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CITIZENS' ATTITUDE AND PERCEPTION TOWARD ROOFTOP GARDENING IN CITY AREA

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Abstract

Bangladesh, well known for its abundant green resources, has experienced rapid population growth and uncontrolled infrastructural development in cities, resulting in a loss of urban green spaces and environmental problem. Rooftop gardening has been proposed as a sustainable and affordable solution to mitigate these problems and create green spaces of cities in Bangladesh. This study assesses the social acceptance of rooftop gardens among city dwellers in Bangladesh. A descriptive quantitative study was conducted using convenient sampling methods. A total of 475 participants, including half of them male and another half female, were surveyed through an online Google form questionnaire in eight divisional cities and district areas across Bangladesh. Data were analyzed using SPSS and MS Excel, including descriptive statistics such as percentage distribution and chi-square test and inferential statistics such as correlation coefficient. The study found that approximately three quarter of respondents had positive attitude scores towards rooftop gardening, while almost a third had negative attitude scores indicating unwillingness. In terms of behavioral perceptions, nearly three quarter of respondents had positive scores, while almost a third had negative scores. The study also found associations between attitude, behavior, and socio-demographic factors such as sex ($p<0.05$). Furthermore, a positive linear association was observed between respondents' attitudes and behavioral perceptions towards rooftop gardening, as determined by the correlation coefficient. However, the study revealed that one third of respondents still had negative attitudes and just over a third had negative behavioral perceptions towards rooftop gardening. Therefore, effective policy measures and joint initiatives from the government and city municipalities are necessary to enhance the acceptance of rooftop gardens among the respondents.

Keywords: Rooftop Garden, Greening strategy, Green city, Attitude, Behavioral perception

Introduction

Rapid urbanization and high population growth, creating carbon-neutral communities is one of the biggest issues facing urban residents globally (UN-HABITAT, 2022). At present, 55 percentages of the world's population are living in urban areas and the portion is expected to increase to 68 percentages by 2050 (UN, 2018). Meanwhile, worldwide urbanization has been bringing various challenges, for instance, increased environmental pollution; excessive demand for food; lack of green space for physical exercise and relaxation; inefficient household waste management; unexpected fluctuation of urban calamities; which forced city dwellers to endure additional mental stress along with city life pressure (Al-Zu bi & Mansour, 2017).

According to Chowdhury et al. (2020) and Safayet et al., (2017) Bangladesh is recognized as a survivor of the adverse effects of climate change as one of the vulnerable country in the world from the last couple of decades. Still now most of the cities in Bangladesh is characterized by highly rated urbanization which raised three major groups of problem for sustainable cities like; excessive food demand, the depletion of natural resources and atmospheric pollution (Siddiqy, 2017). Throughout today's rapidly growing population, the country's leading development issues included poverty alleviation, sustainable development and environmental management (Hossain et al., 2019; Islam et al., 2019). Cities in Bangladesh have resulted in a major loss of urban green space in the urban landscape, which is

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continuously changing for the urban environment in addition to rapid population increase and unplanned infrastructure development (Angelo, 2019). It consequently led to significant environmental issues such increased urban heat and a high demand for natural resources, particularly energy, water, and food (Rahman & Zhang, 2018).

Due to this reason its demand to create sustainable eco-city that progressively required the abatement of pollution, in addition to provide enough food and green space, sound environment, and basic services for all urban residents now and in the future will be a great challenge for the next generation (Roy et al., 2017). Actually, to create this type of green space of cities in Bangladesh rooftop gardening is a sustainable and affordable solution to mitigate many of the environmental problems and to make sustainable Eco- cities. Rooftop garden is strongly associated with achieving Sustainable Development Goal 11 (SDG 11), which aims to create cities comprehensive, safe, resilient and sustainable (Siddiqy, 2017; Rahman & Zhang, 2018).

Moreover, rooftop garden is an eco-friendly strategy for sustainable city development which create a great landscape in urban area and balance of the ecology cycle .Whereas Rooftop garden is one of the most important factors for Eco- city development, which can contribute towards good quality of life and sound environment (Hossain et al., 2019). Rooftop garden can play crucial role in conserving biodiversity into dense urban environment which supports urban agriculture both directly and indirectly (Bon et al., 2010). Rooftop garden ensured urban agriculture which generated the issue of urban food security (Chowdhury et al., 2020; Kalantari et al., 2016). In addition, RTG serve as a useful source of employment for both the low income people and urban poor by the production of food locally. These benefits are especially important in developing countries like Bangladesh where agriculture is a big part of culture (Wei & Jones, 2022). Compared to all other mega cities around the world where the concept of rooftop garden is highly considered as a way of sustainable development of city, in Bangladesh it is a less focused issue and a little initiative is observed in this regard. Moreover, some researchers in Bangladesh have examined the economic and recreational aspects of rooftop garden as well as people perception in designing and planning of green spaces where RTG contribution to sustainable eco- city is ignored .In this context, this study plans to fill in the gaps by analyzing residents 'social acceptance' level about the rooftop garden concepts and considered it is an innovative strategy with regards to personal, social, economic, environmental and sustainability implications for sustainable development of green cities in Bangladesh.

