

WOMEN'S PERCEPTION TOWARDS INTERRELATION BETWEEN PLANTS' ATTRIBUTES WITH RESTORATIVE EFFECTS IN URBAN PARKS OF TABRIZ, IRAN

Ahmad Hami^{1*} and Mahsa Tarashkar¹

¹Landscape Engineering Department, Faculty of Agriculture, University of Tabriz, Iran.

* Corresponding author:
hami@tabrizu.ac.ir

ABSTRACT

This study explores women's perceptions preferences towards plants' attributes as a step towards sustainable development of urban parks. A photo questionnaire survey was conducted among 178 women in urban parks of Tabriz, Iran. The results indicated that women's preference has a strong correlation with spreading ($r = .726$) and circular ($r = .701$) forms of plants in the urban park. Women are most familiar with circular form ($r = .632$), and spreading form is the most attractive one ($r = .512$). The preference for plants had a strong correlation with rough texture ($r = .747$). Among the shrubs containing different colours, preference has a strong correlation ($r = .711$) with pink flowering shrubs. The results illustrated that familiarity had a relatively strong correlation ($r = .642$) with light green foliage meanwhile preference was strongly correlated ($r = .812$) with light green foliage. Shrubs containing light green leaves, pink flowers, rough texture, and circular or spreading forms might contribute to the higher preferences in the urban parks. At a more practical level, the findings of this study will contribute to the sustainable development of urban green spaces and particularly urban parks.

Keywords: : Familiarity concept, landscape stimulus, Sustainable landscape, photo-questionnaire

1. INTRODUCTION

People display emotional and physiological responses to scenes of urban and natural landscapes (Kaplan, 1977; Talbot, Bardwell, & Kaplan, 1987; Talbot & Kaplan, 1984; Ulrich et al., 1991). The promotion of social interactions (Konijnendijk et al., 2013), and improvements in mental and physical health (Berman et al., 2012) are among the subsequent benefits of the physiological responses. Gaining the benefits is only possible with various management practices. Designing the urban parks with desirable elements and features may be the first step. In developing countries such as Iran, public perceptions and preferences received less attention by experts, except for some recent works by Hami (2013). Attention to public perception and preferences is a paradigm to approach with this issue. It causes increased knowledge of landscape designers and managers about sustainable design of urban parks.

Women constitute the largest population of park users in Iran. There are not enough studies regarding women's preferences and perceptions towards plants' attributes and its relation with restoration and attraction. Thus, the attributes which can release mental fatigue have not been included in urban parks of cities. In addition, the relation between perception and landscape sustainability have not received enough attention. In a previous study, researchers were advised to evaluate the impact of colour, form, and texture on women's perceptions and preferences in the urban parks of Tabriz, Iran (Hami & Tarashkar, 2018). Therefore, the current study aims to explore and determine the impact of plants' attributes on women's preferences and perceptions. However, the other attributions of plants such as ecological effect, growing zone, water needs, etc. will not be included in the current

research since they seem not to be effective on restoration, aesthetic, and familiarity as well.

1.1 Preference for plants' attributes

Preference for plants' attributes were the subject of some previous studies. For instance, Zhao et al., (2017) explored the impact of trees' attribute on public preferences using a photo questionnaire. The results of their study revealed that seasonal changes are important features for the vegetation used in landscape design. Some previous studies have been focused on public preference towards plant form. Lin (2000) demonstrated that people prefer trees with conical or spreading forms. Other studies have evaluated the preference for plants' form, measuring the width-to-height ratio. Orians & Heerwagen, (1992) found that people are willing to see trees with a greater width-to-height ratio. According to Nelson et al., (2001) trees with healthy canopies are preferred to trees containing damaged canopies. Polat and Akay, (2015) explored visual preferences for landscape elements in public urban parks in Konya, Turkey. The results revealed that colour composition can enhance the visual quality of urban parks. In addition, other studies show that foliage color significantly affects people's landscape preferences (Kendal et al., 2008, White & Gatersleben, 2011), and colorful foliage is preferred to green one (Hitchmough, 2004). Kaplan (1985) stated that shape, line, color and texture are the elements contributing in landscape perception. Among these four elements, form has the greatest interference in landscape perception process.

