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Ergonomic assessment of kitchen interiors in relation to human health and safety in the region of Uttarakhand

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Abstract

Ergonomics is about how people, based on their physical capabilities, can best organize and conduct their activities. Ergonomics, which is known as human factor, is systematic order which is in the process of understanding and improving human communications with types of product, equipments, environment and system. Human factors and ergonomic is concerned with the "fit" between the user, equipments and their environment, it is about designing for people, whenever they interact with products, system or processes. The survey "Ergonomic Assessment of Kitchen Interiors in relation to Human Health and Safety in the region of Uttarakhand" has been conducted with the objective to study the present situation of kitchen interiors in relation to man's compatibility in terms of equitable use, flexibility in use, simple and intuitive use, tolerance of error and low physical effort. For this survey has been conducted on 60 households which were *purposively* selected. On the basis of study it was revealed that there was complete thoughtlessness in designing the kitchen interiors for the residents, and the ultimate sufferer for this mismatch was housewives, as they are the one who spent maximum time in household environment specially kitchen, due to this incompatibility they are suffering from musculoskeletal disorders and were in a stake of accidents, the main reason for this is lack of reliable anthropometric data of Indian users to decide the comfortable limits of workers as they are also copying the British standards, lack of concern of users for faulty designed layout in relation to environment and low priority towards improvement in household work conditions because of women users, as household work is considered as unproductive. In modern era, although the improvement was made in the sphere of household work also, but efficient relationship between man and their working environment remained missing.

Keywords: Ergonomics, interiors, health, safety

Introduction

Ergonomics is designed to improve system performances by creating and implementing skills and techniques. The plan also focuses on the individual's health, safety and wellbeing. The emphasis of ergonomics is further concentrated in work, leisure and other facets of everyday life. Ergonomics comes from two Greek terms, "Ergon", the job, and "Nomoi" the natural law. Human factors and ergonomics include the "fit" between the consumer equipment and its environments and the people everywhere they communicate with systems or processes. Kitchen is the nerve centre and the most important place in all houses and is a place of worship where God's Fire has resided and nurtured the entire family (Lagomarsino, 2004) ^[11]. The traditional kitchen underwent many changes that contributed to the traditional kitchen (Mathen, 2011) ^[12]. The "famed" kitchen triangle has been a staple of kitchen design for decades now. It is an imaginary triangle which determines the way refrigerator, cook top and sink should be laid out in relation to one another to achieve maximum functionality as cited by a New York based designer Lorena (2011). The ideal length of the imaginary line that unites three areas should not be more than 19 feet. The length of the individual sides of the triangle can vary based on the size and shape of the room. Too much distance between the areas would lead to wasting too much energy walking back and forth and too little distance will make the space cramped and uncomfortable as given by Design Blog (2014). According to Mariyn *et al.*, (2009) ^[20], one third of the semi modular kitchen respondents had average kitchen work triangle against the most desired kitchen triangle size of 15-22 feet. A kitchen planning research documented that the absolute minimum kitchen triangle should be 12 feet and maximum 26 feet. Every kitchen is well tuned for the preparation of food. The challenge of kitchen cooking and kitchen operations has become easier for most urban ladies with contemporary food processing devices in hand. Today's kitchen is the most common space in the entire house and is emphasised by new technology. Home and health are the king of a happy life says Grey (1997).

The ergonomic design of kitchens allows the hour to provide a stress free home-making operation. The modern kitchen known as the modular kitchen essentially consists of a variety of fixtures and cabinets, which are built and functionally organised in order to make the kitchen simpler and more comfortable. A modern residential kitchen is fitted with a stove, sink, fridge and modular built kitchen cabinets. They are normally conceived to fit consumer preferences as seen in a modular market analysis report according to the room available in the cooking. "Ergonomics or human factors is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimize human well-being and overall system performance" (IEA. 2013). Chaudhary (2004) pointed out that the height of the kitchen centres did not meet the needs of homemakers. High counters caused pain in the shoulder and low counters caused pain in the back. Deeper the counter depth, the more bending is required. High reach areas tend to press the arms and the shoulder for height adjustment. This is causing needless fatigue (Nickel and Dorsey, 2002). The workplace results in occupational disorders and the mechanical and physical risks exacerbate the problems. The problems are inappropriate posture, unnecessary force, repeat motions, elevating and carrying loads, vibration, low temperatures and unfavourable lighting (Aghilinejad, 2006)^[2]. The body part involved in the work is affected by musculo skeletal disorder. The top vertebrae and hands are the most vulnerable limbs to these conditions risk factors (Moyodi, 2004)^[14]. Proper room for kitchen storage and regular operations in the kitchen, and the right placing of equipment could save excessive bending and additional movements. Suitable ergonomics are needed to avoid repeated strain injuries that can worsen over time and lead to long-term disabilities. The goal is to access efficacy through the use of measures that maximise productive performance while lowering the risks of musculoskeletal disorders (MSDs) to take into account typical person's size, strength, speed, acute vision and physiological stresses, such as exhaustion, speed and memory and perception requirements. Due to the long-term exposure to ergonomics risks such as repetitive, high strengths and difficult postures may generated MSDs.