Materials and Method

Study Area

The study had collected the data from 8 divisional cities (Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpure and Sylhet) including 39 districts cities(Bagerhat, Barisal, Brahmanbaria, Chapainawabganj, Chittagong, Chuadanga, Dhaka, Dinajpur, Faridpur, Gaibandha, Gazipur, Gopalgonj, Jamalpure, Jashore, Jhenaidah, Khulna, Kishoreganj, Kurigram, Kushtia, Magura, Manikganj, Meherpur, Mymensingh, Naogaon, Narail, Narayangonj, Nator, Nilphamari, Pabna, Panchagarh, Pirojpur, Rajbari, Rajshahi, Rangpur, Sariatpur, Satkhira, Tangail, Thakurgaon, Vhola) under this 8 divisional cities of Bangladesh.

Study Design

This study is descriptive in nature. This research method is designed to provide a picture of a situation as it naturally happens (Siedlecki, 2020). Quantitative and cross-sectional study method used to design the research paper. This study elicited the information of the respondents about their attitude, behavioral perception and challenges which has been measured in using statistical tools. Attitude and perception categorized applied weighted average mean and made categories like, 0=unwillingness, 1=willingness toward rooftop gardening.

Data Collection Tool and Technique

In this study, both primary data and secondary data collection method has been applied for collecting data. In order to collect the primary data from the respondents, a well-structured questionnaire was used which had close ended questions. All these were prearranged before collecting the data from online with Google form. For secondary data this study used different research website, articles, books, newspapers, report used through the literature reviews and find out the gap of the study.

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Sampling procedures and Sample Size Determination

The methodology of the study focused on quantitative investigations and thus snow ball sampling has been followed for the survey part of the study. The inherent reason for choosing snow ball sampling was that outstanding way of attaining preliminary information regarding some research questions quickly and reasonably through online. This study targeted the participants whom live in city area in Bangladesh. The whole data was collected based on the study objectives and the total sample size 475. This study area has unknown population that's why the researcher applying Cochran's Formula given by (& Cochran, 1963) to get required sample size with 95% confidence level and 4.5% margin of error.

Here the formula:

$$n = \frac{Z^2 pq}{e^2}$$

$$n = \frac{(1.96)^2 * 0.5 * 0.5}{(0.045)^2}$$

n=474.27

n=475

Processing of Data

The required data for the study has been collected from respondents in the mentioned study area. To address ambiguities, illegal codes have been removed, logical inconsistencies have been reduced, outliers have been eliminated, and improbabilities have been dropped. Essential tools such as SPSS and MS Excel were used to process the data.

Analysis and Interpretation of Data

In this study data has been analyzed using a statistical package for social science (SPSS) versions 20 to enhance the accuracy of the result. This study has used 5.00 point scale to find out citizen attitude and behavioral perception about rooftop garden. Data has been analyzed by using descriptive statistics such as percentage distribution and inferential statistics such as chi-square, and co-relation.

Results

Figure 1 represents the findings of this study, data was collected from three distinct respondent groups. Notably, a majority of the total respondents were found to have experience with Rooftop Gardening.

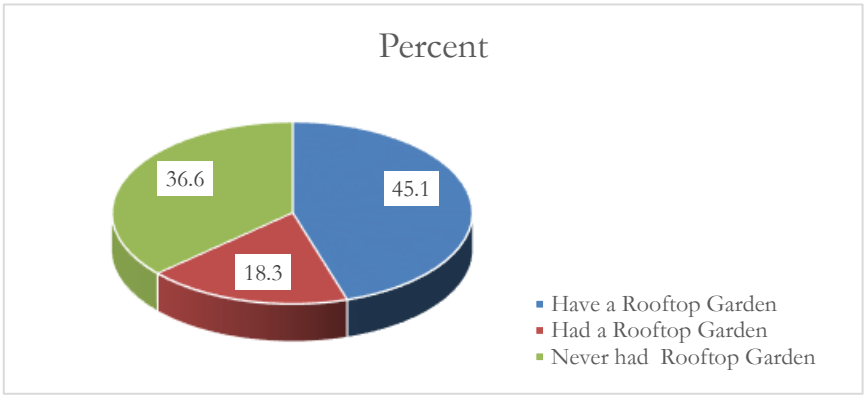

Figure 1.Type of respondents (Source: Field survey, 2021)

Specifically, almost one third percent of the respondents reported having no prior experience with rooftop gardening, while the remaining nearly fifth indicated that they had past experience in this area. These findings suggest that a significant portion of the study participants had engaged in rooftop gardening, highlighting the relevance of this practice within the surveyed population.

