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Problems faced by homemakers while using storage furniture in semi- modular and non-modular kitchen

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ABSTRACT

The present study aims to analyse the homemakers' storage furniture design of semi-modular (SMK) and non-modular kitchens (NMK) in order to reduce their problems.Sixty households were selected from two posh areas of Udaipur city having semi-modular and non-modular kitchens (30 each). An interview and observation schedule was used to gather the relevant information regarding respondents' family background and problems related to kitchen storage layout, arrangement, functionality, accessibility, economic and environment. The findings of the study highlighted that SMK respondents had less problems as compared to NMKs due to good layout of kitchen storage furniture design. This in turn leads to correct posture and lower musculo skeletal disorders, which reduces physiological cost of work.

INTRODUCTION

Kitchens are important premises of any home. Every homemaker's motto is space for everything and everything in its place. Kitchen is the major work area in the home. An Indian homemaker spends about 5-6 hours a day in the kitchen which may amount to approximately one-fourth of her life span. The physical amenities and designing of homemaker's house are not always planned as per need of health, security and workplace comfort (Kishtwaria *et al.*, 2007).

The design of the kitchen storage furniture has direct impact on the strain, time and effort of the homemaker (Varghese *et al.*, 1996). While working in the kitchen women face numerous problems related to improper dimensions of the kitchen storage, faulty design of the kitchen storage furniture, large walking distance between works centres which are responsible for the awkward postures causes' pain in the body leading to decrease in the work efficiency.

Workspace must be given considerable attention in designing of the layout (Charles, 1976). Adequately designed and properly arranged kitchen work area reduces physical, physiological and temporal cost of the homemakers (Saha, 1990). Without considering human factor while designing kitchen storage furniture, workers face varied problems affecting their physiological cost of work. An organized storage area economizes work cost. Storage should have sufficient holding space for all items needed for a group of related tasks done at the same place, the space should permit ready to access to each item. This facilitates the work and reduces its cost (Oberoi *et al.*, 2005).

The problems faced by homemakers in semi-modular and non- modular kitchens storage furniture design were analyzed in terms of functionality, material, cost, arrangement, maintenance, environment and space workflow. Apart from these zonal, postural and environmental problems were also analyzed.

Objectives:

The objective of the study is-

– To examine the problems confronted by the homemakers in Semi-Modular Kitchen (SMK) and Non-Modular Kitchen (NMK) while using kitchen storage *viz.*,

- Layout
- Environment and
- Economic

METHODS

A sample of sixty households having semi-modular (SMK) and non-modular kitchens (NMK) was selected from two posh areas of Udaipur city *i.e.* 30 each from SMK and NMK. An interview schedule was used to gather the relevant information regarding respondents' profile and different problems associated with the kitchen storage furniture design layout, arrangement, functionality, dimensions and accessibility. Apart from these kitchen storage management and environmental problems, and musculo-skeletal disorders while using kitchen storage were also studied. Frequency and percentage were used to analyse the data.

OBSERVATIONS AND ANALYSIS

The findings of the present study as well as relevant discussion have been summarized under following heads:

Family background information:

The average age of the respondents was 41 years (Sd = 3.79). Not much variation was found in the average ages of SMK (mean = 42 years, Sd = 3.26) and NMK (mean = 40 years, Sd = 4.00) respondents. More than one third of the respondents were graduate (41.67 %), postgraduate (25 %) and senior

Table 1: Distribution of respondents according to their problems related to kitchen storage design layout (n = 60)

