PRINT: ISSN 0970-9274 ONLINE: 2456-6608
J. Hum. Ecol., 8(6) : 427-433 (1997)
DOI: 10.31901/24566608.1997/08.06.04

Quality of Environment in Households Kitchens

Veena Gandotra and Veerbala

Department of Home Management, Faculty of Home Science, M.S. University, Baroda 390 002, Gujarat, India

KEY WORDS Quality of Environment. Knowledge. Pollution. Pollutants Variables.

ABSTRACT In the present study the quality of environment in household kitchens was assessed in terms of quality of air, potability of water, adequacy of light, sound levels and temperature levels in three localities of Delhi. The subjective analysis of environmental quality was determined by allotment of scores to existing conditions in the kitchens. A knowledge test was developed to asess the level of knowledge of respondents. A sample of 50 respondents from three localities in Delhi, namely, Shalimar Bagh, Shakur Basti and Subzi Mandi were chosen. The results showed that nearly 60% of houses had satisfactory environmental conditions. About 58% of the respondents had medium level of knowledge while 18% had high and 26% had low level of knowledge regarding environment quality. The quality of household environment was significantly affected by age, education and knowledge of respondents. It also varied with locality in which they lived. The quality of environment was also assessed through field experiments. The results revealed that suspended particulate matter (5 pm) was above permissible limit while SO_2 was found below permissible level in all groups (41.6 to 54.4 mg/m_3). CO level was more when windows were kept closed and SO_2 concentration was more when kerosene was used as fuel. CO levels also increased with use of flat bottom utensils (more than 10 ppm). Water quality was poor in locality where hand pump water was used *i.e.* samples of water were found to be polluted. The sound levels were high (above 67 dB), temperatures were also high (more than 35°C) and lighting was poor (not more than 38 fc) in majority of kitchens where there were no windows. Thus quality of environment in household kitchens was found to be polluted and it varied from locality to locality.

Environment problems have attracted the attention of a wide cross-section of people all over the world especially during the last two decades. Although a lot has been said and done about outdoor pollution, the attitude of people towards indoor pollution has been indifferent. Generally people spend a major part of their time indoors at their homes. Hence, the quality of environment in a home should be prime concern to everyone. According to WHO (1979) a residential environment is physical structure including all necessary services, facilities, equipments and devices needed or desired for the physical and mental well-being of the family and the individual.

Halpern (1978) found that most people spend as 80% of their time indoors. Time budget studies have also shown that women spend about 2-7 hours of time daily in kitchen and it is the place where maximum amount of pollutants are generated. The various pollutants in the kitchen are produced from types of fuel used, smoke and dust coming in kitchen or generated in the kitchen. The quality of environment is also affected by quality and quantitiy of light and ventilation, heat and noise in the kitchen. The sanitary condition and the way water is collected and stored also have a direct bearing on the quality of life of the family.

The present study was conducted to measure the indoor levels of SPM, CO and SO_2 concentration in Delhi, to assess the indoor air quality and to findout the impact of the variables like knowledge, education, age etc. of the reapondants on the quality of the environment.

METHODOLOGY

The research design of the present study was descriptive and experimental in nature. The survey was conducted in 3 localities of Delhi *i.e.* locality A - Shalimar Bagh (near industrial area), locality B - Subzi Mandi (near highly populated commercial area) and Locality C - Shakur Basti (near Railway Station). A total sample of 150 household *i.e.* 50 from each area were chosen. The homemakers were the respondents because they remain in the

kitchen most of the time. For experimental work 10 households from each area were chosen. Purposive sampling method was used and following criteria was laid down for selection.

1) Only ground floor flats were chosen as pollution varies on different floors of building.
2) Households where kerosone or LPG was used as fuels were chosen.

Interview schedule including an observation sheet and knowledge test were used to collect data. Interview schedule had questions regarding the existing conditions in the kitchen with regard to air and ventilation, storage of water, type of fuel and stove used, lighting conditons, sanitary conditions and noise pollution. Observations were also made regarding these aspects. Weighted scores were given to the existing conditions in the kitchen in order to come up with environment quality scores.

The knowledge test was developed to determine the level of knowledge of the respondents. The test items were subjected to item analysis, to establish the validity of the instrument. The items falling in 0.2 to 0.8 value on the item difficulty index and items falling under discrimination index of + 0.20 and above were selected for final test. The reliability of the test was assessed by split-half method and reliability co-efficient was calculated. The test was found to be highly reliable because the reliability co-efficient was 0.92.

