Impact of demographic characteristics on knowledge towards carbon foot print management in apartments of Bangalore city, India

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Abstract

The word carbon foot print is highly termed in all social circles, among all individuals, communities, nations, research center's so as to be responsible and take action against the threat of global warming and climate change. Carbon foot print is the total emission of greenhouse gases and their accumulation which leads to climate change and effects environment. The present study focuses on carbon foot print of individuals on domestic level and their demographic characteristics on their knowledge level. The design of the study is Survey method. Purposive sampling method was used for sample selection. The total sample size comprising of 50 out of which 25 samples were chosen from residents who are living in conventional apartments and 25 samples were chosen from the residents living in eco friendly apartments. The questionnaire was developed to evaluate the knowledge of the respondents residing in two apartments. The questionnaire was used as a tool to measure 10 components. i. Environment ii. Waste Management iii. Water foot Print iv. Food Foot Print v. Energy Management vi. Reduce Reuse and Recycle vii. Indoor air Quality viii. Vaasthu aesthetics ix. Insulation x. Carbon foot print. Pre test assessment on Knowledge towards carbon foot print management on the aspects was done. Further the intervention program was carried using lecture modules and PPT for a period of 45 days. Post test was carried after the intervention program to obtain the knowledge assessment using the same questionnaire. The study found that 52% of the residents had moderate knowledge level during pre test. During post test the knowledge levels was Adequate, increased with 62.0%. The results subjected to variation in the knowledge level among the respondents between pre and post test found to be statistically significant (χ^2 = 56.09*). Mean Pre test knowledge scores found to be 49.5% as compared to post test (80.1%) with enhancement as 30.6% on carbon foot print management revealing significance (t=38.64*). The enhancement of knowledge found higher after post test in energy management (32.1%), followed by Indoor air quality (32.0%),Water foot print (31.9%), Food foot print (31.1%), Environment (29.7%), Insulation (29.3%), Vaasthu aesthetics (27.0%), Further the enhancement of knowledge scores of residents on carbon foot print management among all the aspects order study found to be significant (p<0.05). By creating awareness among individuals, households, social circles and communities in carbon foot print management environment sensitization can be achieved.

Keywords: Carbon foot print, global warming, climate change, eco-friendly, conventional.

Introduction

Carbon Footprint is a measure on the environment in terms of amount of green house gas produced, and in particular climate change[1]. Carbon Footprint (CF) refers to the total amount of carbon dioxide and its equivalents emitted due to various anthropogenic activities. Carbon Footprint is a synonym for emissions of carbon dioxide or other greenhouse gases (GHGs) expressed in carbon dioxide equivalents[2].

Carbon dioxide emissions from households and commercial establishments is due to energy consumption for cooking, lighting, heating and household appliances[3].

An individual's carbon footprint is the direct effect their actions have on the environment in terms of greenhouse gas emission. In general, the biggest contributors to the carbon footprints of individuals in industrialized nations are transportation and household electricity use. An individual's secondary carbon footprint is dominated by their diet, clothes and personal products. Carbon Foot Print relates to the total greenhouse gas emissions produced directly and indirectly in our day to day lives through burning fossil fuels and electricity, heating and transportation etc.

Carbon dioxide has taken a center stage in the environmental arena. It was in the 19th century, scientists realized that gases in the atmosphere cause a "greenhouse effect" which affects the planet's temperature. At the turn of the century, various scientists like Arrhenius, Calendar and Keeling (The Discovery of Global Warming, 2014)[4], argued that the level of carbon dioxide was Climbing and raising global temperature and were of opinion it will result in global warming. With global warming dominating so many headlines today, it's no surprise that many

of us are looking to reduce the amount of carbon dioxide and other greenhouse gases our activities produce.

Global population growth has lead to increasing pressure on world - wide natural resources. Man has becoming a victim of his own behavior. Human beings need to reduce their carbon footprint to save the planet. As a responsible citizen one need to manage the carbon foot prints. Sustainable measures to be practiced in the apartments or buildings by seriously considering the concept of "going green" "A green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building."