Sr. No.	Problems of kitchen storage*	SMK (n=30)		NMK (n=30)				
		Inadequate storage with less width	Deep cabinets require too much bending	Inadequate storage with less width	No sequenced kitchen storage	Fix furniture	Too much bending	Deep cabinets causing low back pain
1.	**Layout**							
	Organized kitchen layout	16.67	23.33	33.33	16.67	-	-	-
	Sequencing of activities	-	-	6.67	3.33	13.33	-	-
2.	**Arrangement**							
	Placement of utensils	-	-	46.67	6.67	6.67	3.33	40.00
	-Frequently placed items	-	-	10.00	-	-	-	-
	-Rarely used items	-	-	10.00	-	-	-	6.67
	-Light weight items	-	-	-	-	-	-	6.67
	-Storage of heavy items	33.33	78.33	-	3.33	-	3.33	40.00
	Problem of back tracing		-	6.67	-	3.33	46.67	33.33
3.	**Functional storage**							
	Consumable zone	13.33	-	13.33	-	-	3.33	-
	Non-consumable zone	26.67	-	26.67	-	-	-	-
	Preparation zone	26.67	-	26.67	-	-	-	-
	Cooking zone	10.00	-	13.33	-	-	-	-
	Cleaning zone	13.33	-	26.67	-	-	-	-
4.	**Problems of storage dimensions**							
	Consumable zone	-	-	6.67	-	-	-	-
	Non-consumable zone	-	-	6.67	-	-	3.33	23.33
	Preparation zone	-	-	6.67	-	-	13.33	36.67
	Cooking zone	-	-	20.00	-	-	16.67	16.67
	Cleaning zone	26.67	-	33.33	-	-	13.33	3.33
5.	**Problems of accessibility to storage**							
	Consumable zone		-	10.00	-	-	6.67	10.00
	Non-consumable zone		-	13.33	-	-	10.00	20.00
	Preparation zone		-	10.00	-	-	10.00	20.00
	Cooking zone		-	6.67	-	-	6.67	6.67
	Cleaning zone		-	3.33	-	-	-	6.67

SMK=Semi-modular kitchen, NMK=Non-modular kitchen

secondary (18.33 %). A small percentage of respondents persuaded technical degree (8.33 %). Glaring difference was found between the postgraduate SMK and NMK respondents (SMK= 33.33 % and NMK=16.67 %). The average size of the respondents' family was 3 members (Sd= 0.82). The average household income was Rs. 3,05,300.00 (Sd =236489.00) of respondents' husband as well as of the family members on annual basis.

Problems of layout:

The problems of respondents related to kitchen storage layout were analysed in the Table 1 which affect their productivity. Surprisingly, SMK respondents faced the problem of inadequate storage (16.67 %) leading to fatigue. NMK respondents also faced numerous problems related to kitchen storage layout. The data in Table 1 disclose too deep cabinets (23.33 %) were the problems related to organized kitchen layout in terms of its impact on the posture of the NMK respondents. Malik (2008) also reported minimum suitability with lowest kitchen storage shelves which were too deep. Respondents preferred to solve the problem of too deep cabinets which require too much bending through improvement in the kitchen layout design. Another problem of non- sequencing of kitchen storage zones activities was confronted by the NMK respondents due to fix furniture (13.33 %).

Problems of arrangement:

A centre is a place where homemaker can do a particular type of work between the equipment, supplies, utensils, storage space for tools and supplies, counter space needed for the activity, are all located together (Steidl, 1957). Centres are arranged in logical manner according to the activities to be performed. Tabulated data illustrate that NMK (16.67 %) respondents face the problem of utensils placement due to inadequate storage space because of small kitchen size. Problem of placing frequently and rarely used items was faced by NMK respondents due to small kitchen size and inadequate storage (46.67 %), too deep cabinets (40 %) and inconvenient storage space. Heavy items storage problem was faced by one third of the SMK and nearly three fourth of the NMK respondents. This can be due to inadequate storage space in SMKs whereas in NMKs deep cabinets (78.33 %) caused low back pain (40 %) during storage of heavy items. Problem of back tracing was unavoidable due to unsequenced kitchen storage, and in accessibility due to deep cabinets. Too much bending for storage of heavy items leads to low back pain.