The urban parks located at different cities of Iran do not fulfill residents' expectations and women's preferences. Thus, identifying women's preferences can be counted as an important step towards developing sustainable urban parks. According to a previous study, establishing residential area with a sustainable protection of urban open green space provides a great opportunity for residents, particularly if they are announced for public use (Rakhshandehroo et al., 2017). The perceived values of plants are numerous such as; improving life quality, producing fresh air, aesthetic aspect, rejuvenation of human spirit, mental restoration, and preservation of urban ecosystems (Hami, 2013).

Ecological services and natural environments have been continuously threatened by human activities (Chapin III et al., 2011). Sustainable development is a comprehensive approach to deal with a numerous environmental, economic, and social issues (Rakhshandehroo et al., 2017). For example, some of the predominant environmental problems correlated with urban green spaces are: species death, re-plantation of green spaces,

noise pollution, losing territories etc. Thus, it is important how authorities can manage green infrastructure development such as urban park landscaping. Planting trees, shrubs, and flowers with desirable attributes in urban landscape can reduce manipulating and re-plantation of urban landscape. Also, longer sustaining of green areas in an environment contributes to atmospheric balance, reduction of air pollutions, and comfort ability of the environment where these are as important key factors for having sustainable environments.

1.2 Familiarity with plants

Familiarity has been detected as an important factor on public perceptual preferences (Hami & Tarashkar, 2018). A previous study has shown that perceived familiarity affects individuals' preferences for landscape biophysical components (Howley et al., 2012). Van den Berg and Koole (2006) investigated the visual preferences towards nature. They claimed that familiarity with rural landscapes is an effective factor on displaying higher preferences. Van der Wal et al., (2014) examined the impact of familiarity on people's preferences. They found that sense of familiarity leads to more robust preferences towards the woodland. Ingold (2000) stated that people prefer the woodlands which they are more familiar and emotionally connected with.

1.3 Restorative impact of plants

Empirical studies have shown that nature provides more physiological and emotional restoration, compared to urban built environments (Hartig et al., 2003). Attention restoration theory (ART) first proposed by environmental psychologists Stephen and Rachel Kaplan (1989). The attention restoration theory shows that people are better able to focus their attention after spending time in nature, or even after looking at scenes of nature. It proposes a series of attributes for a restorative environment; being away (being distinct from the aspects of usual and routine environment), extent (physical or conceptual environment that is of sufficient extent to remain engaged), fascination (containing patterns that hold individual's attention effortlessly), and compatibility (an environment that meets the preferences and needs of a person) (Kaplan, 1995). According to Ulrich's psychophysiological stress reduction framework (Ulrich, 1983) landscapes containing vegetation, water, modest depth, and complexity reduce negative thoughts and thus reduce the psychological and physiological symptoms of stress.

The restorative impact of natural environment has been explored in previous studies. A previous study has found a positive correlation between tree cover density and self-reported restoration (Jiang et al., 2014). Several previous

studies showed that more tree cover density is associated with greater stress reduction (e.g. Roe et al., 2013; Tyrvalinen et al., 2014; van den Berg, Hartig, & Staats, 2007; Thompson et al., 2012). The plants within urban landscape lead to perceived restoration (van den Berg et al., 2014). Wang et al. (2016) compared the restorative impact of natural and built environments using seven videotaped photographs. The results of the study revealed that scenes of natural environments are more restorative, compared to scenes of built environment.

1.4 Attractiveness of plants

Gordon Orians and Judith Heerwagen contributed to Kellert and Wilson's Biophilia Hypothesis, in a chapter titled "Humans, Habitats, and Aesthetics" (Kellert and Wilson, 1993). The study was looking for aesthetic judgements from 102 participants using a black and white photo questionnaire. Trees with broad canopy, short trunks, and horizontal branch clusters were most attractive ones. Individuals' selective perception helps to estimate landscape attractiveness (Gold, 1980). Previous studies have found that people's preference for a specific landscape is related to perceived attractiveness (Carvalho-Ribeiro & Lovett, 2011). Van den Berg and his colleagues (2003) have found that plants with light green foliage perceived more attractive, compared to dark green ones.