Population growth has been one driver of emissions growth over the past several decad.es and that urbanization, aging, and changes in household size can also affect energy use and emissions. Demographers expect major changes in these dimensions of populations over the coming decades. Global population could grow by more than 3 billion by mid-century, with most of that difference accounted for by growing urban populations. Aging will occur in most regions, a result of declines in both fertility and mortality. The number of people per household is also declining as populations age and living arrangements shift away from multi generation households toward nuclear families.

A set of demographic, economic, behavioral, and spatial factors are key determinants of urban household carbon emissions in the region.

The age structure, household size, income and family car-holding influence household carbon emissions significantly[5].

In view of shift from millennium development goals (MDGs) to sustainable development goals (SDGs)with a focus on achieving gender equality, empowerment of women and girls, ensuring healthy lives and promote sustained, inclusive and sustainable economic growth and productive empowerment, there is a need to view the environment in the global context with Carbon Foot Print management at individual and institutional level. Keeping in view of the Sustainable Development goals one need to protect the environment for future generations for sustenance of resources and well being through Carbon Foot Print Management.

Methodology

The Study was undertaken in two apartments at Bangalore city. One Conventional apartment and one Eco friendly apartment were selected for the study. Total sample size comprising of 50 respondents viz., 25 respondents from Conventional apartments and 25 from Eco friendly apartments were selected. The sampling method adopted using purposive random sampling.
Constructed a structured questionnaire and validated by the experts and information obtained from the respondents under

different components: i. Socio-demographic characters considered were Age, Gender, Education, Occupation, Type of family, family members, Residence and Income. ii. Knowledge assessment comprising of 94 statements. Response obtained as 'Yes' and 'No' and further scoring given as 'One' and 'Zero' respectively.

Evaluated the knowledge of residents using questionnaire comprising of 10 components as: i. Environment, ii. Waste Management, iii. Water foot Print, iv. Food Foot Print, v. Energy Management, vi. Reduce Reuse and Recycle, vii. Indoor air Quality, viii. Vaasthu aesthetics, ix. Insulation and x. Carbon foot print management.

After obtaining pre test information from the respondents, intervention program conducted for 45 days to selected samples using modules scheduled on weekly once for two hour duration on the topics stated above. Further, Post test was administered and obtained information on knowledge from the respondents to measure the Impact and effectiveness of the intervention programme. The data was analyzed under both descriptive and inferential statistics.

Results and discussion

The data obtained from the study samples subjected for tabulation and analysis carried out and results indicated in the following tables.

Table-1: Classification of Respondents by Personal Characteristics. N=50

Characteristics	Category	Respondents	
		Number	Percent
Age group (years)	21-30	9	18.0
	31-40	14	28.0
	41-50	14	28.0
	51+	13	26.0
Gender	Male	36	72.0
	Female	14	28.0
Educational level	PUC	8	16.0
	Graduate	19	38.0
	Post graduate	23	46.0
Occupational status	Government	10	20.0
	Private	31	62.0
	Self employed	4	8.0
	Agriculture	5	10.0
Total		50	100.0

Table-1 reveals that the higher respondents were noticed from the age group of 31-40 and 41-50 years (28%) followed by 26% belong to the age group of 51+ and remaining 18% belong to the group of 21-30. Majority of the respondents (72%) were males as compared to females (28%). With regard to the educational level the results indicate that most of the respondents (46%) were postgraduates followed graduates (38%) and remaining 16% were PUC qualified.

Majority (62%) of the respondents worked under private employment, followed by government employees (20%), agricultural field (10%) and self-employed (8%).

Table-2: Classification of Respondents by Family related Characteristics.