Housing quality may improve or lessen the well-being of individuals and families as well as of the whole community. It is therefore an important area that can be significantly enhanced by taking the human factors more thoroughly into consideration. Home ergonomics among home scientists, ergonomists, manufacturers and interior designers is also becoming very relevant (Varghese, *et al.* 1989)^[8]. The fundamental goal of ergonomic design is to adopt the work process, tools or equipment and the working environment to fit the needs, size and capabilities of the worker to enable the worker to work comfortably, safely and ultimately increase productivity (Boerding, 1997)^[6]. Modern Ergonomics applies to work systems and product design and assessment. Unlike in the past where an engineer built a complete machine or product, the design nowadays is a team effort. In the process of design and thorough design and prototyping and evaluation of existing products and facilities, the ergonomist uses a large function (Bridger 1995)^[7]. Architecture design can benefit from ergonomics as a dynamic framework, in which different equipment users, products and treatment/care environment are still always built, regardless of the users who are doing their work there (Villeneuve, 2004)^[19]. In the design of virtually

every product, system or environment, ergonomics should be taken into account. Failure to do this may give rise to designs which are ineffectual, inefficient or uncertain and unlikely to succeed commercially and do not meet the needs of users, whether physical, psychological or sociological. The human sciences of psychology, anatomy and physiology provide information about the abilities and limitations of people, and the wide differences that exist between individuals.

Ahsan *et al.* 2001^[3] describes the basic principle of an ergonomic home: a person's basic needs are fulfilled and met without many problems in the environment. Ergonomics at home means that inclusive design needs to be a central part of developing the environment or devices for the home. Inclusive design is defined according to the British Standards Institute: "The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible Without the need for special adaptation or specialized design" (University of Cambridge 2013)^[17]. Aaras *et al.* 1997^[1] studied that although it is necessary for all working people to take a comfortable position. In two major cases, weak postures pose a risk to health and safety: activities that have a static disposition and require postural retention for relatively long time; and tasks involving the exercise of strength. Postural pressures of the muscles and joints can lead to muscle weakness, pain and cumulative physiological changes and injury in the first case. Kitchen planning with ergonomic concepts inducted is the need of the hour in order to have a stress free homemaking activity. The modern kitchen referred as modular kitchen is basically a range of fixtures and cabinets which are put together in a planned and functional manner to make kitchen work easier and comfortable Kishtwaria (2007)^[10] analysed that poorly designed kitchen work surfaces and storage spaces caused permanent body damage besides increasing the work cost. This justified that height of the kitchen work surfaces and storage spaces should be given careful attention thereby minimizing stress on cardiovascular, muscular and respiratory system. Based on the above considerations, ergonomic evaluation of kitchen work with reference to space designing was done by employing parameters viz. physiological, cardiovascular stress, energy expenditure and perceived exertion. It was also reported that majority of the homemakers were dissatisfied with height and depth of the storage units which necessitates the storage dimensions to suit the worker and prevent physical psychological discomfort. Mira *et al.* (2008)^[13] examined the desirability of small-scale houses and focused on kitchen space planning as critical to well-designed housing. Designers and builders of small-scale housing offer different options in kitchen design to meet the needs of the residents by offering well-planned kitchen with drawers and interior cabinet storage devices. Recognizing the actual use of kitchen flexibility in designing small-scale housing was adapted to meet different lifestyles. Proper spaces in kitchens and normal kitchen operations could save excessive bending and further movements by properly positioning the kitchen's equipment. Many Indian families still embraced and used the old tabu of women taking full responsibility for the kitchen. Average Indian women remain in the kitchen for 20 hours a week. Research indicates that an average woman spends approximately 3 1/2 hours in the kitchen every day. Women in India work in a number of tasks for 14 hours a day (Swaminathan, 1989). Women certainly want a space that is user-friendly, safe and worthwhile all the time that they spend there. Times of India has investigated how Indian women

spent 298 minutes on regular housework, while Indian men only spend 19 minutes a day reporting housework, Shobita (2014) ^[16]. A woman spends much of her time in the kitchen, almost 1/3 of the waking life, so the design of the kitchen has to be considered during construction says Selye (1976). The science of ergonomics is focused on the antiquity. Archaeological documents reveal the use of instruments and appliances that demonstrated ergonomic concepts by the early Egyptian dynasties. But, eventually, it became apparent that the productivity of workers would be improved by developing an atmosphere that would affect human efficiency, not just materials. The interior design plays a key role in making a home welcoming. People are prepared to spend money on their interiors today. While the features produce a luxurious effect, the kitchen's look is enhanced by wall decorating, lighting, tile design, cabinet colours and wall painting. As a rule, every 50 square ft in the kitchen has a ceiling attachment with an illumination rate of 150-200 watts or 60-80 watts of lighting. Accent has the choices to alter the lighting or aesthetic attraction that is costly in the kitchen, but there are other general illumination types or mixture of both lighting systems. Devi (2012) ^[9] analysed the spatial needs, understanding, and satisfaction level of kitchen equipment and found that the selected home makers living in their own home have become more conscious of and know-how in equipping the kitchen with new and modern tools. Among the homemakers living in their own homes, the focus on satisfaction seemed to be strong compared to the people living in an rented house. Ramya (2011) ^[15] investigated the attitude of Urban Women towards modular kitchen. The study related the attitude of urban women in using the modular kitchen with the socio economic status of modular kitchen users, of which 53 percent belonged to upper class and 37 percent belonged to upper middle class and only 10 percent to middle class respectively. The study concluded that 90 percent of the respondents were highly satisfied with modular kitchen. Anurathi (2009) ^[4] studied the life space design of houses constructed by owners employing Engineers, supervisors,

