



## **Ergonomical study of kitchen space design in urban apartments: Case of Pune City, India**

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### **Abstract:**

The kitchen space in house is the prime area. It is work space in which several activities such as cooking, washing utensils, cleaning, storing, maintenance of equipment and supplies etc. are performed. The kitchen environment should be usable as well as comfortable.

This is possible only with the well planned kitchens. Good planning is an essential for the efficiency of a kitchen.

Now a day's even if there is lot of importance given to modular kitchen design and installation within the builder provided apartment spaces, optimization of space within the given area becomes important. Many a times the user personas are completely ignored and one size fits all kind of approach is seen. Thus it creates poor organization and problems for efficient working.

The aim is to study Indian kitchens, with the modular kitchen segment, in context of the Indian urban users and to analyze the problems faced by them to propose design interventions that can be adopted and implemented to eliminate or reduce problems of poor ergonomics and poor organization.

Thus this study addresses the ergonomic considerations while designing kitchen space with respect to kitchen platform type and usage requirement and it focuses on the contemporary kitchen spatial experiences and try to identify the problems faced by the users.

The study is conducted by selecting Pune city as urban context and kitchen space users in apartments in multistoried building units by doing a qualitative research study by survey and using questionnaire and focused group interview. A method used to select sample is a non-probability quota. The respondents are of age group 30 to 55 and all are residing and using kitchen space for everyday cooking activities. The questionnaire survey is done and data is analyzed. At second stage pre scheduled interviews are conducted in the user's environment and using interview technique field observations are noted. Both qualitative and quantitative data is analyzed and findings were noted. Design Guidelines are suggested using reference literature and standardized and established design solutions.

**Keywords:** Indian Kitchen, Urban homes, Modular Kitchen, ergonomic design, Kitchen Layouts

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### **Aim:**

To study Indian Urban modular kitchen with reference to its type, layout, Work activity triangle, ergonomics and ease of use and adaptation to builder designed standard module of kitchen space in apartment configuration and space optimization within the kitchen space with respect to activities performed.

**Objectives:**

1. To study the kitchen layout and work triangle.  
(Direct observation and photographic documentation along with field notes is the methodology used for the same)
2. To study the kitchen platform type and activity user flow with respect to it. To map user satisfaction with respect to it. (Questionnaire survey was conducted)
3. To study if any problems faced while working in Kitchen by user and insights about their requirements and suggestions.

**Methodology:**

Qualitative research is conducted for the selected sample with questionnaire study and focused interviews by taking field notes and photographic documentation. The collected data is analyzed using parameters already decided and findings are presented. Questionnaire and focused interview with photographic documentation is done with selected 35 samples residing at 4 different locations' multistoried apartment, all samples from Kothrud region of Pune city from different residential apartments or complexes. All the respondents are working women and of age group 30 to 55 years. The study is conducted in Pune city and selected samples even though belong to different native places are residing in Pune city for more than 10 years.

**Introduction**

The Indian city of Pune witnessed rapid growth and deep transformation processes in the last three decades. Because of urban structure, people prefer to live in multistoried, builder constructed apartment units of different configurations and areas, popularly known as 2BHK ( Bedroom hall kitchen ) and 3 BHK ( 3 Bedroom, hall Kitchen ). Thus the city is selected for study.

**Modular Kitchen and Spatial Arrangements:**

Now a day it is most popular practice in urban apartments to install these modular kitchens. In metro cities builders do offer this modular Kitchen already installed for user with standard design along with the purchase of apartment unit. Many a times, user requirements as per ergonomics, user profile, tradition and customs, lifestyle, requirements are not considered but just one size fits all kind of approach is adopted.

A modular kitchen is simply a modern and flexible way to design kitchen, allowing user to choose a variety of cabinets for different functions which come in "modules." The modules are available in different sizes which can suit various functions depending on which area of the kitchen the user would choose to use the module. They are also available in any number of colours, styles and finishes.

The general layout of the kitchen space is designed taking into consideration the work triangle, to minimize the walking distance as per the work sequence. The two main kitchen design principles or efficient kitchen design are called the work sequence and the kitchen triangle.

