



## Rural Kitchen Design: A Case Study

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### Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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**Case Study**

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### ABSTRACT

Kitchen is the heart of a house. Since major part of time is spent in kitchen compared to other areas in the house, it needs to be designed with utmost care. Attention needs to be paid to the type of kitchen, work areas in kitchen i.e., preparation area, sink and cooking area. Storage facilities, openings and ventilation must be adequate so that home maker can do cooking with less strain. With this background, the present study has been conducted through case study method to evaluate the kitchen design in rural areas. The study was conducted in Dabliguda, Maheswaram Mandal in Telangana state. Observations were made in 10 kitchens to understand the existing kitchen conditions. It was found that all the kitchens were placed in the right direction i.e., east. Kitchen sizes also met with the standard specifications as minimum size was 90 sq. ft. and maximum size being more than 150 sq. ft. against 45 sq. ft. as the standard size. But the drawbacks observed in the rural kitchens were lack of adequate ventilation, absence of work triangle as only two working spaces are provided in most of the kitchens and very deep storage shelves. The study implies that rural families need to be educated about importance of implementing design standards for better health, comfort, convenience and to improve work efficiency.

**Keywords:** Rural; kitchen; design; features; standards; ergonomic issues.

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## 1. INTRODUCTION

Indian kitchens are well known for their design aspects. Indian women spend majority of their time in Kitchens either for preparing meals which includes washing and cutting vegetables, preparing other food items and cooking, washing utensils, cleaning other household products etc. Hence, the home maker tries to design the kitchen according to her comfort and requirements. It can be in terms of height of kitchen counter, storage space, placement of food and cooking equipment etc. In spite of many changes in the design aspects and kitchen equipment, rural kitchens and their design aspects have not changed much due to the lack of affordability by the rural people to invest on modern kitchen designs, lack of awareness about the ergonomic issues caused by the improper kitchen design, less importance given to the kitchen design compared to the other rooms in the house etc. All these factors will lead to ergonomic issues, health issues which will indirectly take a toll on the women's health, mainly among the rural women. Research indicates that there are lot of respiratory diseases, musculo skeletal problems, trips and falls, accidents, indoor air pollution etc caused by the improper kitchen design. All these can be combated with the proper designing of kitchens.

Yazıcıoğlu and Kanoglu [1] determined the effects of kitchen design rules on its functionality. Results gained highlighted the need for creation of the work triangle correctly. Easy and convenient access to storage units and devices vertically and horizontally must be ensured. Kitchen bench spaces that are empty must be provided on both sides of the kitchen sink and the oven. Proper lighting must be provided according to the actions done in different counters or spaces. All the above - mentioned things are to be provided in a kitchen design properly as these are the first and foremost important rules affecting the design performance. The second equally important design rules to be followed is provision of sufficient empty spaces for circulation mainly in the front of the appliances, between the counters, sink, refrigerator, stove etc. Third degree important design rule to be followed include providing proper dimensions of kitchen counters and storage units in the wash area. The fourth important design rules are regarding the service areas that are mainly located near the devices. The fifth important design rules to be followed include proper dimensions of kitchen entrance

and circulation areas and how the storage areas are designed. Other less important design rules to be followed include providing space for at least two persons to work simultaneously in the kitchen, designing proper eating and food - service areas and total security in kitchen.

Some of the good design features in kitchens include proper ventilation (either natural or mechanical), lighting and air circulation provisions; presence of doors, windows and ventilators; slip resistant flooring; proper storage space and counter heights according to comfort levels of the user etc. This study tried to conduct case studies in selected rural kitchens to analyse their design features and compare the existing features against the guidelines given by the local authorities.

## 2. REVIEW OF LITERATURE

Chahal and Mehta [2] explored on the human factors in rural kitchen design. The study was conducted on 50 rural women respondents between the age group of 24 - 47 years who were involved in kitchen activities for the last 2 years for at least 2 hrs daily. Most of the houses from the selected rural areas (78%) had Peninsula/ G type of kitchen, and most of these (52%) were 5 - 12 years old. No separate counter was found for preparation, cooking, and washing activities; only one work counter was found for all purposes with height and depth of 3'0" - 3'2" and 2'2" - 2'3" respectively. Regarding the counter availability and use of kitchen, all the respondents' kitchens were having facilities for preparation, cooking and storage and was used by women in standing posture. However, the dish - washing (sink) facility was found only in 22.0 percent of the kitchens. It was not used for cleaning purposes as they washed the utensils outside the kitchen in a squatting posture. As per the study findings, most of the rural kitchens were not ergonomically sound; and if the kitchens are not designed according to the ergonomic principles, the workplace can lead to various difficulties and work - related musculoskeletal pains.