masons and builders. It was concluded that the self designed kitchen had evinced great interest in planning work space, work centres, and provide facilities to meet various storage needs when compared to builder constructed kitchens. The demand for modular kitchens is gaining popularity and is growing particularly for branded quality products. As the demand for apartments grow and lifestyles change, convenience and efficient use of space drives the demand for prefabricated kitchens which the modular kitchens offer as style statement, status symbol and ergonomics as stated by Sushil Matey, COO, H&R Johnson Business Line, The Hindu (2013) ^[17].

Materials and Methods

Survey work has been done which included selection of study area, selection of sample and formulation of interview schedule

Locale: The data was collected from the city Haldwani (Uttarakhand).

Selection of sample: Random sampling technique was used to select the households which included mainly housewives. For this 60 households were selected, from 2 areas of Haldwani. The reason for selecting 60 households from Haldwani was that, *the city was occupied with variety of old and newly constructed independent households with different modification.*

Tool used: Mainly questionnaire was used for data collection which comprised of questions regarding the Demographic profile of the respondents, kitchen details, home ergonomics i.e. ease of accessibility in beds, chairs, kitchen shelf, provision of proper lighting in home to do work and provision of environment for differently abled people has been covered under survey work.

Results and Discussions

Table 1: Distribution of respondents according to the usability of kitchen type

| S. No | Usability of kitchen | Number of respondents | % |
|-------|---|-----------------------|-------|
| 1 | Respondents using conventional kitchen earlier | 17 | 28.33 |
| 2 | Respondents using conventional kitchen currently | 13 | 21.67 |
| 3 | Respondents switched from conventional to modular | 47 | 78.33 |

*multiple responses

Table 1 depicts that 28.33 percent respondents were using conventional kitchen earlier, while 21.67 per cent respondents were currently using conventional kitchen whereas 78.33

percent respondents switched from conventional kitchen to modular kitchen. This is due the inconvenience faced by the respondents using conventional kitchen style.

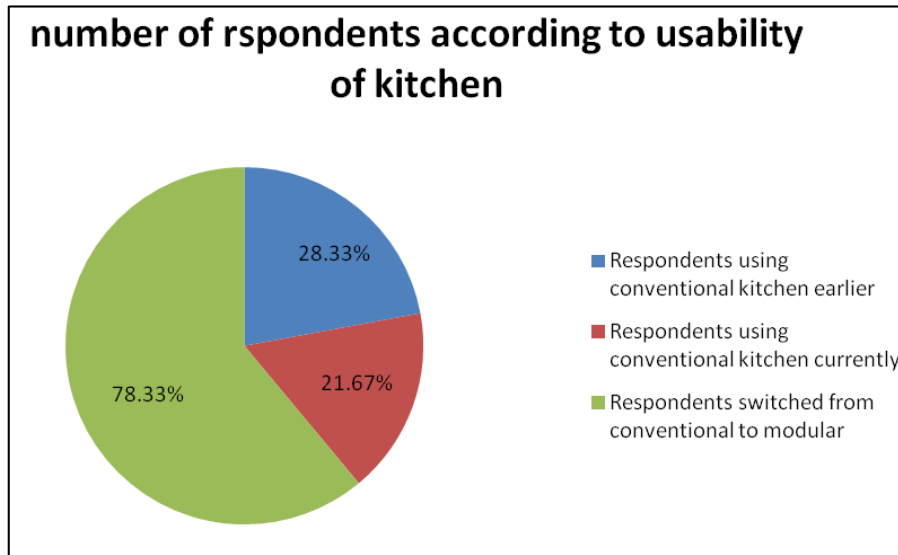


Fig 1: Distribution of respondents according to the usability of kitchen type

Table 2: Distribution of respondents as per General information N=60

| S. No | Demographic details | Modular kitchen | | Conventional kitchen | |
|-------|-----------------------------------|-----------------------|-------|-----------------------|-------|
| | | Number of respondents | % | Number of respondents | % |
| 1. | Age | | | | |
| | <35 years | 13 | 21.67 | 2 | 3.33 |
| | 36-45 years | 30 | 50.00 | 8 | 13.33 |
| | >45 years | 4 | 6.67 | 3 | 5.00 |
| 2. | Education qualification | | | | |
| | Undergraduate degree | 14 | 23.33 | 8 | 13.33 |
| | Post graduate degree | 15 | 25.00 | 4 | 6.67 |
| | Professional degree | 8 | 13.33 | 1 | 1.67 |
| | Diploma/ certificate course | 10 | 16.67 | | |
| 3. | Employment status | | | | |
| | Employed | 28 | 46.67 | 9 | 15 |
| | unemployed | 19 | 31.67 | 4 | 6.66 |
| 4. | Type of family do you live | | | | |
| | Nuclear | 28 | 46.67 | 11 | 18.33 |
| | joint | 19 | 31.67 | 2 | 3.33 |