N=50

Characteristics	Category	Respondents	
		Number	Percent
Type of family	Nuclear	28	56.0
	Joint	15	30.0
	Extended	7	14.0
Number of family members	2-3	28	56.0
	4-5	14	28.0
	5-6	8	16.0
Earlier Place of Residence	Rural	19	38.0
	Semi-urban	23	46.0
	Urban	8	16.0
Family income/month	Rs.3,500-6,000	17	34.0
	Rs.6,000-12,000	14	28.0
	Rs.12,000-18,000	19	38.0
Total		50	100.0

Table-2 depicts the classification of respondents by Family related Characteristics. It is evident that majority (56%) of them belonged to nuclear family background followed by joint family (30%) and extended family (14%). Family size reveals that higher respondents (56%) consisted of 2-3 family members followed by 4-5 family members (28%) and 5-6 family members (16%).

Higher respondents had place of residence as semi-urban (46%) as compared to 36 % of the respondents emerged from rural area and 16% respondents settlement in urban area. Further, regarding family income, majority of the respondents (38%) found in the income range of Rs.12,000 - 18,000 followed 34.% belongs to Rs.3,500-6,000 and remaining 28% of the respondents were in the income group of Rs.6,000-12,000.

Table-3: Classification of Respondent Pre test Knowledge level on Carbon Foot Print Management.

Knowledge Level	Category	Respondents	
		Number	Percent
Inadequate	≤ 50 % Score	24	48.0
Moderate	51-75 % Score	26	52.0
Adequate	> 75 % Score	0	0.0
Total		50	100.0

Respondent Pre test Knowledge level on Carbon foot print management established in Table-3. It is seen from the results that 52% of the respondents noticed moderate knowledge level on carbon foot print management and remaining 48% respondents were with inadequate knowledge. Further, none of the respondents had adequate knowledge on carbon foot print management. The study by Keita Mamady[6] is in par with the results which says that the community residents of Guinea had poor knowledge and unsafe behavior in relation to waste management.

Table-4: Classification of Respondents of Post test Knowledge level on Carbon foot print management.

Knowledge Level	Category	Respondents	
		Number	Percent
Inadequate	≤ 50 % Score	0	0.0
Moderate	51-75 % Score	19	38.0
Adequate	> 75 % Score	31	62.0
Total		50	100.0

Table-4 shows the classification of Respondents of Post test Knowledge level on Carbon foot print management. It is seen from the result that 62 percent of the respondents found adequate knowledge level in the post test on carbon foot print management as compared to remaining 38 percent of the respondents in post test found moderate knowledge level towards carbon foot print management. None of the respondents in post test noticed with inadequate knowledge towards carbon foot print management.

Table-5 reveals the overall pre test and Post test Mean Knowledge on Carbon Foot Print Management. The result indicates that the mean pre test knowledge found to be 49.5% as compared to post test knowledge of 80.1%. It is further evident from the findings that the enhancement of knowledge found to be 30.6% on Carbon Foot Print Management. The data subjected for statistical test reveals that the enhancement of knowledge found to be significant (t= 38.64*).

Table-5: Over all Pre test and Post test Mean Knowledge on Carbon foot print management. N=50

Aspects	Max. Score	Knowledge Response				Paired 't' Test
		Mean	SD	Mean (%)	SD (%)	
Pre test	94	46.5	5.8	49.5	6.1	38.64*
Post test	94	75.3	5.8	80.1	6.1	
Enhancement	94	28.7	5.3	30.6	5.6	

*Significant at 5% level, t (0.05,49df) = 1.96

Table-6: Aspect wise Mean Pre test and Post test Knowledge on Carbon foot print management. N = 50

No.	Knowledge Aspects	Knowledge Response (%)						Paired 't' Test
		Pre test		Post test		Enhancement		
		Mean	SD	Mean	SD	Mean	SD	
i.	Environment	46.8	8.4	76.5	8.7	29.7	11.2	18.75*
ii.	Waste management	52.0	12.5	78.6	11.6	26.6	14.4	13.06*
iii.	Water foot print	48.5	12.0	80.4	9.3	31.9	10.5	21.48*
iv.	Food foot print	46.2	10.6	77.3	9.0	31.1	14.2	15.49*
v.	Energy management	48.9	6.6	81.1	6.9	32.1	6.7	33.88*
vi.	Reduce reuse & recycle	51.4	11.3	81.4	9.7	30.0	13.9	15.26*
vii.	Indoor air quality	44.0	35.9	76.0	29.0	32.0	29.9	7.57*
viii.	Vaastu Aesthetics	59.5	25.2	86.5	15.3	27.0	23.6	8.09*
ix.	Insulation	57.3	32.3	86.7	20.2	29.3	32.0	6.47*
x.	Carbon foot print management	51.0	31.1	76.0	35.3	25.0	25.3	6.99*