The work sequence is the sequence of the order of activities involved while preparing food. This includes all the steps from getting in the groceries, to store, to prepare, to cook, to eating, and to cleaning it all away at the last. Thus, all the kitchen activities can be considered into 6 steps.

1. **To Store** –storing in refrigerator/freezer/ cupboards for dry storage after unloading, unwrapping of food items. In India sometimes people do have more that one space for storage of grains for yearlong use.
2. **To Wash** – washing vegetables, sieving food, dishwashing and cleaning utensils. In India people do use washing sink area for this.
3. **To Prepare** – peeling, chopping, weighing, mixing and pre making, Preparation
4. **To Cook** – Different activities performed while cooking on the hob, stove like boiling and frying, grilling and browning, using oven for baking and roasting, using microwave oven for defrosting, fast cooking and heating. These activities depend upon the type of food and cultural practices.
5. **To Serve** – to prepare dishes of food, keeping food hot, serving, toasting bread, storing cutlery, crockery etc.
6. **To Eat** – table laying and eating food. In India as per cultural practice people do eat either on dining table or by sitting on low height surface or on floor mat.
7. When these steps are completed, one usually follows the return sequence as;
8. **To Clear** – removing dirty dishes to sink and dishwasher, returning uneaten food to refrigerator and cupboards, cleaning surfaces and counters.
9. **Wash up** – waste disposal, loading dishwasher, hand washing utensils, draining, putting away or arranging back again.

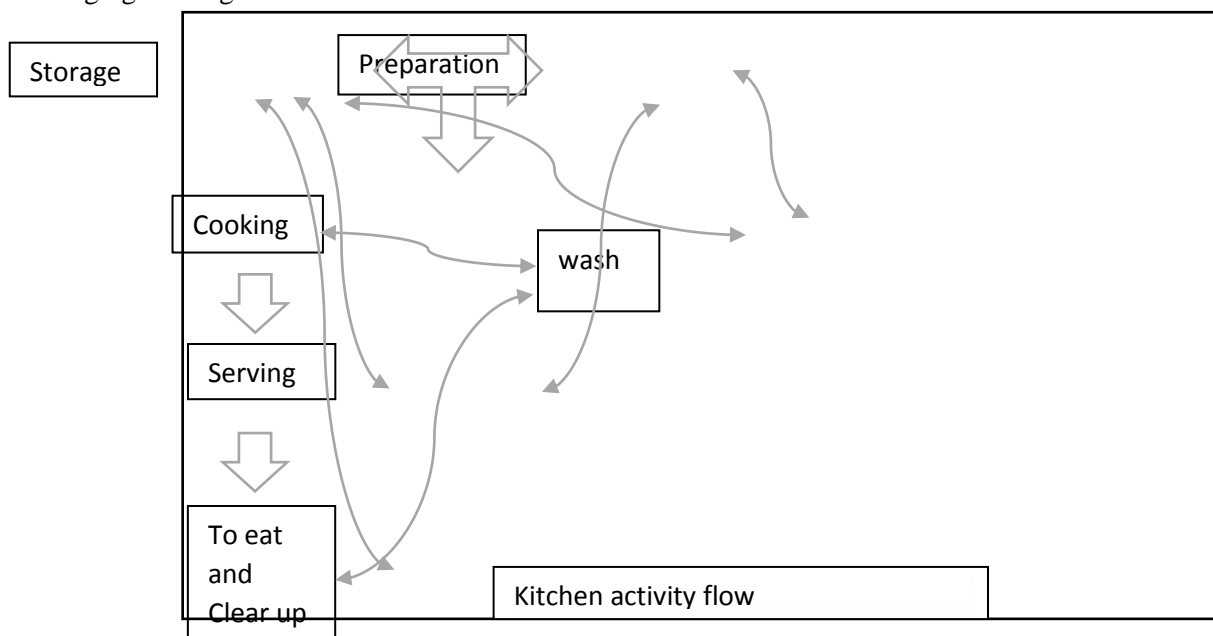


Figure 1

The design process is based on a layout where cross circulation is minimum possible. Thus to arrange the kitchen in a way that the tasks can be carried out with minimum effort even though there can always going to be crossing some of the activities. As an example, the sink is used for preparation and washing up, and the flow of tableware and crockery to and from the dishwasher or washing area to the table. The distance between the preparation area and the wet zone should be minimal.