What is seen across these studies is that most of them point to the impact of plants' attributes on perceptual preferences, perceived attractiveness, mental restoration, and familiarity. This study seeks answers to how plants' attributes affect women's preferences, and how these indicators relate to perceived restoration, perceived familiarity, and attractiveness. It is assumed that plants' attributes affect women's preferences and perceived restoration and attractiveness. Also, it is assumed that perceived familiarity affects women's preferences and perceptions.

2. METHODOLOGY

2.1 Landscape stimulus

For designing a photo questionnaire, fifty representative scenes for plants' attributes were prepared from local electronic books and journals. The plants' attributes were divided into three categories: a) Form, b) texture, and c) colour. Plants with spreading, circular, columnar and oval forms were taken into account and totally twenty representative scenes (five for each one) were prepared. Fifteen scenes were prepared to explore the preference for texture (five rough, five soft, and five medium). Plants with violet, pink, and white flowers (five pink flowering shrubs, five white flowering shrubs, and five

violet flowering shrubs) were selected for the preference study. Image size was adjusted to 8.7cm x13.4cm, contrast, and color and other features were adjusted for all images using Adobe Photoshop CS software.

2.2 Questionnaire structure

The questionnaire contained two sections. The first part of the questionnaire contained demographic information. The participants had to indicate their personal socio-demographic information; marital status, age, education level, monthly income, and city of residence. The second part was allocated to images for familiarity, restoration, attractiveness, and preference assessments. The selected scenes for the dependent variables were presented in a booklet. There were forty nine images in the booklet. The respondent may not be able to concentrate on the initial questions and may also be tired in the final questions and answer the question without regard to the image. Therefore, to increase the accuracy of the research, two photos of the beginning of the booklet and two final pictures were not considered in the analysis. The respondents were asked to answer questions related to familiarity, preference, attractiveness, sense of restoration. Participants were asked to evaluate the images on a Likert scale (scored between 1 and 5).

2.3 Questionnaire survey

Mitra and Lankford's formula (1999) was used to determine sample size. We assumed the standard deviation to be equal to 3.74, with the sampling size amounting to 178 persons. Over the duration of July and August 2017, 178 female public open space users, aged above 19, were systematically selected to answer a questionnaire, using the booklet. The systematic sampling for this study meant the participants were picked according to a multiple of 10 among the park visitors. The questionnaire was distributed every day at 10am to 2pm and 4 pm to 8 pm. These hours constitute most frequently visited times of the urban parks. The distribution of the questionnaire was done by three university student at the same time. First, the participants were asked whether they wanted to answer the questions. After this, in order to ensure the accuracy of the work, the purpose of the study and the structure of the questionnaire were explained to them. After completing each questionnaire, the necessary checkups were carried out by the researcher. In the case of incomplete replies, the respondents were asked to complete their response.

2.4 Study area

This research was conducted in the city of Tabriz, Iran, which is the capital of East Azerbaijan, located at the extreme north-west of Iran. The questionnaire was distributed in two famous and beautiful parks in the city of Tabriz. Shams

Tabriz Park is located in the central part of the city. This park benefits from traditional Iranian architecture.