*Significant at 5% level, t (0.05,49df) = 1.96

Aspect wise Mean Pre test and Post test Knowledge scores on Carbon foot print management depicted in Table-6. The enhancement of knowledge found higher in energy management (32.1%), followed by Indoor air quality (32.0%), Water foot print (31.9%), Food foot print (31.1%), Environment (29.7%), Insulation (29.3%) and Vaasthu aesthetics (27.0%). However, the enhancement of knowledge is found to be less in the aspects of waste management (26.6%) and carbon foot print management (25.0%). Further the enhancement of knowledge scores of residents on carbon foot print management among all the aspects study found to be significant at 5% level (p<0.05).

A study by Kumar and Nandini[7] says that the, The majority of the households about 71% are willing to use the recyclable products which they were using to carry vegetables, grains etc. from whole shops/markets, as they have aware about reduce, recycle and reuse.

Table-7: Association between Socio demographic Characteristics and Pre test Knowledge level on Carbon foot print management.

Characteristics	Category	Sample (n)	Knowledge level				χ^2 Value
			Inadequate		Moderate		
			N	%	N	%	
Age group (years)	21-30	9	6	66.7	3	33.3	1.90 NS (p>0.05)
	31-40	14	6	42.9	8	57.1	
	41-50	14	7	50.0	7	50.0	
	51+	13	5	38.5	8	61.5	
Gender	Male	36	14	38.9	22	61.1	4.28* (p<0.05)
	Female	14	10	71.4	4	28.6	
Educational level	PUC	8	8	100.0	1	0.0	12.79* (p<0.05)
	Graduate	19	9	47.4	10	52.6	
	Post graduate	23	7	35.0	13	65.0	
Occupational status	Government	10	3	30.0	7	70.0	4.62 NS (p>0.05)
	Private	31	17	54.8	14	45.2	
	Self employed	4	3	75.0	1	25.0	
	Agriculture	5	1	20.0	4	80.0	
Type of family	Nuclear	28	18	64.3	10	35.7	7.46* (p<0.05)
	Joint	15	5	33.3	10	66.7	
	Extended	7	1	14.3	6	85.7	
Family size (members)	2-3	28	14	50.0	14	50.0	0.21 NS (p>0.05)
	4-5	14	6	42.9	8	57.1	
	5-6	8	4	50.0	4	50.0	
Earlier Place of Residence	Rural	19	13	68.4	6	31.6	6.03* (p<0.05)
	Semi-urban	23	7	30.4	16	69.6	
	Urban	8	4	50.0	4	50.0	
Family income/month	Rs.3,500-6,000	17	8	47.1	9	52.9	0.74 NS (p>0.05)
	Rs.6,000-12,000	14	8	57.1	6	42.9	
	Rs.12,000-18,000	19	8	42.1	11	57.9	
Total		50	24	48.0	26	52.0	

*Significant at 5% level, NS: Non-significant,

Table-7 indicate the association between Socio demographic Characteristics and Pre test Knowledge level on Carbon foot print management. The result indicate that 61.5 percent of the respondents belong to the age group of 51+ years had moderate knowledge level, followed by the age group of 31-40 years (57.1%) and 41-50 years (50.0%).

Findings reveals that majority of male respondents (61.1%) found moderate knowledge as compared to females (28.6%). On the contrary The study on[8] Assessment of Waste Management Practices among Residents of Owerri Municipal Imo State Nigeria states the effect of gender and education on knowledge, attitude and practice of waste management. Females are significantly more aware of waste management than males (p = 0.025). Results indicate that 65.0 percent with post graduate educational level showed moderate knowledge level followed by graduates (52.6%) on Carbon foot print management.