### **Kitchen work triangle:**

The work triangle is the relationship between three of the main appliances used in the kitchen – the refrigerator, sink, and the cooking top/ stove. As a thumb rule, when added lengths together, the sum should not be less than 3.5 meters, and not more than 6.5 meters. Shorter distance means that we don't have enough work space, compared to longer distance means that user will end up walking around too much every time while cooking a meal. So when working on kitchen layout, one can keep it efficient by following the kitchen triangle rule. The triangle lengths are calculated from the center of each appliance as mentioned above.

### **Types of Kitchen layouts**

**Kitchen Layouts & Work triangle** The layout of the kitchen has impact on the way the user cooks at the kitchen. Refer the image for the type of kitchen layouts and work triangle.

**Single Line/ Single wall** - A very basic layout that should be kept as compact as possible. The cooker and sink must be kept closer in this layout.

**L Shaped** - A work sequence runs around two walls, keeping work triangle reasonable compact.

**Gallery Layout** - Gallery kitchen has the most compact work triangle which is less tiring to use.

**U Shaped** - This adaptable layout is wrapped around three walls in an unbroken sequence. The two corners would give some wasted space.

**G Shaped** – This is for work sequence around three walls and just one small space to enter the kitchen space.

**Island** - This should be used in places where space is plentiful, if there is lot of walking while cooking, this plan might turn inconvenient.

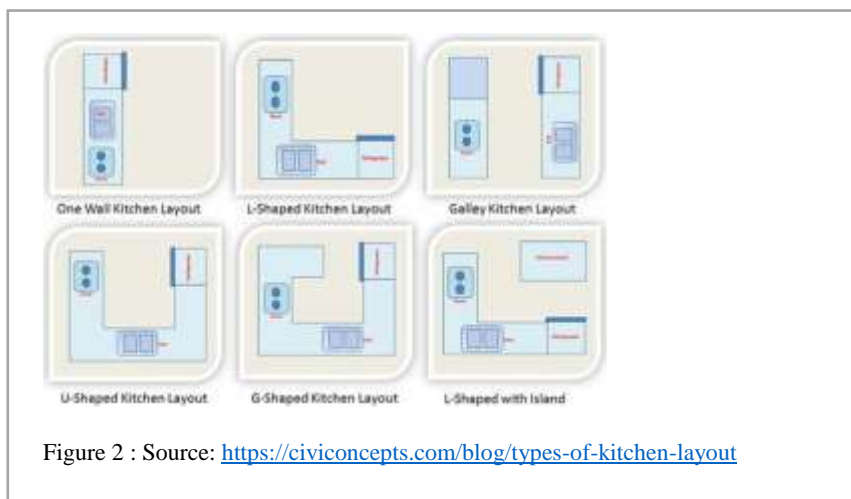


Figure 2 : Source: <https://civiconcepts.com/blog/types-of-kitchen-layout>

### **Ergonomic Standards:**

The study of ergonomics is important in recent years in design process. Ergonomics is the process of designing or arranging workplaces, products and systems so that they are efficient for the people who use them. Ergonomics is a branch of science which aims to learn about human abilities and limitations, and then apply this learning to improve interaction of people with products, systems and environments. Ergonomics helps to improve workspaces and environments to minimize risk of injury or harm.

Ergonomics works with understanding of capabilities of user and invents methods that make tasks easier while utilizing equipment and using the surrounding environment. Ergonomics principles should be considered in designing kitchens especially in developing countries like India.

A countertop is an element that is the most used in the kitchen, hence to know about its standard measurements becomes important. Though there are standard dimensions for the countertop based on the average human height, there could be variations depending on the average height of the household and primary user. The height and depth of the countertop are important factors, as these dimensions determine the comfort of the user while working in the kitchen. The height should be such that the user doesn't strain their back while preparing and cooking the meals. The depth should be appropriate in easy working as well as accommodation of the appliances in the kitchen.

A kitchen work triangle is a combination of dimensions that should be kept in mind when designing a kitchen. The triangle ensures smooth working of all kitchen related functions. The rule of thumb is that the perimeter of the kitchen triangle must ideally be eight meter irrespective of the layout of the kitchen.