Parveen and Kala [3] did an ergonomic evaluation of rural and urban kitchen design of Muzaffarpur district in Bihar. Results showed that the kitchen size of most rural respondents (40%) was 10'0" x 12'0" to 12'0" x 14'0", while in urban area maximum respondents (50%) possessed their kitchen size below 6'0" x 8'0" which is smaller than the standard size i.e., 8'0" x 10'0".

Majority of the rural respondents (90%) had open shelves for their storage provisions which needs improvement in the kitchen design, while urban area respondents (67%) had cupboards for storage of items. Maximum number of rural respondents (80%) had their cooking counter height between 0'5" - 1'5" and in urban area only half of the respondents had these dimensions. Majority of the rural respondents (40%) had their cooking counter width between 5" - 8", and in urban area maximum respondents (43%) had their cooking counter width between 2'8" - 4'1".

Nowakowski [4] conducted a study on Kitchen chores Ergonomics: Research and its application. He highlighted that the selection of functional program of a kitchen, organization of chores and equipment in it will help in determining the ergonomic quality of a house. With these changes, the kitchen users gain the sense of comfort, physical and psychical effort reduction, content feelings, pleasure from using technical goods, increased work satisfaction, motivation, efficiency, creativity and safety. As only some of the kitchen users attempt to implement some of the above - mentioned ergonomic criteria, the real time problems are not solved by the entire population of users in a technical manner. Lack of proper measuring tools is another issue which hinders the good kitchen designing aspect. Hence, it is important to use aids such as tabular comparisons of sizes of furniture and big household appliances with dimensions of sizes of human body, various schemes of workflow and their equipment, check lists and safety warnings for creating a better work environment in the kitchens.

Darekar and Peshave [5] studied about the importance of kitchen designing in standalone restaurants. This study also tried to analyse various factors that influence the kitchen designing process. Findings stated that a well - designed and an organized kitchen will be helpful in saving operational cost and time of the worker. It also increases the work efficiency of the worker along with the cooking output. Structural limitations are one of the major influencing factors that have the maximum impact on kitchen designing. Other recommendations from this study includes designing kitchens by anticipating the work flow of the operations; placement of kitchen equipment based on the operational requirements and space available; Easy location of each equipment and fixtures; Sufficient budget allocation for the kitchen designing so that all the required features can be installed and the design

should complement the structural characteristics and other things installed in terms of positioning of water inlets, external drainage system, doors and windows etc.

Mishra and Agarawal [6] conducted an evaluation of hundred kitchens in rural areas of Orissa. The carpet area of kitchens varied between 42-112.5 sq. ft. In 30 kitchens there were no shelves. There was a proper orientation in all houses, but no drainage facility. Medium level of satisfaction was expressed regarding the kitchen by 57 housewives, as they were unaware about the features of an ergonomic kitchen. More number of kitchens had mud flooring (89), stone walls (62) and thatched roofing (77), and due to this low level of satisfaction was attributed to the kitchens where the users felt discomfort mainly during the rainy season. There were no doors and windows in 27 kitchens, 57 kitchens had a single door and in rest 16 kitchens had a door and window. In 43 kitchens there was proper ventilation and in 57 kitchens, it was poor with little air circulation, due to the presence of only one door in the kitchen. Thirty - two houses had their own source of water. Working counters were not present in all the kitchens. Only cooking area was reserved with the placement of fireplace and rest of the area was used for preparation, storage of cooked food, serving and eating purpose. There was not even a single cupboard or shelf in 30 kitchens. The respondents had a good knowledge for the placement of kitchens in Ayshanya corner of the house. Features like location, uncomfortable wall, roof, and floor condition, keeping of heavy ingredients in other rooms, distant water source, outside washing platform, lack of drainage facility inside the kitchen, absence of cupboards and shelves caused inconvenience. Improper lighting and ventilation and bigger work - triangle affected the working process and efficiency and acted as hindrances against the principles of work - simplification.