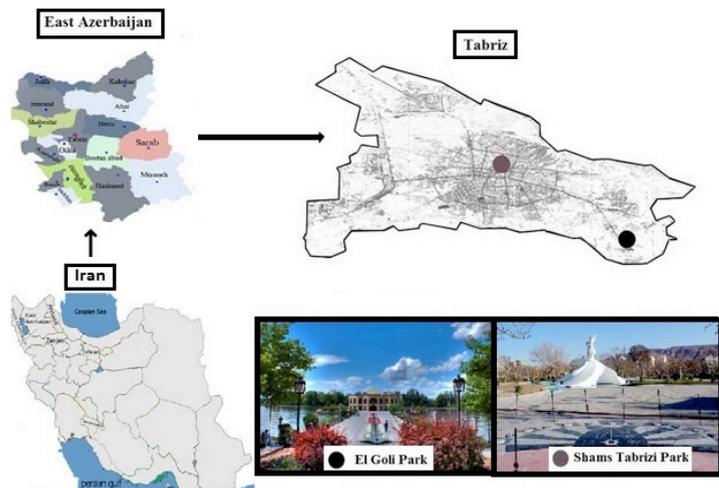


Figure 1: Map of the study area

Traditional pools and water paths with sound of water purling and numerous wooden and concrete pergolas throughout the park are illustrations of traditional architecture. A statue of Shams Tabrizi, the 13th century Persian poet, is located in the park. El Goli Park is one of the most important places for recreation in the city, and it is located in southeast of Tabriz. An artificial rectangular lake is located at El Goli historic park, and it is surrounded by four sidewalks. In the middle of lake a building representing the traditional architecture of Tabriz is located. El Goli Park was registered in Iran's National Heritage list on February 15, 2009, under the registration number of 24774.

3. RESULTS

3.1 Participant's background information

As seen in table 1, 178 participants were involved in this study. Most of the participants were in the age group 19 to 29 ($n=75$, 42.1%). Average 39.9 % of the participants were single and 60.1 % married. These are in line with the report of Iran's Statistics Organization in 2016, which announced the age of marriage of women to be 23 in urban areas. The educational status of the majority of the participants ($n=72$, 40.4%) lay at the level of high school diploma and the majority of them ($n=84$, 47.2%) had a monthly income of 300 to 900 USD.

Table 1: Distribution of the Participants' Socio-demographic Information

Participants	Number	Percentage
Total	178	100
Category	Number	Percentage
Age	75	42.1
	54	30.3
	22	12.4
	15	8.4
	12	6.7
Marital status	71	39.9
	107	60.1
Education	10	5.6
	72	40.4
	35	19.7
	41	23.0
	20	11.2
Income	20	11.2
	84	47.2
	43	24.2
	31	17.4

3.2 Ranking of landscape plants based on women's perception

Figure 2 shows six most preferred scenes for the urban parks. The two most preferred scenes (scene one & two) include sceneries of pink flowering shrubs with circular forms. Third scene of this category is dedicated for *Salix babylonica*, which has light green foliage, spreading branches, and soft texture. In general, the scenes include plants with spreading (Scenes 3 and 5) and circular forms (Scenes 1, 2, 4, and 6), pink flowers (Scenes 1 and 2), and light green foliage. Majority of the scenes except for one scene (scene 3) represent rough texture.

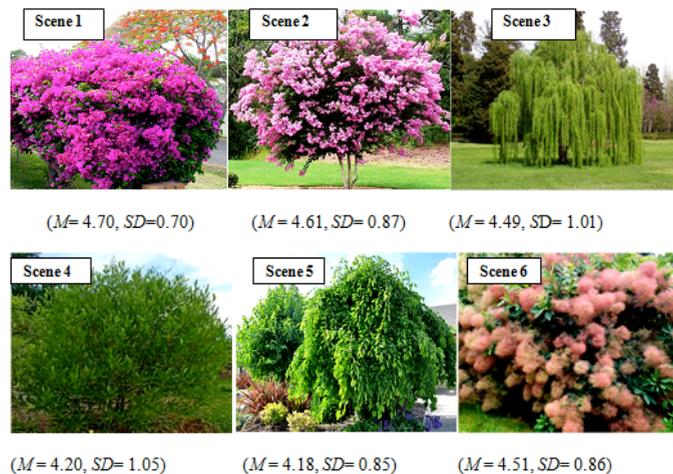


Figure 2: Six most preferred scenes for the urban parks

Figure 3 shows six most familiar scenes for women in the urban parks. The two most familiar scenes (scene one & two) are the plants with columnar forms. Third scene of this category is dedicated to *Mirtus occidentalis*, containing a rough texture and oval form. Scene 4 illustrates a tree with oval form and light green foliage, with scene 5 and 6 illustrating circular form plants.