Problems of functionality:

For functional kitchen adequate storage space for performance of routine activities is essential at different zones. The physical need for space is determined by the storage around furniture and equipment. The correct positioning of equipment saves a lot of unnecessary bending and other motions of the homemaker (Steidl, 1957). Table 1 shows that due to small kitchen size shortage of storage space at different zones was common problem faced by SMK and NMK respondents. Lesser width of storage furniture was reported by a small percentage of to SMK respondents at consumable (10 %) and cleaning zone (10 %) whereas NMK faced this problem at non-consumable zone (10 %) which affect the functionality of the respondents while working at these zones.

Problems of storage dimensions:

Poorly designed kitchen work surfaces and spaces

Table 2: Distribution of respondents according to the problems of kitchen storage management and separate storage space (n=60)

Sr. No.	Problems of storage management*	SMK (n=30)			NMK (n=30)					
		Opened/ rollout units	Inadequate storage	Too much bending	Opened/ rollout units	Inadequate storage	Unorganized kitchen	Inconvenient reach	Lack of furniture	Inadequate storage
1.	Haphazardness	-	-	-	-	-	13.33	-	23.67	40.00
2.	Compactness	-	-	-	-	-	-	-	-	23.33
3.	Work flows obstruction due to	-	-	-	-	-	-	16.67	-	30.00
	Doors	13.33	-	-	16.67	-	-	-	-	-
	Windows	6.67	-	-	13.33	-	-	-	-	-
	Drawers	13.33	-	-	6.67	-	-	-	-	-
	Cabinets doors/ trolleys	13.33	-	-	6.67	-	-	-	-	-
4.	Separate storage space									
	Storage space equipment and appliance at work surface	-	63.33	-	-	77.00	-	-	-	-
	Corner storage unit	-	33.33	-	-	47.00	-	-	-	90.00
	Stacking of soiled dishes	-	26.67	-	-		-	-	-	33.33
	Sitting aid used	-	26.67	-	-	33.33	-	-	-	-

SMK=Semi-modular kitchen NMK=Non-modular kitchen

causes' permanent body damage besides increasing the workload (Kishtwaria *et al.*, 2007). It was striking to note that none of the SMK respondents faced problem of kitchen storage dimensions at consumable zone. But at non-consumable zone respondents faced problem due to inconvenient reach (23.33 %) which can be related to short height of some of the respondents. Inadequate space of cabinets due to less width of storage zone was the common problem faced by respondents at non- consumable, preparation, cooking and cleaning zones. This can be attributed to small size of the respondents' kitchen. Furthermore in NMK deep cabinets was the common problem faced by the respondents at non- consumable (23.33 %), preparation (36.67 %) and cooking (16.67 %) zones.

Problems of functional storage:

Tabulated data show that NMK respondents due to inadequate storage faced the problem of accessibility and storage at non-consumable, preparation and cleaning zones. Similar problems were also faced by SMK respondents at non-consumable and preparation zones. This may be attributed to small kitchen size and numerous storage items.

Problems of accessibility:

Tabulated data clearly established the fact that in accessibility to storage items at consumable zone was faced by NMK respondents due to depth of cabinets which had improper light at last corner (10 %). At non-consumable and preparation zone, main problems confronted by the respondents were deep cabinets, lack of light in cabinets and too much bending. Due to more depth of cabinets (13.33 %) stacking and layering of articles was faced by the respondents at preparation zone in NMK. Few short height SMK respondents (3.33 %) faced problem of inaccessibility to storage at non-consumable zone.

Problems of storage management:

A well managed kitchen looks organized and increases efficiency of the homemaker. In NMK inadequate storage spaces (40 %), lack of furniture (23.67 %) and unorganized kitchen size (13.33 %) leads to haphazardness. Compact (23.33 %) and small kitchen size leads to inadequate storage space. Obstruction in work flows was observed by nearly one third of the NMK respondents due to inadequate storage and inconvenient reach to upper limb units which requires stool to climb up, thus obstructing the workflow. Moreover in both the kitchen respondents faced obstruction in workflow due to opening of doors, windows, drawers and cabinets/ shelves. In SMKs due to organizational options and rollout units drawers and trolleys can be opened as per the requirement which occupies less space in the kitchen workflow. However, in NMK doors of the drawers and shelves can be fully opened in the work area which obstructs the workflow of the worker. At the same time more time and energy of the worker was required in tracing back stored items from deep cabinets in the kitchen which again obstructs the workflow.