Table 2 represents the general information of the respondents for both using modular and conventional kitchen and the results depicted that, majority of respondents (50.00 %) from the age group of 36-45 years uses modular kitchen while only 13.33 per cent respondents from the same age group uses conventional kitchen. Further majority of modular kitchen

users (25%) have post graduate degree, while majority (13.33%) of conventional kitchen users have undergraduate degree. Further 46.67 per cent respondents who use modular kitchen are employed and 15 per cent respondents who use conventional kitchen are employed.

Table 3: Distribution of respondents as per housing Details N=60

| S. No | Housing details | Modular kitchen | | Conventional kitchen | |
|-------|---|-----------------|-------|----------------------|-------|
| | | N=47 | % | N=13 | % |
| 1 | Type of house | | | | |
| | Rented | 13 | 21.67 | 4 | 6.67 |
| | Owned | 34 | 56.66 | 9 | 15 |
| 2 | Type of accommodation | | | | |
| | Independent | 38 | 63.33 | 13 | 21.67 |
| | Bungalow | 9 | 15 | - | - |
| 3 | How many rooms are there in your house | | | | |
| | 1 BHK | 3 | 5 | - | - |
| | 2 BHK | 21 | 35 | 6 | 10.00 |
| | 3 BHK | 15 | 25 | 6 | 10.00 |
| | 4 BHK | 8 | 13.33 | 1 | 1.67 |
| 4 | House designed by | | | | |
| | Contractor | 29 | 48.33 | 11 | 18.33 |
| | Architect | 8 | 13.33 | - | - |
| | Builder | 3 | 5 | - | - |
| | Self/Family members | 7 | 11.67 | 2 | 3.34 |

| | | | | | |
|----------|---|----|-------|----|-------|
| 5 | Years of residing in the house | | | | |
| | 2-4 years | 4 | 6.67 | - | - |
| | 5-8 years | 6 | 10 | - | - |
| | 9-12 years | 13 | 21.66 | 3 | 5 |
| | Above 12 years | 24 | 40 | 10 | 16.67 |
| 6 | Major decision for constructing functional area in building households done by | | | | |
| | husband | 24 | 40 | 2 | 3.33 |
| | wife | 5 | 8.33 | - | - |
| | Both | 18 | 30 | 11 | 18.34 |