Ergonomic Risk Factors in a kitchen Users are prone to following risk factors like application of force, physical effort because of Repetitive tasks that use the same muscle groups repeatedly which lead to fatigue and muscle damage. Risk factor is also because of awkward postures that occur when the body has to work in postures that are not natural like Static Pose in which Muscles tire quickly because blood flow is restricted. Another factor can be contact stress happens when body parts come in contact with hard or sharp objects.

### **Data Collection:**

#### User Profiling

Age group of 30 to 45 were chosen for the research. The City selected is Pune city in Maharashtra state. The apartment units total 35 samples in multistoried building are selected. All users are working women. Homes with modular kitchens of various brands are selected from four different localities within Pune city. Users with disabilities were not considered for the study.

#### Research tools

Field survey, pre structured questionnaire survey, focused interviews, Contextual enquiry are the methods and tools used for the study.

### **Key Findings:**

Major findings of the study are noted. In all the samples the primary user of the kitchen space is the women. The family size is consisting of 3 to 6 members. The kitchen space is used for minimum three time's food preparation including breakfast, lunch, evening tea and snacks and dinner.

Time spent in kitchen activities in morning is more than evening hours. This shows that the time spent in morning for activities like breakfast preparation and lunch preparation is almost double than the time spent in evening hours. The average time for morning activities is 3.5hours which is higher than evening

time kitchen activities. All these working women prefer to finish their morning cooking processes early in the morning before their professional work schedule begins.

1. In 75 percent households out of the selected sample the Kitchen platform is L shaped with the wash area at one end.

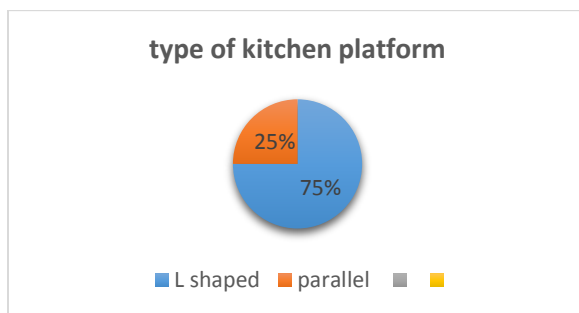


figure 3

This is due to open kitchen and living concept. There is window wall on one side and side wall on another. Mostly there is an immediate access to dry area next to platform. This is the best possible way to provide the counter in L shape in order to cater the space available and to allow user to have main countertop for cooking and side counter top for all other electrical appliances use.

2. The activity wise segregation of available kitchen space is studied. In this figure 2, it is seen that major activities even though varied in nature happens on kitchen platform. Side counter spaces are also important as most of the activities related to electrical kitchen appliances like using mixer grinder, microwave oven etc happens on side counter. In most of the houses there is separate space for dinning and washing utensils like dry balcony. But in 57% cases everything happens in one space.

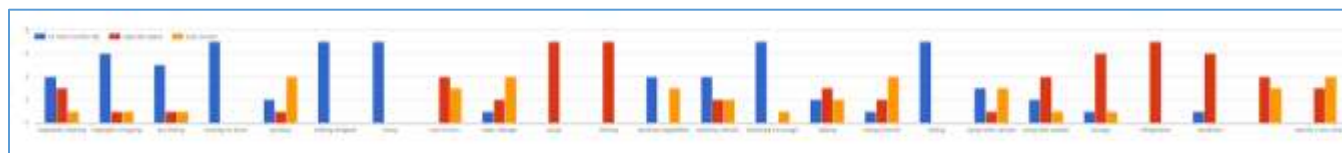


Figure 4

3. When asked about the problems faced in kitchen space 71% users face problem of insufficient storage space. As Indian cooking needs different utensils for different cooking practices space for storage is not enough in existing kitchen.
4. As there is a practice of washing every food and every utensil before cooking and Indian cooking practice needs lot of water for cooking certain food preparation, water spillage over the counter is observed.
5. Also some users face problem of drying utensils after wash as there is no dedicated drying space available in kitchen.