Tables indicate majority (80.0%) of respondents involved in agriculture back ground noticed with moderate knowledge level followed by government (70.0%), Private (45.2%) and self employed (25.0%). Majority of respondents (85.7%) from extended family identified with moderate knowledge level than joint (66.7%) and nuclear (35.7%).

Almost 50.0 percent of respondents noticed with moderate knowledge level among type of family size category. Results indicate that semi-urban respondents had higher response on moderate knowledge level (69.6%) compared to urban (50.0%) and rural (31.6%). Family income status depicts almost similar response on knowledge level on carbon foot print management.

The data subjected for statistical analysis indicate that the significant association noticed among gender ($\chi2$ =4.28*), type of family ($\chi2$ =12.79*), family income ($\chi2$ =7.46*) and place of residence ($\chi2$ =6.04*) with knowledge level on carbon foot print management. Similar results were found in the study by Ali Haider et al.[9] which reveals that Socio-economic factors (i.e. gender, age, education, income, family members, etc.) played a significant role in determining the waste generated quality and quantity by each household.

Further, the association found non-significant (p>0.05) with age group, occupation, family size and family income with knowledge level on carbon foot print management.

The result are on par with the findings of Adeyemo and Gboyesola[10] on knowledge, attitude, and practices towards waste management of people living in the university area of Ogbomoso which indicated that the respondents were knowledgeable in refuse management. In this study females were found to be more aware than males on knowledgeable about waste management. It is evident and surprising that the female respondents knew so much about basic waste management principles. Margaret Banga[11] study contributes on household knowledge of solid waste segregation in Urban Kampala showed about 17.5 percent of the respondents had attained tertiary level education and secondary education (43.8%) where as 30.5 percent had up to primary. Consequently, the high level of awareness 254 (90%) of waste management could be explained by high educational status of respondents and the commonest (75.18%). Further, source of information about waste management was through the mass media (TV, Radio and Newspaper).

Study on Municipal solid waste Generation, composition and GHG emissions in Bangalore that the household per capita waste generation was positively related with income and education levels, while negatively related with family size.

Conclusion

Majority of the respondents were from the age groups 31-40 and 41-50 years, males, post graduates working in private organizations. Among the respondents male members were the highest (72.0%). Majority from nuclear family, family size with 2-3 members, semi urban background and income range between Rs.12,000-18,000. The study also found that majority (52%) of the residents had moderate knowledge level during pre test increased to adequate (62.0%) knowledge level in post test. The pre test mean knowledge found to be 49.5% as against 80.1% in post test with enhancement of 30.6% on carbon foot print management establishing statistical significant (t=38.64*), Further, the enhancement of knowledge scores of residents on carbon foot print management with all the aspects under study found to be significant (p<0.05). The data subjected for statistical analysis indicate that the significant association noticed with knowledge level on carbon foot print management found non-significant (p>0.05) with age group, occupation, family size and family income with knowledge level on carbon foot print management.

In order to reach sustainable development goals it is the duty of every global citizen to take a pivotal role in sensitizing about environmental issues, challenges and remedies to protect the environment at the micro and macro level. Through advocacy and policy every citizen should be made responsible to protect and conserve environment.

In this study it is proved that through intervention program knowledge levels of the respondents of both eco friendly and conventional apartments in the post test has enhanced in reducing the carbon foot print .Therefore family and community science is a catalyst for reaching sustainable development goals on Clean Water and Sanitation, Affordable and Clean Energy, Industry, Innovation and Infrastructure, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life below Water, Life on Land and Good Health and Well-being.

For reaching sustainable development or universal goals it is proved that Home Scientists play a vital role in creating the

level of awareness among communities concerned and the population by demonstrating the consequences of Carbon foot print on environment and living organisms and discussing possible solutions through intervention programme. Let us join hands in making a healthy and sustainable resources country New India an environment friendly, livable space.

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