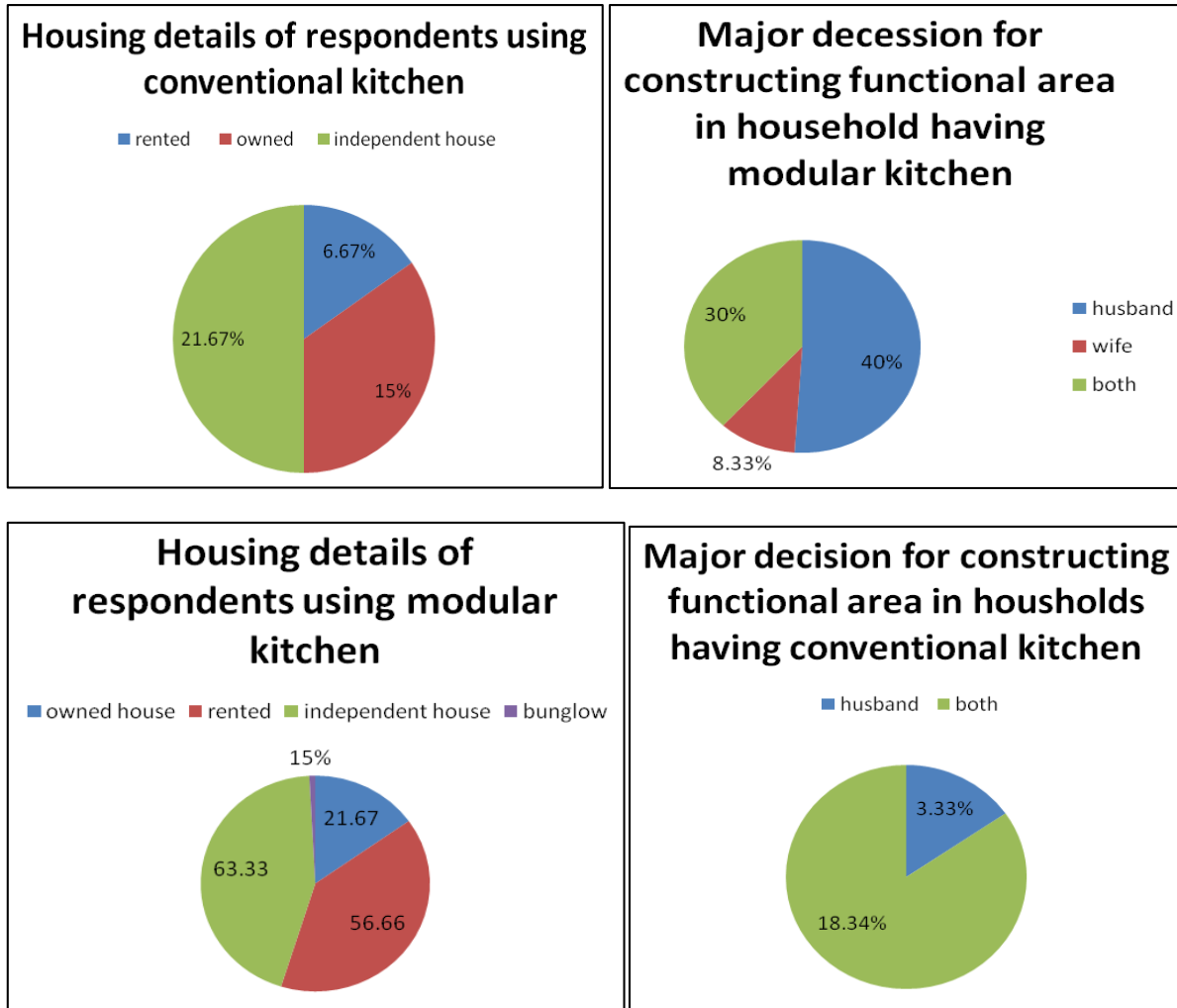


Fig 2: Distribution of respondents as per housing Details

It is clear from the table 3 that majority of respondents who uses modular kitchen have their owned property (56.66 %) and independent house (63.33 %). While 25 per cent conventional kitchen users have owned property and 21.67 per cent independent houses. Also only 15 per cent modular kitchen users have bungalow. Users having Independent

house structures and owned property have the freedom to design according to their own preferences, also 40 per cent decision regarding constructing the functional area in building households among modular kitchen users was done by husband followed by both husband and wife (30%) while only 8.33 percent decision was taken by wife.

Table 4: Distribution of respondents as per the kitchen details N=60

| S. No | Kitchen details | Modular kitchen | | Conventional kitchen | |
|----------|----------------------------------|-----------------------|-------|-----------------------|-------|
| | | Number of respondents | % | Number of respondents | % |
| 1 | Total area of the kitchen | | | | |
| | <100 sqft | 7 | 11.66 | 4 | 6.67 |
| | 101-200 sqft | 24 | 40.00 | 7 | 11.67 |
| | >201 sqft | 16 | 26.67 | 2 | 3.33 |
| 2 | Kitchen attached with | | | | |
| | Store room | 13 | 21.67 | 3 | 5 |
| | Dining room | 25 | 41.67 | 9 | 15 |
| | Open ended kitchen | 9 | 15 | 1 | 1.66 |

| | | | | | |
|----------|--|----|-------|----|-------|
| 3 | Shape of the kitchen | | | | |
| | One walled | 1 | 1.66 | - | - |
| | Double walled | 13 | 21.67 | 8 | 13.33 |
| | L shaped | 9 | 15 | 1 | 1.67 |
| | U shaped | 24 | 40.00 | 4 | 6.67 |
| 4 | Number of members use kitchen for cooking | | | | |
| | Only homemakers | 13 | 21.67 | 2 | 3.33 |
| | Home makers and other family members | 23 | 38.33 | 7 | 11.67 |
| | Homemakers and cook | 11 | 18.33 | 4 | 6.67 |
| | Only cook | - | - | - | - |
| 5 | Money spent on construction | | | | |
| | Less than Rs. 50,000 | - | - | 4 | 6.67 |
| | Rs. 50,0001-1,00000 | 17 | 28.33 | 8 | 13.33 |
| | Rs. 100001-200000 | 23 | 38.33 | 1 | 1.67 |
| | Rs. 200001-300000 | 4 | 6.67 | - | - |
| | More than Rs. 300001 | 3 | 5.00 | - | - |
| 6 | Years of using kitchen | | | | |
| | Less than 2 years | 7 | 11.67 | - | - |
| | 2-4 years | 18 | 30.00 | 1 | 1.67 |
| | 4-6 years | 15 | 25.00 | 3 | 5.00 |
| | Above 6 years | 7 | 11.67 | 9 | 15 |
| 7 | Experience with kitchen | | | | |
| | Satisfied | 28 | 46.67 | 4 | 6.66 |
| | Partially satisfied | 19 | 31.67 | 7 | 11.67 |
| | Unsatisfied | - | - | 2 | 3.33 |
| 8 | Type of lighting used in kitchen | | | | |
| | Accent | | | | |
| | Local/general | 33 | 55 | 13 | 21.67 |
| | Combination of both | 14 | 23.33 | - | - |