Kishtwaria et al. [7] conducted an ergonomic evaluation of kitchen work with reference to space Designing. They expressed that poorly designed kitchen platforms and storage provisions may cause permanent damages in the body of the worker and increase the cost of work. This highlighted the need for properly designed work area in the kitchens, and when this is done properly the stress on the bodily systems like respiratory, muscular and cardio-vascular systems etc will be reduced. In this study, the ergonomic evaluation of kitchen work with

reference to space designing was conducted by using certain parameters viz. physiological, cardio - vascular stress, energy expenditure and perceived exertion. The working counter dimensions viz. height, width, depth and storage spaces were studied and how some modifications can be done to make the kitchens more efficient and comfortable were expressed. The study (n = 30) tried to determine the cost of kitchen work and convenient heights for selected kitchen activities viz. chopping, cooking, kneading dough and dishwashing. Anthropometric measurements were used as a reference data in planning and recommending suitable kitchen counter heights. Analysis showed that 79 cm for kneading dough; 84 cm for chopping and 96 cm for cooking were the most comfortable kitchen counter heights with least ergonomic cost of work of the respondents. Amount of exertion perceived during performing the selected kitchen activities showed a linear relationship with heart rate and energy expenditure by the sample.

Oberoi et al. [8] formulated guidelines for an ergonomically sound kitchen for rural women. Study results highlighted that the kitchen design based on anthropometry and reach measurements of the women was very effective in reducing the ergonomic cost of work in the kitchen, at least up to 47-50%. Organized kitchen layout further reduced the cost up to 7 - 22%. Some of the design features suggested by them are size (9'8" x 8'0"), ventilator (4'0" x 3'6") and two storage shelves along the wall with a depth of 1'0" for the top shelves and 1'6" for the lowest one. Apart from these, 2 tube lights, one smoke outlet over the stove, exhaust fan, covered dustbin, tap with regular water facility and drainage system etc. were recommended.

Seema and Oberoi [9] explored the organisational design, storage facilities and environmental conditions in rural kitchens in Ludhiana district of Punjab (n = 25 families). Greater proportion of kitchens were of standing type (94%) and the remaining were of sitting type (06%). Kitchen's direction was not good for maintaining appropriate environmental conditions, and this may be that the families did not have adequate knowledge about it. Most families had kitchens nearby the living area and hence was out of the view of the visitors. Majority had a tap (74%), and 30 per cent used a hand pump. Very few families had a pucca drain (8%). Majority had sufficient light (78% artificial light and 54% natural light) but the intensity was

below the comfortable limits, built - in storage shelves (98%) above the work counters and L - shaped counters (40%). Only a small proportion had storage shelves below (38%) and away from the work counters (16%). Average height of the counters was 2'6".

Majority of the studies done earlier focussed majorly on the ergonomic evaluation of kitchens and the problems caused due to improper kitchen counter heights and widths. Earlier kitchens did not focus much on studying the basic design features of a kitchen like size of the kitchen, facilities provided, fixtures provided, type of kitchen, ventilation provisions, appliances placed in the kitchen, work triangle etc. As this gap was identified from the earlier research, this study tried to fill the gap by studying the basic design features incorporated in the rural kitchens and these were compared with the requirements according to the Modern Building Bye - laws, 2016, given by the Ministry of Urban Development, Government of India.

### 3. METHODOLOGY

After developing the rapport with the respondents, importance of the study was explained to them and sought the permission to gather information about kitchen. Observation method was followed for collecting data regarding kitchen design in Dabliguda village of Maheswaram Mandal. Physical measurements of the kitchen area and storage units were taken by using a measuring tape. Kitchen layout and presence of facilities were observed and noted in observation sheet. Qualitative data analysis was done.

### 4. RESULTS AND DISCUSSION

**1. Observations from the survey:** Following are the observations made in the kitchen design in the selected rural areas:

**(a) Direction of the Kitchen:** It was observed that the kitchens in the selected rural areas were facing towards the East, which implies that everyone is particular about Vaastu.