Table 1. Socio-economic Characteristics of the Respondents

Variable	Category	Frequency	Percentage (%)
Sex	Male	245	51.6
	Female	230	48.4
	Total	475	100
Age	Youth (18-35)	394	82.9
	Adult (36-65)	81	17.1
	Total	**475**	**100**
Family Types	Nuclear Family	264	55.6
	Extended Family	211	44.4
	Total	475	100
Type of Residence	Owner	289	60.8
	Renter	186	39.2
	Total	475	100
Level of Education	Primary	16	3.4
	Secondary	13	2.7
	Higher Secondary	37	7.8
	Undergraduate	283	59.6
	Postgraduate (Masters/Ph.D.)	126	26.5
	Total	475	100
Primary Occupation	Service	83	17.5
	Business	58	12.2
	Unemployed	334	70.3
	Total	475	100

(Source: Field survey, 2021)

Table 1 presents findings regarding the personal and socio-economic characteristics of the respondents. Firstly, it's notable that just over half of the respondents were males, while nearly half were females. When considering age groups, a significant portion fell into the youth category (aged 18 to 35), while nearly fifth were adults (36 to 65).In terms of family structure, almost half of the respondents lived in nuclear families, while just under half of the respondents lived in extended families. Regarding housing, the majority of respondents were house owners, while almost a third were renters. Looking at educational qualifications, most respondents had completed their high school education, followed by those with bachelor's degrees, while smaller percentages had completed primary, secondary, and higher secondary education (3.4%, 2.7%, and 7.8% respectively). Only a quarter of respondents had post-graduate qualifications. Finally, in terms of income status, a significant portion were unemployed, with nearly a fifth working in the service sector and almost one in ten engaged in business.

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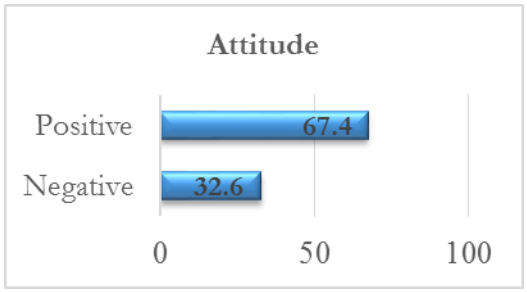

Figure 2. Attitude of Respondents

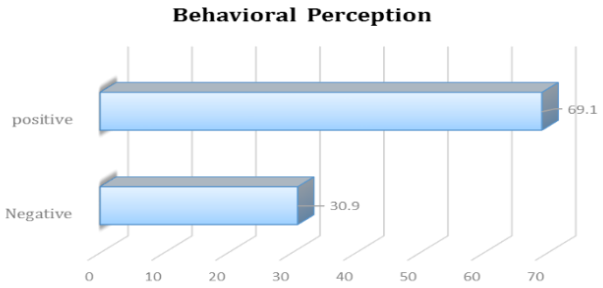

Figure 3. Behavioral

Perception

Figure 2 and 3 represent that out of the respondents surveyed, majority of the respondents displayed a positive attitude, while the remaining just over a third proportion exhibited a negative attitude. Similarly, a significant proportion of respondents demonstrated positive behavioral perception, with the remaining a third proportion expressing negative behavioral perception.