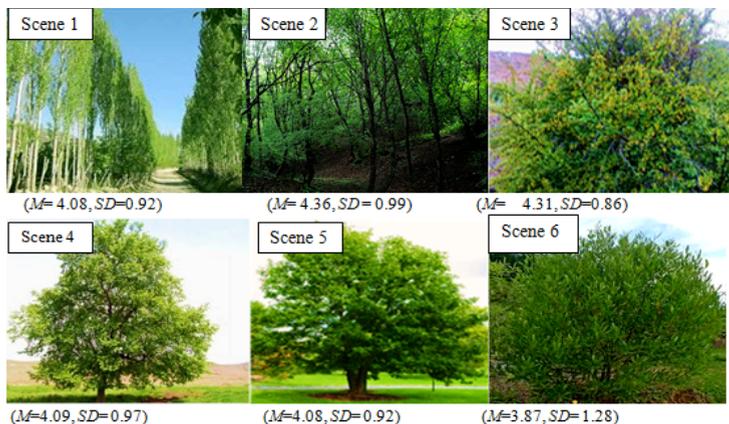


Figure 3: Six most familiar scenes for women in the urban parks

Figure 4 illustrates the three most restorative scenes for women in the urban parks. The first scene contains a plant containing oval form, light green foliage, and soft texture. The second scene of this category contains pink flowering circular shrubs. The third scene contains Eucalyptus tree, with circular form, light green foliage, and rough texture.

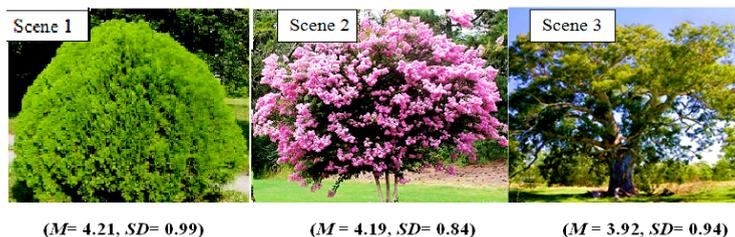


Figure 4 : The three most restorative scenes for women in the urban parks

Figure 5 illustrates the three most attractive scenes. The first scene contains a plant with oval form, light green foliage, and soft texture. The third scene contains Eucalyptus tree, with circular form and light green foliage. The second scene of this category contains pink flowering circular shrubs.



Figure 5 : The three most attractive scenes for women in the urban parks

3.3 Analysis of women's preference for plants' form

The result of B-variate correlation (table 2) illustrates moderately strong correlation between preference for plants and spreading form ($r=0.726, \alpha=0.00$). This correlation is followed by circular form ($r=0.701, \alpha=0.00$), oval form ($r=0.665, \alpha=0.00$) and columnar form ($r=0.664, \alpha=0.00$). The result of mean analysis reveals the similar results, and shows that women prefer spreading form ($M=3.80, SD=.75$), circular form ($M=3.52, SD=1.13$), oval form ($M=3.34, SD=1.06$), and columnar form ($M=3.24, SD=1.17$), respectively. Spreading form is most attractive one ($r=0.512, \alpha=0.00$). Oval form contributes to restoration ($r=0.574, \alpha=0.00$), followed by columnar form ($r=0.428, \alpha=0.00$). Also, the reliability analysis demonstrates that all the reliability indices for each category are close to 0.7, recommended by Vaus (2002).

Table 2: : The B- Variate Correlation between Plants' Form and Preference/ Attractiveness/ Restoration

	Circular	Spreading	Columnar	Oval
Preference	.701** .000	.726** .000	.664** .000	.665** .000
Attractiveness	.119 .114	.512** .000	.307** .000	.305** .000
Restoration	.305** .000	.299** .000	.428** .000	.574** .000
Familiarity	.632** .000	.532** .000	.415** .000	.357** .000
Mean analysis	3.52 1.13	3.80 .75	3.24 1.17	3.34 1.06
Reliability	.666	.702	.736	.775

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

3.4 Analysis of people preference for plants' texture

According to table 3, women's preference for plants is strongly affected by plants' texture (e.g. soft texture, $r=0.628$, $\alpha=0.00$; medium texture, $r=0.639$, $\alpha=0.00$; rough texture 0.747 , $\alpha=0.00$). As seen in table 3, women most prefer the plants containing rough texture ($r=0.747$, $\alpha=0.00$; $M=3.91$, $SD=.851$), followed by medium ($r=0.636$, $\alpha=0.00$) and soft texture ($r=0.625$, $\alpha=0.00$). Rough texture is most effective in inducing sense of restoration ($r=0.589$, $\alpha=0.00$) and attraction ($r=0.585$, $\alpha=0.00$). Same as the previous section, the reliability analysis demonstrates that all the reliability indices for each category are close to 0.7, recommended by De Vaus (2002).

