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Research Paper

Survey of the ergonomic aspects of kitchen workstation

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ABSTRACT : It is often noticed that very well decorated home kitchen do not invite housewives. To work with the kitchen interior arrangements, she has to do a lot of stretching as well as bending very often. It is beyond doubt that kitchen activities demand a high degree of physical effort leading to fatigue. The major causative factors responsible for this are the static muscular effort and unnatural body postures, mainly resulting from poor designing of kitchen counters, inappropriate kitchen shelves, floor and almost continuing work in standing posture. Therefore, it was imperative to evaluate the existing features of kitchen workstation. The present study revealed that the height of counter varied in between 76 cm to 91 cm and work triangle from 2.6 to 5.3 meters. Kitchen size ranged between 5 and 10.1 m sq., with majority of the kitchens facing east in the selected sample.

KEY WORDS : Work station, Ergonomics, Designing, Kitchen, Homemaker

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The quality of housing can enhance or diminish the well being of individual and families as that of the entire community. The work area especially kitchen should be adequately designed and properly arranged in order to reduce the physical, psychological and temporal cost of the homemaker. According to Saha (1999), housing is a major health problem in our age of industrialization; hence this needs to be looked into critically so that improvements can be made by considering more fully the human factors involved. The planning of the kitchen area in the house needs to be considered of prime importance in order to facilitate the carrying out of activity by reducing the effects of fatigue and accidents in the kitchen. With the little imagination and inexpensive planning, the worker can transform the kitchen into a comfortable and pleasant working place and make the kitchen activities easy and enjoyable and not a hateful necessity. In recent years, there has been a trend of more and more women getting employed outside the home, in addition to their traditional domestic work, to share the financial burden of the family, and also to gainfully utilize their professional expertise (Varghese *et al.,* 1994). Experience had shown that most of the people keep a kitchen for approximately two decades or even more and do not get it repaired or renovated with change in demand or change in the fashion. That's why it pays to carefully consider the needs and wants of the homemaker while designing the kitchen. Poorly designed kitchen work surfaces, storage spaces, material and dimensions cause permanent body damage besides increasing the work cost. This justifies that dimensions of kitchen work surfaces and storage spaces should be given careful attention thereby, minimizing stress on cardio-vascular, muscular and respiratory system. Therefore "work space must get considerable attention in the designing of the layout" (Charles, 1976). Considering the importance of dimensions and designing it was felt that an ergonomic evaluation is needed of the existing kitchen situation, so that recommendations/ guidelines for improvement can be made to suit the Indian style of kitchen.

RESEARCH METHODS

For study, a field survey of eighty respondents, forty each from east and west zone of Ludhiana district in Punjab was done. Field survey is necessary and one of the most important steps in ergonomic evaluation. A proper survey helps in crisply evaluating the workstation, defining the problems and generating relevant concepts for improvement. Understanding the homemaker, her preferences, and problems

faced at workplace as the starting point to know the loopholes or gaps in their workstation designs. The underlying assumption being that user friendly and comfortable workstation and system designs begin with an understanding of the needs and requirements of the users. A self-structured interview schedule was used for collection of data. The interview schedule consisted of two parts. First part dealt with socio-economic status of the family which gathered the information related to occupation, education, income, family type and family size.The basic components of kitchen working area are the work surface, storage and major appliances. Multifarious activities are carried out in this space such as sweeping, mopping, meal preparing, cooking, eating, cleaning of dishes and so on. Considering the importance of these working areas in kitchen, in the second part of the interview schedule specific information like kitchen type, kitchen size, dimension of work counter etc were analysed. Data for the study were collected through personal interview method. Equipments like accutape, measuring tape, anthropometer were used to record the data. The data collected were tabulated and suitable statistical tool such as frequency, averages, percentages, correlation coefficient and standard deviation were used for analysis of data.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation have been discussed under following heads:

General profile of the respondents :

Data of Table 1revealed that the average age of the selected respondents was found out to be 38 years, the average height 156 cm, and the average weight 58 kg. Majority of respondents were graduate *i.e.* 70 per cent, followed by respondents who had qualification up to matriculation (16.25 per cent) and the least number (2.50 per cent) of respondents were having professional degree of doctorate. Further, it was observed that most of the respondents were housewives (56.25 per cent), 35 per cent were self-employed and about 8.75 per cent were in government or private jobs.