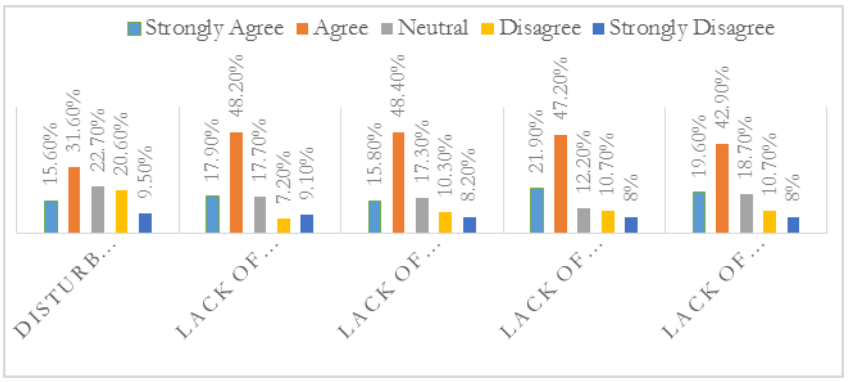

Figure 4. Challenges of Rooftop Gardening

The figure 4 presents the findings of a survey focused on understanding why people do not engage in rooftop gardening. Nearly half of the surveyed population reported insufficient training, expertise, and experience in rooftop gardening as a primary hindrance. A substantial portion mentioned a scarcity of leisure time and limited entertainment options as the main reason for their inability to effectively manage and maintain a rooftop garden. They attributed this to their busy schedules and commitments. Similarly, just under half of participants identified inadequate space as a significant barrier preventing them from engaging in rooftop gardening. Rest one-quarter of survey participants disclosed that the absence of suitable concrete structures on their rooftops had led to a loss of interest in physical activities, discouraging them from pursuing rooftop gardening.

Table 2 shows the association between two demographic factors and attitude. To investigate the connection between attitude and gender, a chi-square test for independence was conducted with a significance level of 0.05. The results showed that the chi-square test was statistically significant: χ^2 (1, N=474) = 6.53, p = 0.011 (which is less than 0.05), and the Phi coefficient was 0.117. These findings suggest that there is only a weak link between gender and attitude. Likewise, a chi-square test for independence was employed to explore the relationship between attitude and the level of education, also using a significance level of $\alpha = 0.05$. The results revealed statistical significance: χ^2 (4, N=474) = 11.458, p = 0.022 (which is less than 0.05), and the Phi coefficient was 0.155. This indicates that there is only a moderate connection between the level of education and attitude.

Table 2. The Association between Attitude & Socio-Demographic Variable

Variables	Attitude		Test Statistics	*p*- Value	Effect Size
	Unwillingness (%)	Willingness (%)			
		Sex			
Male	93 (38.0)	152 (62.0)			
Female	62 (27.0)	168 (73.0)	6.533	0.011**	0.117
		Level of Education			
Primary	9(56.2)	7(43.8)			
Secondary	7 (53.8)	6(46.2)			
Higher Secondary	10 (27.0)	27 (73.0)			
Undergraduate	98 (34.6)	185(65.4)	11.458	0.022**	0.175
Postgraduate	32 (24.6)	95 (75.4)			

Table 3. The Association between Perception & Socio-Demographic Variable

Variables	Perception		Test Statistics	*p* - Value	Effect Size
	Negative Perception (%)	Positive Perception (%)			
		Gender			
Male	93 (38.0)	152 (62.0)	11.641	0.001**	0.157
Female	54 (23.5)	176 (76.5)			
		Type of Residence			
Owner	79 (27.3)	210 (72.7)			
Renter	68 (36.6)	118 (63.4)	4.505	0.034**	-0.097
Attitude					
Unwillingness	114(73.5)	41(26.5)	195.39	0.000**	0.641
Willingness	33(10.3)	287(89.7)			

Table 3 displays the relationship between demographic variables and perception. To determine whether behavior is associated with gender, a chi-square test for independence was conducted at a significance level $\alpha = 0.05$. The results indicated statistical significance: χ^2 (1, N=474) = 11.641, p =0.001 (which is less than 0.05), with a Phi coefficient of 0.157. These findings suggest a weak connection between gender and perception. Similarly, a chi-square test for independence was employed to examine the relationship between perception and the type of residence, using $\alpha = 0.05$. The test revealed statistical significance: χ^2 (1, N=474) = 4.505, p = 0.034 (which is less than 0.05), with a Phi coefficient of 0.097. This indicates a very slight association between types of residence and perception. Additionally, a chi-square test for independence was used to assess whether perception is linked to attitude. The results showed strong statistical significance: χ^2 (1, N=474) = 195.39, p = 0.000 (which is less than 0.05), with a Phi coefficient of 0.641. These findings highlight a robust relationship between perception and attitude.