Table 3: The B- Variate Correlation between Plants' Texture with Preference/ Attractiveness/ Restoration/ Familiarity

	Preference for plants' form		
	Soft	Rough	Medium
Preference	.625** .000	.747** .000	.636** .000
Attractiveness	.166* .027	.585** .000	.373* .000
Restoration	.385** .000	.589** .000	.315** .000
Familiarity	.526** .000	.550** .000	.383** .000
Mean analysis	2.88 .879	3.91 .851	3.60 .875
Reliability	.736	.726	.728

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

3.5 Analysis of people preference for plants' colour

Among the plants containing various colors, pink flowering plants ($r=0.711$, $\alpha=0.00$) are preferred features of urban parks (See table 4). Light green foliage ($r=0.812$, $\alpha=0.00$) is preferred to dark green foliage ($r=0.361$, $\alpha=0.00$). Light green foliage seems most familiar for women ($r=0.642$, $\alpha=0.00$), and this correlation is followed by dark green foliage ($r=0.435$, $\alpha=0.00$). Among flowering plants, pink flowering shrubs are familiar for women ($r=0.363$, $\alpha=0.00$). Perceived familiarity for white and violet flowering plants is negligible. It can be mentioned that with increases in familiarity, preference for plants goes up. Correlation analysis was performed to prove the statistical significance. The results shows that preference is positively correlated with familiarity ($r=0.564$, $\alpha=0.00$).

Table 4: The B- Variate Correlation between Preference for Plants' Colour and Preference/ Familiarity

	Preference for plants' texture				
	Flower color			Foliage color	
	Pink flower	White flower	Violet	Dark green	Light green
Familiarity	.363** .000	.145 .054	.231** .002	.435** .000	.642** .000
Preference	.711** .000	.358** .000	.679** .000	.361** .000	.812** .000
Mean analysis	4.02 .69	3.87 1.10	3.38 .84	3.51 1.18	3.17 .88
Reliability	.744	.764	.712	.702	.782

Spearman correlation coefficient: <0.3 negligible correlation, 0.3 - 0.5 weak correlation, 0.5 - 0.7 moderately strong correlation, 0.7-0.9 strong correlation, 0.9< very strong correlation (Hinkle, Wiersma, & Jurs, 2003).

4. DISCUSSION

4.1 Women's preference for plants' attributes

Preference for plants' attributes was the subject of interest in some studies. Previous studies have revealed that people are more interested to observe spreading trees (Lin, 2000; Legg and Hicks, 1978). Lohr and Pearson-Mims (2006) studied preference for plants' form at Washington State University. The results of their study showed that people have higher preference for spreading trees, compared to rounded or columnar tree forms. Circular trees were the most preferred forms in Turkey (Muderrisoglu et al., 2006). According to the result of this study women prefer plants with spreading and circular forms, respectively. The results showed that women have an interest to observe pink flowering shrubs. Previous studies have shown that flowering plants always gain more attention and preference (Todorova et al., 2004; Kaplan, 2007). Gender differences lead to changes in the specialization of visual pathways that allow women to discriminate red wavelengths better than men (Silverman & Eals, 1992). Previous studies have revealed that the plants with light green foliage seem healthier, and dark green foliage usually displays the water stress, and people always prefer a healthy plant with green foliage and abundant flowers, with regular management (Nassauer, 1995; Orians and Heerwagen, 1992). The results of the current study illustrated that women prefer the plants containing light green foliage.