Experiments were conducted to assess, air quality, water quality, adequacy of lighting, heat stress and noise pollution. The air and water samples were collected and tested in the laboratories of NEERI at Delhi. Concentration of SPM, SO_2 and CO were determined. Bacteriological analysis of drinking water was done primarily to determine its potability. MPN (most porbable number) test was carried out to find out the presence of pathogenic coliform organisms. Lightmeter was used to measure intensity of illumination at work place, sound level meter was used to assess sound produced during cooking activity and thermometer was used to measure heat at the work place.

Housewives were interviewed to collect relevant data and observations were recorded during the interview. For exprimental work observations regarding heat, light and noise were recorded from 11 a.m. to 1 p.m. Water samples collected from the selected households and air pollutants were sampled for 2 hours duration and analysed. The data thus collected was categorised, coded, tabulated and analysed statistically.

RESULTS AND DISCUSSION

The demographic characteristics of the sample revealed that majority of the respondents were in the age group of 10-44 years (60%) and about 23% were in older age group while 17% in the younger group. A little less then half of the respondents had education upto secondary school level and nearly 21% were post-graduates and about 19% were illiterates. With regards to occupation of the respondents it was found that nearly 59% were housewives, 28% employed and 13% were self employed. Nearly two-thirds of the respondents had family income ranging from Rs. 1500-3000, with 13% below Rs. 1500 and about 11% above Rs. 3000. The family size of the respondents was not very large, majority of the respondents belonged to the category of 1-3 family size (62%). However 36 per cent had family size upto 4-6 members and only 2% had more than 6 members in the family.

Type of Kitchen

Majority of the respondents had seperate kitchen (88%) out of which 79% did not have openings towards courtyard and they cooked in kitchen in both the seasons *i.e.* summer and winter. The size of kitchen in all the houses was not adequate *i.e.* less than recommended size and most of them were not properly oriented (Deshpande, 1985). The quality of environment was judged on the basis of existing conditions in the kitchen with regards to venti-

lation, heat stress, lighting, sanitation, noise and water storage conditions. Weighted scores were given to the existing conditions on the basis of recommendations made by various authors (Deshpande, 1985; Grandjean, 1978; Pickett, 1962). The respondents whose kitchens scored mean or above mean scores were categorised as good and those below mean were categorised as poor. The various parameters of quality of environment are discussed below.

Ventilation : The ventilation in the kitchen was judged on the basis of number and size of doors and windows, the direction in which they were placed and provision of ventilators. The various aspects were scored and a combined score for each respondent was developed (Deshpande, 1985). The results showed that, on the whole ventilation was good in A and C localities but in B it was very poor.

Table 1: Frequency of percentage distribution of household according to quality of environment

Parameter of quality of environment	*Localities*				
	A (N=50)	*B (N=50)*	*C (N=50)*	*Total (N=150)*	
1. Ventilation					
Good	42	9	42	93	62
Poor	8	41	8	57	38
2. Heat stress					
Less	37	29	44	110	73.3
More	13	21	6	40	26.7
3. Lighting					
Good	43	5	42	90	60
Poor	7	45	8	60	40
4. Sanitation					
Good	36	01	35	72	48
Poor	14	49	15	78	52
5. Noise					
Less	25	20	32	77	51.3
More	25	30	60	73	48.8
6. Water storage conditions					
Good	37	24	21	82	59.4
Poor	13	26	17	56	40.6
Over all quality of environment					
Poor (below-70)	02	19	08	25	16.7
Satisfactory (71-105)	28	30	62	89	59.3
Good (above 105)	20	1	30	36	24.0

Heat Stress : Use of different fuels and cooking practices followed by the respondents affect the conditions in the kitchen and may increase temperature, causing discomfort. These aspects were taken into consideration while assessing the heat stress in the kitchens (Grandjean, 1978). Compared to A and C localities, locality B kitchens had more heat stress because they either did not have any window in the kitchen or the size of the window was not adequate.