Table 4 examines the relationship between demographic variables and challenges faced in rooftop gardening. To determine if these challenges are associated with gender, a chi-square test for independence with a significance level (α) of 0.05 was employed. The results indicated statistical significance: χ^2 (1, N=474) = 6.427, p = 0.011 (which is less than 0.05), with a Phi coefficient of 0.116. This suggests a weak association between gender and gardening challenges, revealing that males encounter more challenges in gardening compared to females. Likewise, a chi-square test for independence was used to assess the relationship between challenges and the type of residence, using $\alpha = 0.05$. The test revealed statistical significance: χ^2 (1, N=474) = 4.456, p = 0.035 (which is less than 0.05), with a Phi coefficient of -0.097. This indicates a very slight connection between types of residence and gardening challenges, suggesting that household owners face more challenges than renters. Furthermore, a chi-square test for independence was conducted to investigate whether these challenges are linked to attitude. The results showed strong statistical significance: χ^2 (1, N=474) = 41.772, p = 0.000 (which is less than 0.05), with a Phi coefficient of 0.297. This points to a moderate relationship between challenges and attitude. Additionally, another chi-square test for independence was used to determine if behavior is associated with these challenges. The test also revealed strong

statistical significance: χ^2 (1, N=474) = 64.190, p = 0.000 (which is less than 0.05), with a Phi coefficient of 0.368. This indicates a strong relationship between challenges and behavior.

Table 4. The Association between Socio -Demographic Variable and Challenges

Variables	Challenges				
	Low (%)	High (%)	Test Statistics	*p*- Value	Effect Size
Gender					
Male	111 (45.3)	134 (54.7)			
Female	78 (33.9)	152 (46.8)	6.427	0.011**	0.116
Type of Residence					
Owner	104(36.0)	185(64.0)	4.456	0.035**	-0.097
Renter	85(45.7)	101(54.3)			
Attitude					
Unwillingness	94(60.6)	61(39.4)	41.772	0.001**	0.297
Willingness	95(29.7)	225(70.3)			
Perception					
Negative Perception	98(66.7)	49(33.3)	64.190	0.001**	0.368
Positive Perception	91(27.7)	237(72.3)			

Table 5. Pearson correlation matrix between Attitude and Perception

		Attitude	Behavior
Attitude	Pearson Correlation	1	0.895**
perception	Pearson Correlation	0.895**	1

*** Correlation is significant at the 0.01 level (2-tailed).*

In Table 5, the Pearson's correlation coefficient is reported as 0.895, indicating a robust and positive linear correlation. This study's findings, denoted as ($r=0.895$, $p<0.001$), highlight an exceptionally high level of statistical significance. This result unequivocally rejects the null hypothesis, demonstrating a highly significant and positive relationship between attitude and behavior. This signifies a strong positive social acceptance of rooftop gardening among the residents of urban areas in Bangladesh.

Discussion

The main aim of this study is to explore the social acceptance of city dwellers toward rooftop gardening in urban areas of Bangladesh. This study focuses on the attitudes and behavioral perceptions of city dwellers to understand the social acceptance of rooftop gardening. Similarly, Kosorić et al. (2019) focused solely on attitudes toward rooftop gardening with a productive facades system among people in Singapore. In this study, researchers examined the associations among behavioral perceptions, attitudes, and demographic variables such as sex, age, family types, type of residence, level of education, and primary occupation. Similar results were found in the research articles by Wei & Jones (2022) and Kosorić et al. (2019). Coefficient of correlation was used to explore the relationship between attitude and behavior, similar to the approach taken in Wei & Jones, 2022 research. On the other hand, this study identified a strong relationship between attitude and behavior, which aligns with the findings of previous literature (Kronenberg et al., 2020). This study also revealed a significant relationship between gender and challenges, indicating that males faced more challenges than females in gardening. Another significant relationship was found between the type of residence and challenges. While previous literature (Kosorić et al., 2019) suggested that renters faced more problems than owners, this study found that owners encountered more challenges than tenants. Additionally, this study found a significant relationship among attitude, behavior, and challenges. In essence, challenges moderate the attitudes and behavioral perceptions of rooftop gardening.

Conclusion

The growth rate of the urban population, the demand for food and air pollution is increasing exponentially. However, resources are scarce as agricultural land is being converted to residential, commercial, or industrial land uses. Rooftop gardening can help meet the food demand by providing fresh and hygienic food products, reducing

household expenditure, creating a healthier atmosphere by improving air quality and absorbing carbon from the air, and mitigating the impact of climate change. The study revealed that 32.6% of respondents still had negative attitudes, and 30.9% had negative behavioral perceptions towards rooftop gardening. Implementing this on a large scale is not possible without government intervention. Therefore, to ensure sustainable green cities, both the government and city dwellers should take initiatives and cooperate with NGOs and municipalities to promote rooftop gardening on a large scale in urban areas of Bangladesh.

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Conflict of Interest
The authors declare no conflict of interest.

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