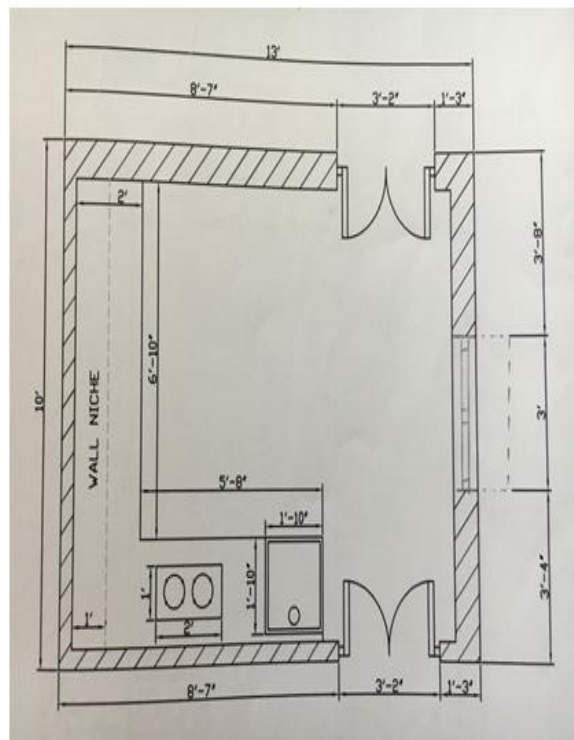
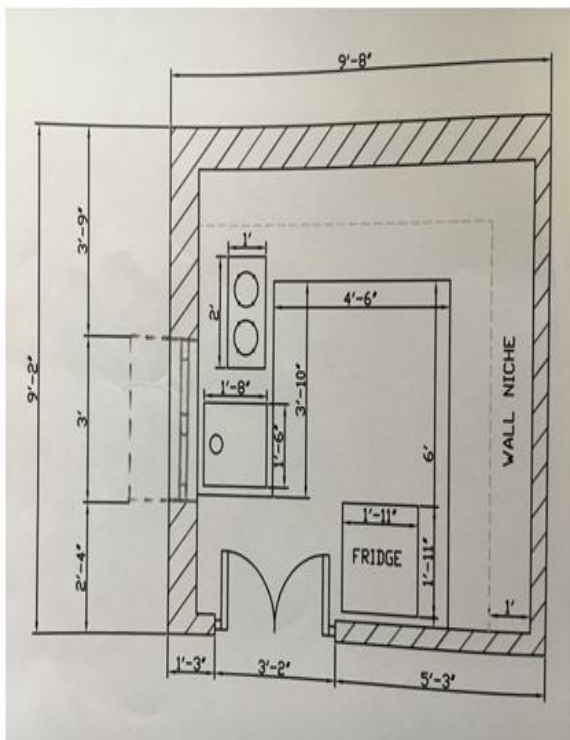
**(b) Safety Features – Doors:** In all the ten kitchens observed, doors were provided for the circulation and safety aspects. In majority of the kitchens, there was one door and a small percentage of kitchens had two to three doors. Since the houses

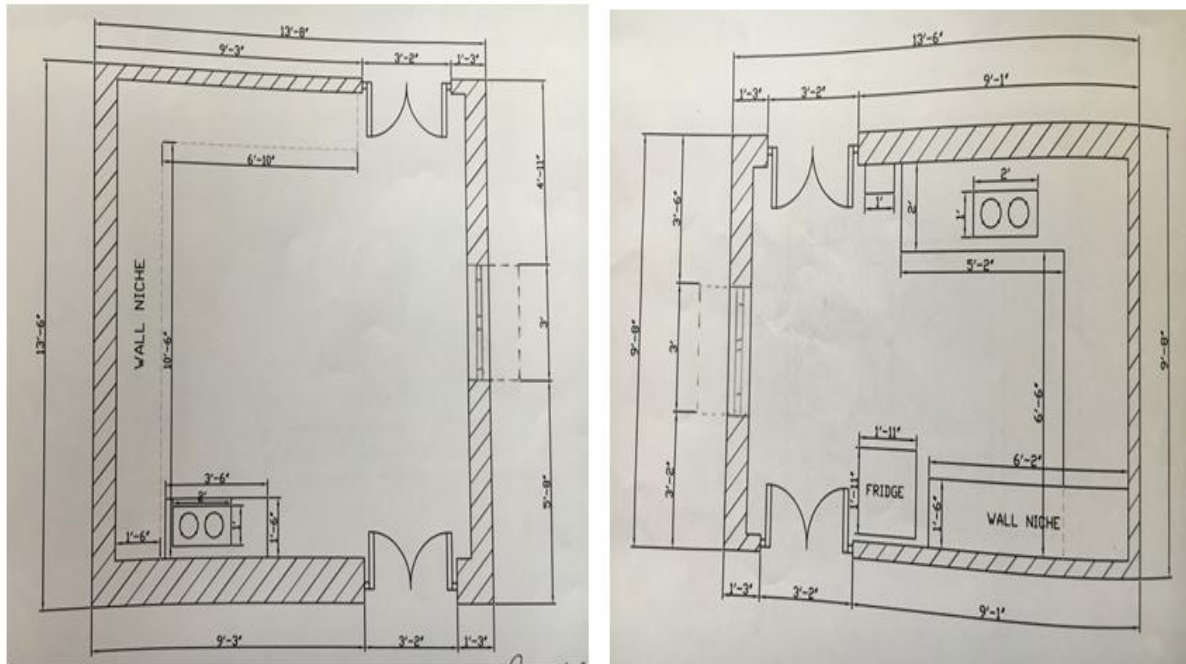
are small, they have kitchens having access from living room only as there is no separate wash area. Mostly houses are row houses due to which kitchen is in line with living room, bedroom, or multipurpose room. These doors were used for safety, and they provided access to other rooms and outside of the house. The width of the doors ranged between 3'0" to 3'2". The height of the doors ranged between 5'8" to 6'4".