Table 4 depicts the kitchen details of both modular kitchen users and conventional kitchen users 40 per cent of modular kitchen users and 11.67 percent conventional kitchen users have area of 101-200 sqft. Shape of the kitchen which was popularly used by modular kitchen users was U shaped (40.00 %) and conventional kitchen users was double walled (13.33

%). Further 46.67 per cent respondents found to be satisfied with modular kitchen followed by 19 per cent was found to be partially satisfied with the same. Further 11.67 percent respondents were found to be partially satisfied with conventional kitchen while 3.33 per cent respondents were found to be unsatisfied from conventional kitchen.

Table 5: Distribution of Respondents as per the reasons for using conventional kitchen N=30

| S. No | Reason | Conventional kitchen | |
|-------|---|-----------------------|-------|
| | | Number of respondents | % |
| 1 | Easy to use | 30 | 50.00 |
| 2 | Easy to maintain | 22 | 36.67 |
| 3 | simplicity of design | 26 | 43.33 |
| 4 | Comfortable, warm, secure, and relaxing space | 21 | 35.00 |
| 5 | Cost effective | 30 | 50.00 |

*Multiple responses

Table 6: Rating of Stress Experienced by the Homemakers in using conventional kitchen N=30

| S. No | Reasons | Conventional kitchen | | | | | |
|-------|--|----------------------|---------|-------|---------|----------|---------|
| | | Strongly Agree | | agree | | disagree | |
| 1 | More time taken for collecting ingredients for cooking | 18 | 60 % | 5 | 16.67 % | 7 | 23.33 % |
| 2 | More distractions during peak hours | 2 | 6.66 % | 5 | 16.67 % | 23 | 76.67 % |
| 3 | Insufficient floor space for homemaker and cook at same time | 26 | 86.67 % | 3 | 10.00 % | 1 | 3.33 % |
| 4 | Uncomfortable Counter Heights | 22 | 73.33 % | 3 | 10.00 % | 5 | 16.67 % |
| 5 | Insufficient space for labour saving devices | 17 | 56.67 % | 13 | 43.33 % | - | - |
| 6 | Poor storage provision | 21 | 70 % | 9 | 30 % | - | - |
| 7 | Bodily discomfort during meal preparation | 11 | 36.66 % | 17 | 56.67 % | 2 | 6.67 % |
| 8 | Difficulty in maintaining the kitchen | 4 | 13.33 % | 9 | 30.00 % | 17 | 56.67 % |

Table 7: Distribution of respondents according to the choice for Modular Kitchen over Conventional Kitchen N=30

| S. No | Reason | Responses | |
|-------|---------------------------------------|-----------------------|----------|
| | | Number of respondents | % |
| 1 | High Status | 3 | 10.00 % |
| 2 | Pest can be Controlled easily | 23 | 76.66 % |
| 3 | Provides use of Electronic Appliances | 30 | 100.00 % |
| 4 | More Cabinet Space | 30 | 100.00 % |

| | | | |
|---|---|----|----------|
| 5 | Flexible | 24 | 80.00 % |
| 6 | Comfortable | 22 | 73.33 % |
| 7 | Floor space for more than two people | 30 | 100.00 % |
| 8 | Experiences of modular kitchen usage heard from friends/relatives | 21 | 70.00 % |

*Multiple responses

Table 8: Distribution of respondents as per the knowledge about Ergonomics N=60

| S. No | Ergonomic Factors | Yes | | No | |
|-------|---|-----------------------|-------|-----------------------|-------|
| | | Number of respondents | % | Number of respondents | % |
| 1 | Awareness of ergonomics | 17 | 28.33 | 43 | 71.67 |
| 2 | Awareness about benefits of ergonomically designed kitchen | 19 | 31.67 | 41 | 68.33 |
| 3 | Persistence of any discomfort and fatigue while working in kitchen | 37 | 61.67 | 23 | 38.33 |
| 4 | Persistence of back pain during work | 33 | 55 | 27 | 45 |
| 5 | Persistence of back pain after work | 22 | 36.67 | 38 | 63.33 |
| 6 | do you take break/rest in between your work | 45 | 75 | 15 | 25 |
| 7 | have you ever met with any accident while working in kitchen | 21 | 35 | 39 | 65 |
| 8 | do you use stools/ chairs to keep or take away stuff from kitchen shelves | 41 | 68.33 | 19 | 31.67 |