Table 1 : Personal profile of the respondents

Respondents' profile	Number (n=80)	Percentages
Age (yrs)		
26 – 35	27	33.75
35 – 45	36	45.00
Above 45	17	21.25
Average age: 38 yrs		
Height (cm)		
145 – 155	37	46.25
155 – 165	28	35.00
Above 165	15	18.75
Average height: 156 cm		
Weight (kg)		
Below 55	10	12.50
55 – 65	46	57.50
65 – 75	24	30.00
Average weight: 58 kg		
Qualification		
High School	13	16.25
Graduate	56	70.00
Post Graduate	9	11.25
Doctorate degree	02	02.50
Occupation		
Housewife	45	56.25
Self-employed	28	35.00
Pvt. Job	03	03.75
Govt. job	04	05.00

Features of the selected kitchens :

Kitchen size:

The size of the kitchen for a household of 3- 4 persons, without a dining alcove (e.g. open working kitchen) should be of minimum of 8 sq. meters and desirably 12 sq. meters and for a kitchen with a dining alcove it should be of minimum of 12 sq. meters and desirably 15 sq. meters (Grandjean, 1973). It was observed that majority of the kitchens of the selected sample had an area from 6.7 to 8.4 sq. m (56.25 per cent) followed by kitchens with area in the range of 8.4 sq m. to 10.1 sq. m (23.75 per cent) and minimum number of kitchens were with area 5 to 6.7 sq. m *i.e.* 20 per cent (Table 2). Though the area of the majority of kitchens was found within the limits but in a considerable number of kitchens *i.e.* 20.00 per cent, it was less than the minimum recommended kitchen area. These findings are similar to the observation of Verma (2001) who also reported that the area of kitchen in urban areas was less than the recommended area.

Table 2: Kitchen size of selected kitchens

Kitchen size (sq. meter)	Number (n=80)	Percentages
5.0 - 6.7	16	20.00
6.7 - 8.4	45	56.25
8.4 - 10.1	19	23.75
Minimum and maximum recommended kitchen area size :8 to 15 sq. m. (Grandjean,1973)		

Kitchen type :

It was observed that all of the respondents (100 per cent) had closed and standing type of kitchens. It may be due to the obvious advantages of the standing kitchen type as

compared with the older way of cooking while sitting. The style of kitchen *i.e.* standing or sitting style has an effect on the home maker's performance level, time spent and her physical fitness (NBC of India, 2001). In standing type of kitchens as the worker maintains the standing posture while working, we can move quickly from washing to cutting to cooking areas, thereby saving our time and energy.

Kitchen orientation :

Although kitchens are small places in the home but their planning requires outmost attention to details. Kitchens should face north-east or north-west direction. Kitchens should be well located internally with respect to pantry, dining room and living room (Ernst and Neufert, 2000). According to Deshpande (1965), in Indian context, the best direction for kitchen is eastern or north-eastern. Such placement makes the kitchen pleasantly warmed and its air, purified by the morning sunshine entering it, and would remain cool during the other part of the day.

It is evident from Table 3 that the majority of the kitchens facing east were higher (40 per cent) in the selected sample, followed by kitchens facing north-east (15 per cent) and north (13.75 per cent). Besides that, a few (12.5 per cent, 11.25 per cent, 7.5 per cent) kitchens had facing in west, north-west and south directions, respectively. It may be due to the reduced spaces in the urban areas that people neglect the directional aspect of the kitchen or may be because of the facing of the plot.

Table 3 : Orientation and work triangle of selected kitchen

Orientation of kitchen	Number (n=80)	Percentages
East	32	40.00
North-east	12	15.00
North	11	13.75
West	10	12.50
North-west	09	11.25
South	06	7.50
Kitchens should preferably face east or north-east direction (Deshpande,1965)		
Perimeter of work triangle (m)		
2.6 – 3.5	18	22.50
3.5 – 4.4	15	18.75
4.4 – 5.3	47	58.75

Perimeter of work triangle should be at most 7 to 8 m (Grandjean,1973)

Kitchen work triangle :

The idea of "kitchen work triangle" was formulated at the School of Architecture of the University of Illinois at Urbana-Champaign, founded in 1944 which, aims at reducing cost through standardization. Work triangle is simply an efficient arrangement of three major work areas or points *i.e.* cooking, refrigeration and sink. It is necessary to design arrangement of work stations which, cuts down travelling distances of the user. Grandjean (1973) quotes maxima of 7 m for 'small to medium-sized kitchens or 8 m for 'large kitchens'.

The data given in Table 3 further unveil the information of the kitchen work triangle of the selected samples that in all of the kitchens of the selected samples, the work triangle was within the recommended maximum limits and it varied from 2.6 to 5.3 meters. It may be due to the trend of reduced or compact and more recent of the modular types where kitchens are mostly of closed type that all three major centers *i.e.* cooking, preparation and sink placed close to each other.

Kitchen work counters :

Each work counter in a kitchen should have three components (Ernst and Neufert, 2000).

– Adequate work area on counter space.

– Adequate storage areas and volume.