Storage space problem and sitting aid used:

Data of Table 2 reveal that apart from kitchen storage furniture separate storage was found in SMK (63.33 %) and NMK (77 %) for storing items like small and big drums, utensils, grains, pulses etc. Few NMK confronted problem of storing small containers and place equipments and appliances at right activity location (20 %) due inadequate storage spaces. Storing equipment and supplies at work surface problem was faced by one third of the SMK and near about half of the NMK (47 %) respondents. One third of SMK (33.33 %) and near about majority of the NMK (90 %) respondents faced corner storage problem. This can be attributed to that these SMK respondents do not have corner units whereas NMK respondents had to bend too much to retrieve / replace items from the corner spaces in kitchen storage.

Near about one third of the SMK (26.67 %) and NMK respondents (33.33 %) faced problem of stacking soiled dishes at sink owing to inadequate storage spaces. Due to obesity as well as age sitting aid was used by SMK (13.33 %) and NMK (63.33 %) respondents because it was difficult for them to bend or sit on the floor in squatting posture for longer period of time.

Problems of inconvenience while cooking:

Data of Table 3 clearly show that due to small kitchen, SMK respondents faced problem of unorganized kitchen storage (26.67 %). Respondents found inadequate storage due to less numbers of drawers (13.33 %) in SMK. Moreover, upper limb units reach were found to be inconvenient in both the kitchens (SMK=26.67 %, NMK=20 %). This can be related to

Table 3 : Distribution of respondents according to the inconvenience caused while cooking in the kitchen (n=60)

Sr. No.	Inconvenience while cooking *	SMK (n=30)		NMK (n=30)	
		Inadequate storage	Inconvenient reach	Inadequate storage	Inconvenient reach
1.	Height of the storage	-	-		-
2.	No. of drawers/ pullouts	13.33	-	3.33	-
3.	Upper limb units	-	26.67	-	20.00

*Multiple responses SMK=Semi-modular kitchen NMK=Non-modular kitchen

lower height of the respondents though upper limb units were within convenient reach *i.e.* maximum height for wall shelves should be 74 inches (Thakur, 2007).

Furniture problems and its maintenance:

Data of Table 4 reveal that NMK respondents incurred problem of opening drawers and doors especially in rainy season due to swelling up of wood which causes jamming up of drawers and doors of kitchen storage furniture (16.67 %).

Loosening of channels of drawers and cabinets which cause them to hang out in due course of time was reported by SMK respondents (30 %). Moreover, steel casing used in the base units is needed to be replaced when get loosened which is a costlier affair. In rollout units SMK respondents faced problem due to material of furniture which causes difficulty in closing drawers as they get loosen with time and slight more pressure is applied on them for closing leads them to comes out.

Problem of insect attack was found by SMK (10 %) and NMK respondents due to material of furniture (13.33 %). The synmica of the storage furnitures chip out with time but can be cleaned and maintained easily. Respondents highlighted that locally made storage furniture (SMK=13.33 % and NMK= 6.67 %) were of substandard quality hence require frequent periodic maintenance otherwise insects and termites attack (20 %) problem occurs.

Environmental problems of kitchen storage:

Kitchen environment has a direct bearing on the work efficiency and output of the worker which will affect the physiological cost of the work while using storage furniture.

Humidity:

The data in Table 5 indicate that the problem of humidity within storage units was faced by one third of the SMK and nearly two third of the NMK respondents (67.67 %) due to absence of fan and small windows in the kitchens. At the same time, due to humidity wooden furniture deteriorates which harbors insects and termites. Presence of undesirable level of humidity affects the efficiency of the worker (Grand jean, 1987; Gandotra *et al.*, 2005).