Table 9: Distribution of respondents according to the Ergonomic benefits in the existing kitchen styles. N=60

| S. No | Kitchen providing Ergonomic Benefits | Modular kitchen | | Conventional kitchen | |
|-------|---|-----------------|--------|----------------------|-------|
| | | N=47 | % | N=13 | % |
| 1 | Ventilation | 47 | 100 | 13 | 100 |
| 2 | Natural lighting during day time. | 47 | 100 | 13 | 100 |
| 3 | Temperature / humidity control | 15 | 31.91 | 4 | 30.76 |
| 4 | Sound absorption effect | 4 | 8.51 | - | - |
| 5 | Sufficient cabinet or Shelf Space | 47 | 100.00 | 6 | 46.15 |
| 6 | Sufficient counter Space for working | 47 | 100.00 | 11 | 84.61 |
| 7 | Space for Storing all the essential ingredient in the work area | 47 | 100.00 | 7 | 53.84 |
| 8 | space for Keeping Labour Saving Devices | 47 | 100.00 | 4 | 30.76 |
| 9 | Sink Space for washing/drying utensils | 47 | 100.00 | 5 | 38.46 |
| 10 | space for movement | 47 | 100.00 | 8 | 61.53 |
| 11 | Good Reach level for storage | 28 | 59.57 | 10 | 76.92 |
| 12 | Provision for more than one sink | 47 | 100.00 | - | - |

*Multiple Responses

Table 10: Check list related to home ergonomics N=60

| S. No | Items | Yes | % | No | % |
|-------|---|-----|-------|----|-------|
| 1 | Is the height of the furniture (dining table and chair) comfortable | 32 | 53.33 | 28 | 46.67 |
| 2 | Is the chair too sliding | 24 | 40 | 36 | 60 |
| 3 | Is the surface of the seat of the chair too hard | 21 | 35 | 39 | 65 |
| 4 | Is there is provision of arm rest in study table | 39 | 65 | 21 | 35 |
| 5 | Is the height of the cupboard kitchen/ wardrobe comfortable | 31 | 51.67 | 29 | 48.33 |
| 6 | Is the height of the bed according to user's convenience | 41 | 68.33 | 19 | 31.67 |
| 7 | Is the height of the kitchen shelves properly accessible to user | 38 | 63.33 | 22 | 36.67 |
| 8 | Is their provision of controls of switches at both the ends of staircase for differently abled people (old age/people with physical disability) | 43 | 71.67 | 17 | 28.33 |
| 9 | Is their provision of door locks on both the side of doors of bathroom for differently abled people | 41 | 68.33 | 19 | 31.67 |
| 10 | Is there is provision of grab bars in bathroom for differently abled people | 33 | 55 | 27 | 45 |
| 11 | Is the floor slippery | 37 | 61.67 | 23 | 38.33 |
| 12 | Is their provision of sufficient natural light in the house | 57 | 95.00 | 3 | 5.00 |
| 13 | Do you use multipurpose furniture (sofa- cum- bed), modular furniture | 43 | 71.67 | 17 | 28.33 |

Table 11: Assigned score values for perceived exertion of respondents while doing household activity N=60

| Sr. No. | Variables (perceived exertion) | Assigned score | No of respondents | Percentage |
|---------|--------------------------------|----------------|-------------------|------------|
| 1. | Very light | 1 | | |
| 2. | Light | 2 | 18 | 30.00 |
| 3. | Moderate | 3 | 26 | 43.33 |
| 4. | Somewhat heavy | 4 | 10 | 16.67 |
| 5. | Heavy | 5 | 6 | 10.00 |

Table 5, depicts the reason of using the conventional kitchen style and it was revealed that majority of respondents (50 %) used this style as it was cost effective and easy to use. Further

there were many stress factors which was faced by the respondents while using the conventional style kitchen as depicted in table 6. among which major reason which was

reported by respondents was insufficient floor space for home maker and cook at the same time (86.67 %), followed by uncomfortable counter heights (73.33 %), poor storage provision (70 %), more time taken for collecting ingredients for cooking (60 %), while more distraction during peak hours (6.66 %) was least reported. Majority of respondents switched from conventional to modular kitchen as it provides use of electronic appliances (100 %), more cabinet space (100 %), maximum floor space for more than two people (100%), more flexible (80 %) and comfortable (73.33 %), pest can be controlled easily (76.66) and also from the experiences heard

from friends/ relatives (70.%) depicted in table 7. It was further reported in table 8. that only 28.33 per cent respondents were aware about the ergonomics while 71.67 per cent have no awareness regarding ergonomics, persistence of fatigue and discomfort was also reported among 61.67 % respondents, 55 per cent have back pain during work, it was also reported that 68.33 per cent respondents use stools/ chairs to keep or take away stuff from kitchen shelves which shows that inspite of having modular kitchen still there is mismatch of design, and users are incapable to reach the storage areas in the kitchen at a particular height.