- (c) Ventilation Features – Windows and Ventilators:** In all the ten kitchens observed, there were windows provided. The number of windows ranged between one to two. The width of the windows ranged between 1'6", which was a single pane window to 3'0" i.e., double pane windows. It is very shocking to see that none of the ten kitchens surveyed had a ventilator.
- (d) Storage:** There is a provision of storage in all the kitchens observed. The width of the individual storage units ranged between 3'0" to 10'6", and the depth ranged between 1'0" to 2'3". Apart from the individual storage shelves, shelves were also provided underneath the

kitchen counter which had a depth ranging between 1'6" to 2'3".

- (e) Area/Size of the Kitchen:** Different sizes of kitchens were observed. None of them had a common size like the doors and windows as the space allocated for the kitchen depended on the space available to the owner for building a house. The minimum size of the kitchens observed was found to be nearly 90 sq. ft. and the maximum size was around 188 sq. ft.
- (f) Type of Kitchen:** Two types of kitchens were found in the surveyed households i.e., L shape and U shape kitchens.
- (g) Appliances and Work triangle:** All the kitchens surveyed had a gas stove. Half of them had a sink and refrigerator. The work triangle is an imaginary triangle formed between the three workspaces in a kitchen: (i) Refrigerator, (2) Sink and (3) Stove. In the case of the surveyed households, the work triangle was not formed in most of the kitchens, as the three workspaces were not present. Only one - third of the kitchens surveyed had a work triangle, but the distance between all the three appliances was not proper as the kitchen size was small.





**Figs. 1 – 4. Floors plans of the Kitchens surveyed**

**2. Standards:** According to the Modern Building Bye - laws [10] published by the Ministry of Urban Development, Government of India, following are the minimum standards to be followed in the kitchen design:

**(a) Height:** The height measured from the surface of the floor to the lowest point in the ceiling (bottom of slab) shall not be less than 2.75 m (9'0"), except for the portion to accommodate floor trap of the upper floor.

**Comparison with the standards:** Rural kitchens observed in this study were also meeting the standards as all of them were having 9' height. Most of the kitchens were L shape with only cooking area and preparation area. They do not have a sink in the kitchen. However refrigerator was provided in the kitchen. It implies that still in rural areas, soiled utensils are washed outside the kitchen only either from hygiene point of view or due to lack of running water facility.

**(b) Area/ Size:** Following three conditions were given with relation to the kitchen area/ size:

- **Kitchen with a separate storage area:** The area may be reduced to 4.5 m<sup>2</sup> (48 sq. ft.)
- **Kitchen without a dining area:** The area shall be not less than 5.0 m<sup>2</sup> (54 sq. ft.) with a minimum width of 1.8 m (5'10")
- **Kitchen with a dining area:** Floor area should not be less than 7.5 m<sup>2</sup> (81 sq. ft.) with a minimum width of 2.1 m (6'10")

**Comparison with the standards:** All the kitchens surveyed had a separate dining area, which means that the area should not be less than 54 sq. ft. It can be concluded that all the kitchens surveyed were meeting the standards with relation to the area/ size as the smallest kitchen among the surveyed ones was around 90 sq. ft., whereas the standard dimensions prescribed was only 54 sq. ft.