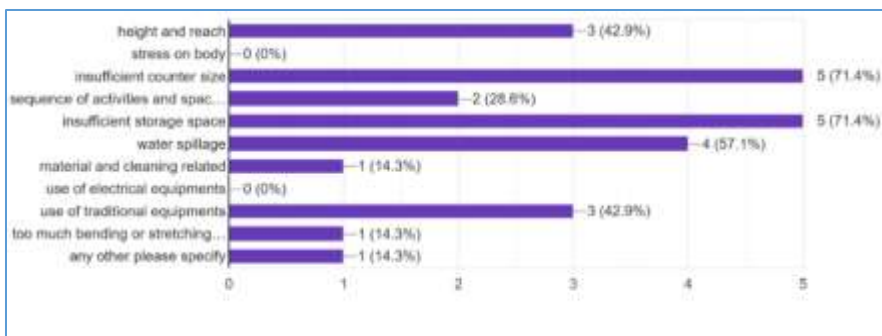


Figure 5

7. As per Indian Anthropometric dimensions the Kitchen counter is not designed in 42% cases and users do face problem of reaching higher storage units. Sometimes they have to bend or stretch to reach these modular storage units.

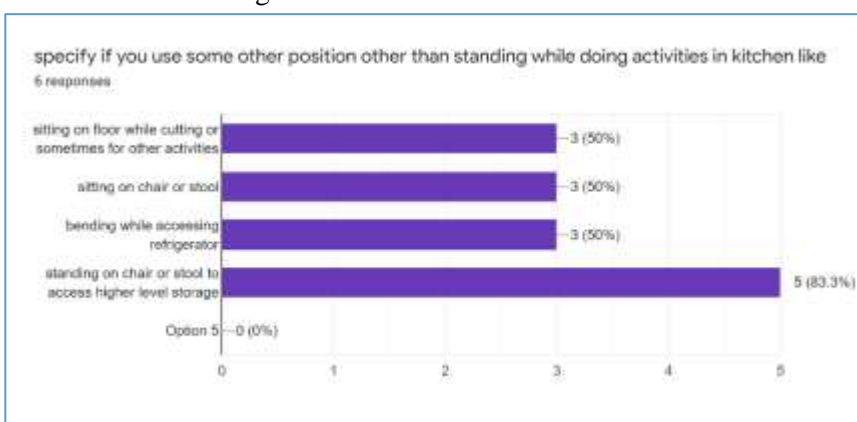


Figure 6

8. It is also noted that most common problem faced is of size of kitchen and storage space. Also it is also due to cooking practices adopted.

Space optimization and adaptation to spatial planning is observed through photographic documentation.



Figure 7

**Conclusion:**

In urban kitchen the spatial planning is not according to cultural cooking practices which requires longer hours for cooking activities and requires different postures while performing those. It is also very clear that the kitchen space and modular kitchen units are not sufficient to cater to user’s requirement of storage and use of electrical equipment. Customization up to certain extent is possible in these modular kitchen units but it does not provide flexibility like varying counter height and flexibility of height and size of storage space. It is observed that need more customization and flexibility of spatial planning.

## Design Guidelines suggested

Few suggested guidelines are listed below

1. Efficient layout: Standardization of heights based on average Indian height has to be done.
2. Utility Kitchen Sink should be placed near the preparation area for washing and cutting vegetables and avoid frequent trips to the main sink. Utility sink will avoid frequent movement between the sink and preparation space.
3. Upgraded Cooking Slab: Simple height adjustable cooking slab is recommended to suit people of different heights. Varying platform height to suit ergonomic posture required for the task at hand. No storage space is suggested above the cooking platform as it increases the risk of contact with hot utensils or hazard.
4. Redefining Storage Space- Height adjustable storage units are recommended.
5. Use of Appliances: More flexibility for positioning of plug sockets than builder provided options or better positioning of microwave oven, refrigerator, mixer grinder, a dishwasher, automatic kettle, water filter, flour mill, wet grinder etc. Providing space for ovens and other appliances like grinders at mid-level which can offer easier access in many kitchens and it would make the kitchen more usable for people who find it hard to bend down to reach.
6. Reaching and access: One need to provide pull out shelves in cupboards for better access without bending or stretching, use of corner cupboards with revolving units for better access and space utilization.

Along with ergonomic and activity specific design it is essential to study the cooking practices and provide solutions suitable for urban apartment's kitchen space is essential for efficient spatial planning of Indian urban kitchen space.

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