Table 12: Distribution of respondents according to musculoskeletal problems N=60

| Parts of body | Tingling | Numbness | Swelling | Stiffness | Persistent pain |
|---------------|-----------|-------------|-------------|-------------|-----------------|
| Head | - | - | - | - | 37 (61.67%) |
| Eyes | - | - | - | - | 10 (16.67%) |
| Neck | - | 31 (51.67%) | - | 26 (43.33%) | 41 (68.33%) |
| Shoulders | - | 27 (45%) | - | 26 (43.33%) | 27 (27%) |
| Upper arm | - | 21 (35%) | 17 (28.33%) | 30 (50%) | 39 (65%) |
| Lower arm | - | - | 11 (18.33%) | 13 (21.67%) | 19 (31.67%) |
| Wrist | - | - | - | 14 (23.33%) | 11 (18.33%) |
| Fingers | - | - | - | - | - |
| Nails | - | - | - | - | - |
| Back | - | - | - | 44 (73.33%) | 53 (88.33%) |
| Upper leg | - | - | 11 (18.33%) | 23 (38.33%) | 41 (68.33%) |
| Knee joint | - | 8 (13.33%) | - | 17 (28.33%) | 47 (78.33%) |
| Lower leg | - | 19 (31.67%) | 16 (26.67%) | 14 (23.33%) | 51 (85%) |
| Ankle | - | 19 (31.67%) | - | 14 (23.33%) | 11 (18.33%) |
| Feet | 21 (35 %) | - | 12 (20 %) | 27 (45%) | 43 (71.67%) |

*multiple responses

*Note: Figures in parenthesis indicate percentage of respondents

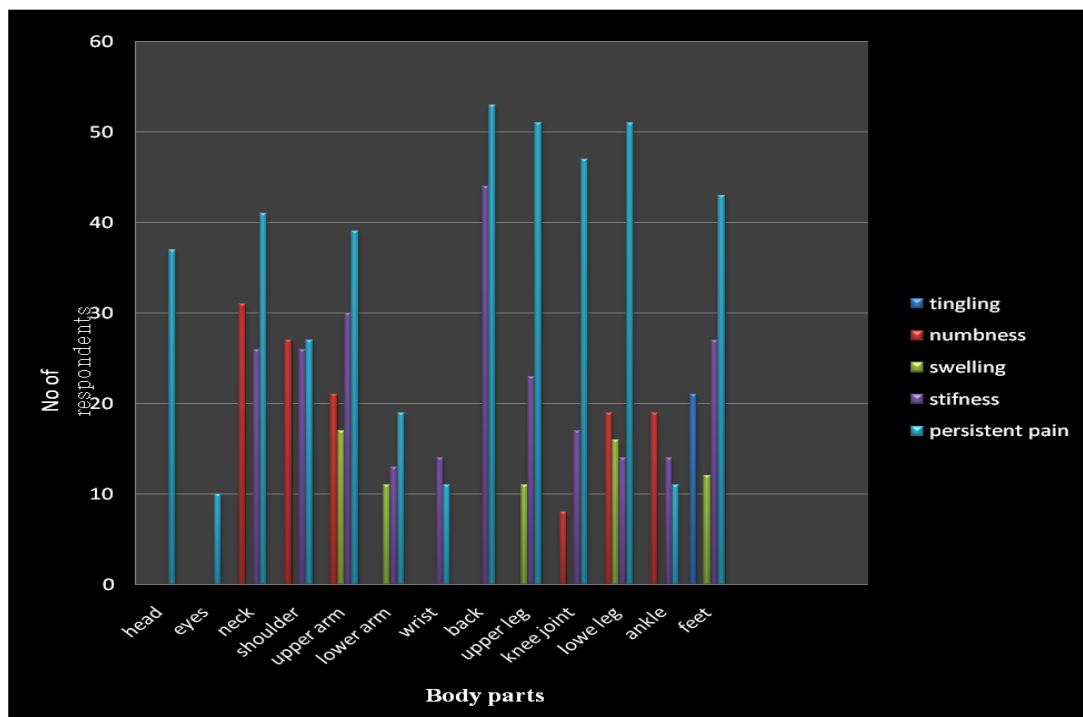


Fig 3: Distribution of respondents according to the musculoskeletal

It is evident that household operation is performed for continuous longer hours and the worker is constrained due to bending in the same position for extended period of time with repetitive movements of the shoulder, head, arms, neck, back, fingers, and legs only and retaining a fixed posture for long periods of time causes, muscle fatigue which leads to pain and injuries and is one of the major factors responsible for

musculoskeletal problems among women involved in households activity. Table 12 depicts that 88.33 percent respondents were suffering from persistent back pain, while 73.33 per cent respondents have stiffness at the back, further 85 per cent have persistent pain in the lower leg, whereas 71.67 per cent have persistent pain in the feet.

Conclusion

Majority of respondents suffers from MSDs due to faulty designs of the interiors, the results of the survey revealed that in most of the cases the British standard are copied for designing the interiors in spite of taking into consideration the anthropometric measurements of the Indian users.

It may also be concluded that cent percent decision related to house construction and designing are taken by husbands, due to which there is negligence to the housewives preference as household work is considered as less productive. Majority of respondents suffered multiple musculoskeletal stresses in body parts like shoulders, feet, neck, feet and ankle. Majority of respondents perceived the household work as moderate. From the checklist it may be concluded that less consideration is given to the people with special need as there is no special provision in the house to facilitate them. Awareness regarding the planning principle, ergonomic aspect while designing the house and use of space saving furniture was also imparted.

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