4.2 Women's familiarity with plants' attributes

Previous studies have proven that people prefer the landscapes that they are more familiar with (Gundersen et al. 2017). Ryan, (2012) maintained that

landscape quality indicators, such as color, shape, depth, and horizontal and vertical structure, are profoundly engraved in our existence; which somehow refers to perceived familiarity. So, preference for plants' attributions might be supported by perceived familiarity. The strong correlations between perceived familiarity and preference for plants' attributes in the current study are the evidence of this statement. Previous studies have stated that African people are willing to see the trees with a high ratio of width to height, and concluded that their tendency is due to the growing of this kind of plants in the east African savannah's fertile habitats (Kaplan, 1987; Oriens, 1980).

4.3 Women's perceived restoration

The results of this study showed that plants' form and texture contribute to women's mental restoration. van den Berg et al. (2014) examined the restorative effect of urban spaces differing in degrees of naturalness. They found that psychological restoration in urban landscapes depends on perceptions in relation to physical characteristics. Rough texture and oval form are the most restorative plant characteristics. A previous study has revealed that people do not respond in the same manner to all forms of plants (Zube, Pitt, & Evans, 1983). So it is justifiable why different plants have different abilities to induce a sense of mental restoration.

4.4 Women's perceived attractiveness

According to the results of this study, spreading shape is the most attractive plant form. Kellert and Wilson (1993) explored perceived attractiveness using black and white photographs of various tree shapes. They found that attractiveness is based on low trunk height, canopy layering, and a high ratio of tree canopy width to tree height. In other words, broad canopy trees with short trunks and horizontal branch clusters were most attractive. The results of the current study are in line with the findings of Kellert and Wilson (1993). In addition, a previous study has shown that green elements in a city lead to perceived attractiveness (Borst et al., 2008). Another study has revealed that landscape types would have a significant influence on aesthetic preference judgment (Wang, Zhao, & Liu, 2016). Therefore, it is justifiable that why plants with rough texture and spreading form are perceived more attractive, compared to other forms and textures.

4.5 Sustainable landscape design

The results of the current study confirmed the importance of public cooperation in urban parks development. It is deeply believed that creating a sustainable city

is not only related to economic growth and environmental quality of city, but it also has a tight relation to social aspects such as perception and experience (Hami et al., 2011). Environmental preference studies can affect planning and design of urban parks. A recent study has also emphasized the importance of understanding women's preferences for sustainable development of urban parks (Khairussalleh & Hussain, 2017). Landscape design of urban parks plays a significant role in usability and sustainability of parks. For example, a better design of park landscape may prevent re-planting issues as common problems in urban parks, which leads to establishing sustainable green spaces (Hami et al., 2009).

5. CONCLUSION

Plants' attributes such as color, form, and texture affect women's preferences and perception. Selecting landscape plants significantly depends on design approaches and objectives. Spreading and circular forms are most preferable for the urban parks. Spreading form is most attractive for women, and will encourage women to spend more time in the urban parks. Columnar and oval forms are most effective in inducing a sense of restoration and tranquility, and are therefore appropriate selections for restorative landscapes and healing gardens.

Vegetation containing rough texture is preferred by women. Perception of plant texture usually depends on the distance with a plant. Plants which are placed in closer distance to viewers may be perceived more rough. Therefore, in order to increase the efficiency of the urban parks, the viewer's distance with the plants must be controlled. This might also lead to a higher sense of familiarity, which in turn leads to a greater sense of restoration. Adherence to this instruction might also result in greater perceived attractiveness.

The bushes in the public urban parks of the city usually have white (e.g. Spiraea, Viburnum, and Sambucus), pink (e.g. Cotinus coggygria), and violet (Syringa) flowers. That is why three colors were taken into account in the current study. Shrubs with rough texture, light green leaves, pink flowers, and circular or spreading form, might better contribute to women's restoration and satisfaction. Lagerstroemia indica and Cotinus coggygria have most of the mentioned attributes, and are recommended for sustainable development of the urban parks of the city. Designing the parks with considering the introduced principles might provide a suitable place for social interaction, which in turn helps solving the less-use problems.

Women's perceptions and preferences have been known an important step towards sustainable development of urban landscapes. So, the instructions regarding form, color, and texture in the current study might help sustainable landscaping in the urban parks of the city.

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