aesthetic built environment. Increasing the effective width of sidewalks by reducing barriers on their surface could be a feasible and cost-efficient policy. The ratio of roads to paths is a useful indicator for monitoring the implementation of urban policies to encourage walking (Giles-Corti et al., 2016). Regarding the importance of sidewalks' width, this study suggests considering the recommended minimum effective width of sidewalks (1.5 m) to calculate their length in the mentioned indicator. Planting cypresses (Arizona cypress) along with pine (Eldar pine) trees in local parks would better protect them visually and audibly from traffic around than planting only pine trees. This is because the branches and leaves of cypresses cover almost the whole length of their trunks. Furthermore, according to the semi-arid climate of Tehran, planting Arizona cypresses is more preferable to Eldar pine trees (Sadeghi et al., 2015). Besides, historically, cypresses are symbols of aesthetics in Iranian culture. The results of this study showed the complexity of the relationship between the physical environment and walking as a context-bound phenomenon. This study recommends exploring the process by which physical factors interacting with individual and social factors in influencing walking.

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