Lighting Conditons : Inadequate light generally leads to fatigue and loss of efficiency and may cause visual strain. The existing lighting conditions in the kitchens were seen in terms of sufficiency of artificial and natural light (Pickett, 1962). The natural light was seen in terms of size and placement of door and windows and their direction. While artificial light was seen in terms of source of light, number of lamps and wattage ratings. The colour of wall was also considered in order to see whether it was light, medium or dark because the colour would affect reflection of light. On the whole lighting conditions were found to be good in A and C locality but it was very poor in B where the houses were close-by and overcrowded and also because majority of the respondents in this locality used kerosene lamp as source of light and the colour of walls was dark.

Sanitation : Hygenic surroundings are essential for good health. In the kitchen disposal of garbage, use of dust-bins, frequency of cleaning affect sanitary conditons. The general cleanliness of kitchen walls, and storage units were considered. The sanitary conditions in B locality kitchens were very poor as nearly 98% scored low, while only one third of families in A and C locality had poor sanitary conditions.

Noise Level : Noise from outside and noise produced inside the kitchen may have harmful effect on the health of homemaker who spends considerable amount of time in kitchen. The

noise levels were seen in terms of materials used for floor, ceiling, walls, doors and windows as well as use of stoves, pressure cooker and other household gadgets were seen. The results showed that the households were nearly equally distributed with regards to noise level *i.e.* 51% were less noisy and 49% were noisy. The C locality houses were more noisy than A and B houses because the C locality was near railway station.

Water Quality : The contamination of water generally occurs during transport and storage. Hence water storage practices of the respondents were studied. Also the frequency of changing water and frequency of cleaning the surrounding near stored water were also considered. Again the quality of water was found to be good in 60% of cases and poor in 40%. B and C locality had poor quality while A locality had better quality of water.

Environment Quality : To judge the environmental quality of kitchen a scoring sheet was prepared considering all the above mentioned aspects *i.e.* ventilation, lighting, heat, noise, sanitation and water quality. The results showed that nearly 60% of households had satisfactory environmental conditions, 24% had good and 26% had poor.

Knowledge About Quality of Environment : The knowledge of respondents about quality of environment was determined on the basis of specially designed knowledge test. The validity and reliability of the test was established before it was administered on the sample of the present study.

The results showed that 56% of respondents had medium level of knowledge while 26% had low level and 18% had high level of knowledge (Table 2). None of the B locality respondents had high level of knowledge. This again showed a close relationship between knowledge and existing environmental quality as well as their feelings with regards to quality of environment.

Table 2: Knowledge of respondents with regards to quality of environment

Level of knowledge	*Localities*				
	A (N=50)	*B (N=50)*	*C (N=50)*	*Total (N=150)*	
Low	6	24	9	39	26
Medium	30	26	28	84	56
High	14	-	13	27	18

RESULTS OF HYPOTHESES

Hypotheses were formulated to see the relationship between selected independent and dependent variables. The relationship between age and education of the respondent and their knowledge about environment quality, was tested.

The knowledge about quality of environment was found to be negatively associated with age (r = -0.51) but positively associated with education (χ^2 - 38.17) (Table 3). Younger homemakers were found to be more knowledgeable than older ones. The more the women were educated the higher was their awareness and knowledge about quality of enrivonment.

Table 3: Relationship between selected variables and knowledge of respondents

Variables		*Calculated values*	*df*	*Level of significance*
Knowledge and				
a.	Age	r=-0.51	148	0.01
b.	Education	$\chi^2 = 38.17$	4	0.01
c.	*Quality of environment*			
	Locality			
	A	r = 0.53	48	0.01
	B	r = 0.83	48	0.01
	C	r = 0.28	48	0.01
d.	*Aspects of environment*			
	Ventilation	$\chi^2 = 28.04$	2	0.01
	Heat	$\chi^2 = 18.27$	2	0.01
	Sanitation	$\chi^2 = 15.98$	2	0.01
	Lighting	$\chi^2 = 21.78$	2	0.01
	Noise	$\chi^2 = 0.48$	2	N.S.
	Water	$\chi^2 = 2.15$	2	N.S.

It was assumed that the existing quality of enrivonment in household kitchen would be directly related to the level of their knowledge. The results showed that in all the three groups the housewives who had higher knowl-

edge scores maintained better quality of environment in their kitchens. Further analysis revealed that this was true with respect to ventilation and air, heat stress, sanitation and lighting but not significantly related in case of noise and water.