Airflow:

Fresh air problem was confronted by SMK and NMK (13.33 %) respondents in kitchen storage due to absence of fan and small windows size in kitchen which affects the efficiency of the respondents while using kitchen storage. Absence of chimney in respondents' NMKs (83.33 %) leads to low-grade indoor air quality as compared to SMKs (20 %).

Noise:

A small percentage of SMKs (20 %) and nearly three fourth of the NMK (76.67 %) respondents suffered from irritable noise while taking out utensils. This can be related to absence of multi-section drawer/shelves which cause layering and stacking of the utensils. Due to fix type furniture few NMK (13.33 %) respondents also faced this problem.

Light:

The data in Table 5 clearly reveal that in rollout units, light reaches each and every corner of the drawers, trolleys of base units of respondents SMK storage which was absent in NMKs. Cent per cent of the NMK respondents faced problem of visibility at last corner of the deep cabinet due to fix furniture which causes stress and strain on the eye muscles, back, shoulders to search items up to last corner of the shelves of the base units. Furthermore it consumes more time and energy of the respondents thus leading to fatigue hence lower their

Table 4 : Distribution of respondents according to the kitchen furniture maintenance (n=60)

Sr. No.	Problem of furniture maintenance*	SMK (n=30)				NMK (n=30)				
		Material of furniture	Jamming of wooden furniture	More efforts during cleaning	Pressure on drawers/ cabinets	Material of furniture	Deep cabinet	More efforts during cleaning	Insects and termite attack	Jamming of wooden furniture
1.	Efforts required to open drawers and doors	-	33.33	-	-	-	-	-	-	36.67
2.	Loosening of drawers and cabinets	-	-	-	30.00	-	-	-	-	-
3.	Problem due to rollout units/ fixed type storage furniture	3.33	-	-	3.33	-	30.00	-	-	26.67
4.	Insects in kitchen	10.00	-	-	-	13.33	-	-	-	-
5.	Cleaning of drawers and cabinets	10.00	-	100.00	-	20.00	-	100.00	-	-
6.	Requires frequent periodic maintenance	13.33	-	-	-	6.67	-	-	20.00	-

*Multiple responses SMK=Semi-modular kitchen NMK=Non-modular kitchen

Table 5: Distribution of respondents according to the environmental problems in kitchen (n=60)

Sr. No.	Problem of environmental parameters*	SMK (n=30)			NMK (n=30)				
		No chimney	No fan	Absence of multi section drawers/ trolleys	No chimney	No fan	Absence of multi section drawers/ shelves	Fix furniture	Very small windows
1.	Humidity within storage units	-	33.33	-	-	67.67	-	-	-
2.	Airflow in the kitchen	-	13.33	-	-	13.33	-	-	26.67
	Chimney enhance indoor air quality	20.00	-	-	83.33	-	-	-	-
3.	Irritable noise while taking out utensils	-	-	20.00	-	-	76.67	13.33	-
4.	Darkness in the base units	-	-	-	-	-	-	100	-
5.	Temperature within storage units	-	13.33	-	-	13.33	-	-	26.67

*Multiple responses SMK=Semi-modular kitchen NMK=Non-modular kitchen

efficiency.

Temperature:

The problem of temperature was faced by a meagre percentage of SMK (13.33 %) and NMK (13.33 %) respondents due to absence of fan. NMK had very small window/s (26.67 %) to regulate temperature.

Economic problems:

Cent per cent of the SMK respondents emphasized that economically semi modular kitchen's furniture and its maintenance both are costly affair. More than 50 per cent of the SMK and more than three fourth of the NMK respondents (80 %) had the problem of special periodic treatment of storage furniture to save natural material from dampening (wood) and as well as from termite attack, which is again quite a costly affair (Table 6).