– Sufficient access to facilities like ventilation, lighting, drainage etc.

The finishing material used for walls, floor, and counter tops should be slip resistant, heat and fire resistant as well as eco-friendly so that the homemakers can work confidently and comfortably (Bridger 1995). The information regarding the shape and material of kitchen work counter has been presented in Table 4.

Table 4 : Shape and construction material of the work stations in the selected kitchens

Shape of kitchen counter	Number (n=80)	Percentages
'L' shaped	49	61.25
'U' shaped	31	38.75
Material of kitchen work station		
Granite	36	45.00
Marble	26	32.50
Cement	18	22.50

Shape of kitchen counter :

Not any one type of kitchen is more ideal than another. The room and interior character should itself dictate the design of an efficient kitchen layout (Conran, 1986). From the Table 4, it is evident that only 'L' and 'U' shaped kitchen counters were common in the selected kitchens, with majority of respondents having 'L' shaped kitchen counter (61.25 per cent) and 'U' shaped (38.75 per cent). Similar were the observations of Mittal (1971), Grandjean (1988) and Sumangala (1995) who all reported that 'L'-shaped kitchen arrangement is the best as it is found to be the most efficient for performing kitchen work.

Material of kitchen counter :

Regarding the material used for the kitchen counters, it

can be seen from Table 4 that most of the kitchens had counters of granite (45 per cent) followed by kitchen counters of marble (32.5 per cent) and only (22.5 per cent) had cemented counters in their kitchens.

Dimensions of the work counter of selected respondents :

Regarding dimension of work counter, it was observed that in majority of the kitchens the height of all the working centers *i.e.* washing, cooking and preparation centres was same (Table 5). But a single-height counter is not considered ergonomically good because its height has been fixed and is the same for all the three work centres which is not appropriate especially when the worker is to perform a variety of activities in the kitchen. Grandjean (1988) had recommended different counter heights for different activities depending upon the force the worker was required to exert.

Table 5 : Dimensions of the kitchen work station of selected respondents\houses

Dimensions of work stations	Cooking centre		Preparation centre		Washing centre	
	Number	%	Number	%	Number	%
Height (cm)						
76 – 81	22	27.5	25	31.25	23	28.75
81 – 86	43	53.75	40	50.00	37	46.25
86 – 91	15	18.75	15	18.75	20	25.00
Average height	85.72		85.00		84.07	
Depth (cm)						
46 – 57	18	22.50	19	23.75	28	35.00
57 – 68	34	42.50	33	41.25	28	35.00
68 – 79	28	35.00	28	35.00	24	30.00
Average depth	64		61		63	
Width (cm)						
40 – 103	25	31.25	19	23.75	33	41.25
103 – 166	43	53.75	26	32.50	28	35.00
166 – 229	12	15.00	35	43.75	19	23.75
Average width	128		158		114	

Steidl and Beatton (1968) recommended height of cooking counter from 76 – 81cm, width 91 – 102 cm and depth 61 – 69 cm.

Majority of the kitchens had counters with height ranging from 81 to 86 cm (53.75 per cent for cooking, 50 per cent and 46.25 per cent for preparation and washing area, respectively (Table 5). Although most of the selected kitchens had counter height within the recommended height of 82 – 85 cm (Verghese *et al*., 1989) but a considerable number of respondent's had kitchen counter height which were above or below the recommended heights and may become the cause of backache as well as / or shoulder pain and the distorted posture of the homemakers after prolonged cooking. These findings can be substantiated with the findings of Verma (2001) who also found that counter height was below the recommended height.

It was observed that in majority of the kitchens, the depth was same for cooking, preparation and washing counter, except in few kitchens where the washing centre depth varied. Depth of the counters varied from 46 to 79 cm with majority having counter depth from 57 to 68 cm for all the selected centres of the kitchen.

Width of all the three work centres was different. On cooking centre, majority of kitchens had width of 103 to 166 cm (53.75 per cent). For washing centre majority (41.25 per cent) of the kitchens had width ranging from 40 to 103 cm whereas maximum width was observed for preparation centre *i.e.* 166 to 229 cm in 43.75 per cent houses.

Steidl and Bratton (1968) recommended height of cooking counter from 30 inches - 32 inches (76 - 81cm), width 36 inches - 40 inches (91 - 102 cm) and depth from 24 inches - 27 inches (61 - 69 cm).

Conclusion :

Kitchen design developed on the basis of ergonomic principles and anthropometric measurements of the homemakers can be used by the architects in planning the kitchens to ensure enhanced work efficiency, health and safety of the workers. The results of the present study will be useful to understand and improve the work, worker and workplace relationship which will help the homemakers to minimize the physical and temporal costs of selected household activity.

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