The relationship between quality and environment and the locality was also seen. It was found that quality of environment varied with locality and therefore better localities had better quality. The relationship was further analysed with respect to different aspects and it was found that in all aspects, *i.e.* ventilation and air, heat stress, lighting, sanitation, noise and water; the relationship was found to be significant. Thus the quality of environment depended a lot on the type of locality.

The investigator also wanted to study the relationship between the actual quality of environment and the feeling of respondents towards the quality of environment. It was found that the relationship was positive *i.e.* the feelings of respondents towards quality of environment matched with the actual quality of environment (r = 0.66). It showed that the respondents were sensitive to the quality and their environment.

Air quality analysis revealed that SPM concentration was above permissible limits in all cases whether the window was kept open or closed. The health implications of such a situation are self evident. However concentration of SO_2 was found below permissible level in all groups. Concentration of CO was found ot be very much related to ventilation conditions (Table 4). It was above permissible level when windows were closed and below level when windows were kept open (Agarwal, 1982).

When related to type of fuel it was found that concentration of SPM was high in all the kitchens where kerosene was used as fuel as compared to kitchens using LPG. Similarly the SO_2 concentration was also less in kitchens where LPG was used as fuel. Concentration of CO was found to be high in A locality where LPG was used as fuel while in B and C locality it was high because kerosene was used as fuel. The reason of the said situation was that in A and B locality the stoves were kept below the counter resulting incomplete combustion arising due to restricted air supply.

Shape of the utensil used by the housewives for cooking was also studied in relation to air quality. It was found that SPM level was above permissible level irrespective of shape of utensil and similarly SO_2 level was below permissible level but CO level was more when flat bottom rather than round bottom utensils were used because it coverd the entire burner resulting in incomplete combusion due to restricted air supply.

Table 4 : Concentration of SPM, SO_2 and CO analysed in the air sample taken from kitchen of three groups

Air quality analysis	*A Group (N=10)*			*B Group (N=10)*			*C Group (N=10)*		
	Mean Concentration								
	Spm	*SO_2*	*CO*	*Spm*	*SO_2*	*CO*	*Spm*	*SO_2*	*CO*
Ventilation Conditions									
Window open	343.4	45.3	9.5	586.04	63.3	9.8	472.7	47.3	9.3
Window closed	442.2	59.4	12.5	463.3	52.2	11.8	232.5	55.9	10.5
Type of Fuel Used in Kitchen									
LPG	343.2	41.6	11.2	461.0	48.4	9.25	367.9	41.5	9.8
Kerosene	444.0	64.9	9.6	567.1	64.9	11.8	389.8	64.6	9.8
Shape of Utensil Used									
Flat bottom	398.3	50.9	12.0	507.9	58.3	12.2	384.7	52.8	10.2
Round bottom	367.8	51.0	9.4	541.4	57.7	9.4	368.5	48.6	9.4

Permissible Units. SPM 200 µg/m3; SO_2 80 µg/m3 and CO 10 ppm

Water Quality : The bacteriological analysis of water was done primarily to determine the potability of water, the MPN (most proba-

ble number) index was used to find out the presence of pathogenic organisms which indicates the number of *E. coli* present in the sample (Table 5).

The analysis of date revealed that in A locality 30% of samples were contaminated while in B and C locality and 40% of samples were contaminated respectively. For locality B and C higher contamination may be attributed to the use of water collected from hand pump without treatment or purification at home. In other locality tap water was used and more number of families tried to purify water by either using filters, boiling water or adding chlorine tablets to water.

Table 5 : Frequency and percentage distribution of respondents having MPN index within and above the standard limit for various combination of the positive and negative results when five 10ml portions are used

MPN Index	*A*		*B*		*C*		*Total*	
	N = 10		*N = 10*		*N = 10*		*N = 30*	
	F	*%*	*F*	*%*	*F*	*%*	*F*	*%*
Within the standard limit	7	70	3	30	6	60	16	53.3
Above the standard limit	3	30	7	70	4	40	14	46.7

Sound Level Measurements : Sound level was measured with the help of a sound level meter. The sound was measured in kitchen while cooking was going on and also when no activity was being carried out. Sound level outside the kitchen was also measured. The data revealed that the kitchens were quite noisy while cooking was going on because the sound was above tolerance level of 67 db. (Grandjean, 1978). It was highest in A locality because it was near railway station, followed by B locality where vehicular traffic increased sound levels and least in C locality (Table 6).