Postural problems:

The data in Table 7 highlight that pain in respondents lower extremities was due to obesity (SMK= 10 % and NMK= 16.67 %). One third of the SMK respondents faced the problem of pain in legs due to long duration of work in kitchen which affects respondents work efficiency. Two third of the NMK respondents felt pain in lower back (66.67 %) and legs (40 %) due to deep cabinets (78.33 %) and inconvenient reach (33.33

Table 6 : Distribution of respondents according to their kitchen storage furniture cost problem (n=60)

Sr. No.	Problems of cost	SMK (n=30)	NMK (n=30)
1.	Actual cost of storage furniture is high	100.00	-
2.	Maintenance cost of storage furniture is high	100.00	-
3.	Periodic special treatment of natural material (wood) for storage furniture is a costly	60.00	80.00

*Multiple responses SMK=Semi-modular kitchen NMK=Non-modular kitchen

Table 7: Distribution of respondents according to postural problems (n=60)

Sr. No.	Postural problems*	Types of kitchen								
		SMK (n=30)		NMK (n=30)						
		Obesity	Long duration of work	Obesity	Long duration of work	Inconvenient reach	Pain in legs	Tire some	Deep cabinet	Low back pain
1.	Problems of lifting of items from base units of storage causes severe pain in*									
	Pain in lower extremities while storing	10.00	33.33	16.67	-	33.33	40.00	3.33	78.33	66.67
	Pain in upper extremities	-	16.67	-	23.33	33.33	6.67	10.00	33.33	33.33
	Joints	-	26.67	-	33.33	-	-	3.33	26.67	-
	Back	-	10.00	-	-	-	-	-	33.33	-
2.	Problem while storing heavier items more common are									
	Numbness in legs	-	-	-	-	-	-	-	78.33	-

*Multiple responses SMK=Semi-modular kitchen NMK=Non-modular kitchen

%) of upper limb units which causes leg muscles to stretch.

This can be attributed to the respondents sitting on the floor in squatting posture and bending towards shelves to search items from deep cabinets cause hand, neck and leg muscles to stretch. At the same time, bending also causes pain in mid and lower back.

The long duration of work in kitchen leads to pain in upper extremities *i.e.* shoulder, neck, arms, clavicle portion and in SMK (16.67 %) and NMK (23.33 %) respondents. Two third of the NMK respondents also faced problem of low back pain due to deep cabinets which were inconvenient to reach cause hand muscles to stretch. Pain in joints was due to long duration of work in SMK (26.67 %) and NMK (33.33 %) respondents. Deep cabinets also lead to joint pain in NMK respondents (26.67 %) in kitchen. Pain in back was confronted by few SMK (10 %) respondents due to long duration of work whereas one third of NMK respondents defy it due to deep cabinets.

During storage of heavy items in corner units and deep cabinets both the kitchen respondents confronted problem of numbness in legs. This can be attributed to the fact that this one third of the SMK respondents does not have revolving corner units whereas deep cabinets (78.33 %) in NMKs which leads to more sitting to search, retrieve or store items.

Conclusion:

Thus, it can be said succinctly that SMKs were preferred more than the NMKs due to its functionality, layout, easy accessibility, smooth workflow and environment. The specific features of kitchen storage design are multi-sectional drawers, pullout trolleys with organizational options, upper limb storage units with different levels for storing items, corosoule units. These features facilitate worker to see, grasp and replace easily stored items. The zonal arrangement of the kitchen items at under counter or at upper limb unit within comfortable limits made kitchen storage activity more convenient for the SMK respondents. Though economically, it is costly affair as compared to NMKs. The kitchen storage furniture design caused minimum stress and strain on the spinal cord in SMKs due to its pullout units. On the contrary NMKs require -more sitting and squatting postures, too much bending which increase muscular stress and more deviation of spinal cord from the natural alignment of the body. Thus, increasing the energy cost of the worker's results in increased physiological cost.

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