**(c) Other Requirements:** Every room to be used as a kitchen shall have:

- **Provision for washing kitchen utensils**

**Comparison with the standards:** All the kitchens surveyed had access to outdoor areas of the house. Some of them had a sink inside the kitchen itself, but they still had access to go out directly from the kitchen for washing their utensils

or other food items. As all the kitchens surveyed were in rural areas, and Indian traditions will say that the soiled things should not be there in the house, and hence the people might not have put a sink inside the kitchen, as it is used to wash soiled vessels and utensils. Another reason for not having a sink inside the kitchen is due to lack of proper water supply and drainage facilities in the rural areas.

- **An impermeable floor**

**Comparison with the standards:** Most of the kitchens have used either Tandır or Cuddapah stone for flooring and only one house had used tiles. The reason for using stone flooring might be due to easy cleaning and maintenance issues as they don't have that time to invest in housekeeping due to the involvement in farm activities either partially or fully.

- **A chimney (if found necessary)**

**Comparison with the standards:** None of the kitchens surveyed had chimneys installed in them. As the respondents felt that the chimneys were not really required in the kitchen, they did not install them. The cost of the chimney and lack of awareness regarding the importance and use of chimney are also some of the additional factors which made the respondents opt for not installing a chimney in their kitchens.

- **A window or ventilator or opening**

**Comparison with the standards:** All the kitchens surveyed had doors and windows in

their design. None of the kitchens surveyed had ventilators installed either natural ventilators or mechanical ventilators. This gave an indication that, all the surveyed kitchens did not follow the standards prescribed with relation to the installation of a ventilator compulsorily in a kitchen.

Along with the window(s), the presence of a ventilator is also very important provision to be provided in a kitchen to have air circulation. It is very shocking to see that none of the ten kitchens surveyed had a ventilator. This maybe a minute detail in the building design, but in the long run, there can be many issues faced by the workers, as the heat and bad air generated during cooking is not replaced by the fresh air. This also affects the health of the worker.

- **The minimum aggregate area of openings of kitchens excluding doors shall be not less than 1/10<sup>th</sup> of the floor area.**

**Comparison with the standards:** It can be noticed from the above table that none of the kitchens surveyed met the requirements prescribed in the bye - laws, regarding the minimum aggregate area of openings excluding the doors. According to the prescribed standards, the openings area should not be less than 1/10<sup>th</sup> of the floor area. From the above data it can be observed that all the kitchens surveyed had less than 1/10<sup>th</sup> area for its openings, which included only the windows.

**Table 1. Comparison of the area of the existing openings in the kitchens surveyed with the bye - law requirements**

Kitchen No.	Area of the surveyed kitchens (In sq. ft.)	Prescribed area for the openings according to the standards (In sq. ft.)	Area of the existing openings - Windows (In sq. ft.)
1	133.28	13.33	12.00
2	130.00	13.00	12.00
3	90.16	9.02	9.00
4	187.68	18.77	9.00
5	154.44	15.44	9.00
6	88.56	8.86	9.60
7	80.00	8.00	9.00
8	80.00	8.00	4.80
9	157.76	15.78	7.80
10	130.00	13.00	12.00



## 5. CONCLUSION

The study revealed that vaastu was followed related to the aspect of kitchen as all kitchens observed were in east side which is a good sign as kitchen gets purified with morning sunrays. Size of the kitchens in the study area was as per the building standards. Stone flooring was commonly used. Work triangle concept was not followed in the workspace's arrangement. No kitchen was found with a ventilator. Thus, the study implies that rural families need to be appraised of importance of ventilation in the kitchen and work triangle. A negligible number had sink in the kitchen otherwise rest of them had to walk so much to put the soiled utensils outside and to bring washed utensils inside. If work triangle between preparation, cooking and sink is more, worker needs to walk more resulting in severe fatigue. Depth of the storage shelves also need to be reduced as in many cases it is more than one foot because frequent bending forward either to keep or retrieve the things from storage shelf will harm the spine and causes musculoskeletal disorders. Hence more awareness campaigns about building standards, ill effects of non- standard specifications and importance of ventilation in the kitchen needs to be conducted.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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