Heat Stress : Heat stress was measured by recording temperatures near cooking area, general temperature inside the kitchen and ambient temperature outside the kitchen. The results showed that the temperatures recorded were above tolerance level of 21°C to 23°C (Grandjean, 1978), in all the kitchens (Table 7). It was highest near cooking area. The ambient temperature was also high as the data were collected during summer.

Lighting Measurement : The amount of day

Table 6 : Sound level measurement in kitchen

Sound Level in Kitchen (dB)	*A (N = 10)*		*B (N = 10)*		*C (N = 10)*		*Total (N = 30)*	
	Range	*Mean*	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*
Sound level while cooking	70-81	75.3	67-84	74.5	85-70	71.4	65-84	73.7
Sound level with no activity (General sound level)	63-70	66.5	60-70	65.0	55-64	60.1	55-70	63.9
Ambient sound levels	63.4-69	66.8	60-71	65.3	55-73	59.2	55-71	63.8

Table 7 : Different temperature levels

Temperature level in kitchen	*A (N = 10)*		*B (N = 10)*		*C (N = 10)*		*Total (N = 30)*	
(°C)	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*
Temperature near cooking area	36.4-39	37.9	38.5-42	38.8	37-39	38.1	36.4-42	38.3
General kitchen temperature	34.9-39	35.9	34-38	36.8	35-39	35.1	34-39	35.9
Ambient temperature	35.9-39	36.3	35-38.3	36.4	34-39	35.9	34-39	36.2

Table 8 : Lighting measurements (Natural of Kitchen)

Lighting Measurements	*A (N = 10)*		*B (N = 10)*		*C (N = 10)*		*Total (N = 30)*	
(Foot Candles)	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*	*Range*	*Mean*
Work area	20-45	34.2	10-35	18.9	30-50	39.7	10-15	30.9
General illumination	32-58	43.5	12-30	21.8	36.58	43.4	12-58	36.2
Ambient illumination	25-80	41.8	16-40	31.3	25-60	43.1	16-60	38.7

light in the kitchen was measured with the help of a light meter. Illumination on work area, general level of illumination and light outside the kitchen were measured (Table 8). Among the three localities more number of households had adequate light in A and C while poor light in B locality kitchen (Pickett, 1962). The reason being that some of the houses did not have any window in kitchen and if they had the size of window was not adequate.

SUGGESTIONS FOR IMPROVEMENT

The observation as well as results of experiments provided some guidelines for improving environment quality in household kitchens.

To improve air quality the kitchens should be well ventilated, good quality of fuel should be used, cleaning of stoves should be done regularly, stove should be placed at counter level and use of slightly round bottom utensils is recommended. Quality of Lighting can be improved by painting walls with light colour, planning uniform distribution of light over work area, planning adequate number and size of doors and windows, selecting proper size and shape of light source and place the light source to avoid glare the shadows. Knowledge about adequte lighting needs to be provided to homemakers.

Sanitation practices can be improved by use of closed type of dust-bins, disposal of kitchen waste frequently, and directing flow of waste water in closed drain. Water quality would be better if families adopt any suitable method of purification of water, keep surrounding area clean and dry and change water regularly and clean the surrounding often.

Noise pollution can be reduced by planning houses which obstruct path of outdoor noise, using thick draperies, planting trees and shrubs in the direction from where noise is coming and maintaining the households appliances in working condition so that noice produced within the household can be reduced. Thus to improve the quality of environment in household kitchen, the combined effect of architect, planners and homemakers are needed.

REFERENCES

Aggrawal, G.D. : *A Paper on Ambient Air Quality Standards. Monograph*. Central Board for Prevention and Control of Air Pollution, Delhi (1982).

Despande, R.S. : *Build Your Own Home*. Poona United Book Corporation, Pune, 8th Edition (1985).

Grandjean, E. : *Ergonomics of Home*. Taylor and Francies Ltd., London (1978).

Halpern, M. : Indoor-outdoor air pollution exposure continuity relationship. *J. Pollution Control Asso.* **28** (1978).

Pickett, M.S. : Your Light and your sight. *Iowa Farm Science*. **17** (1962).

WHO : *Cited from State of India's Environment, A Citizens Report*. Centre for Science and Environment, New Delhi (1979).