

# ASSESSING KITCHEN SINK CENTER OF MIDDLE CLASS HOUSEHOLDS OF VADODARA CITY

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**ASSESSING KITCHEN SINK CENTER OF MIDDLE CLASS  
HOUSEHOLDS OF VADODARA CITY**

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## DESCRIPTION OF THE BOOK

A homemaker spends a large part of her day in kitchen. This consumes more amount of energy daily. The kitchen is primarily a food preparation center. It is a nerve center of the house hence the activities carried out in kitchen is time consuming that requires paying of attention continuously. A kitchen is a room or part of a room used for cooking and preparation. In the West, a modern residential kitchen is typically equipped with a stove, a sink with hot and cold running water, a refrigerator and kitchen cabinets arranged according to a modular design. Many households have a microwave oven, a dishwasher and other electric appliances. The main function of a kitchen is cooking or preparing food but it may also be used for dining, food storage, entertaining and dishwashing.

The kitchen is the heart of the home. Today kitchen is gradually assuming greater and greater importance. This is so, because servants are becoming scarce and expensive and the middle class homemaker of the house has to spend a good deal of her time and energy in the kitchen. Therefore, it has become necessary that the kitchen should be an efficient, comfortable and pleasant place. There are different centers in the kitchen such as range center, refrigerator center, sink center, preparation center, mix center and china center. The preparation center is used for pre-preparations like cleaning, cutting, chopping and blending of food. A cooking center is used for preparing the food, whereas sink center for cleaning the food and utensils and refrigerator for storage of food. Among all the centers sink center is considered the most essential area in the kitchen where different tasks are performed which are interrelated to other centers.

The design and placement of the sink requires careful consideration for a number of factors if fatigue from work is to be reduced among its users. Working on a sink center for a considerable amount of time should help the worker to maintain proper posture. The design of the sink center may affect the homemaker physically and mentally, as poorly designed sink center in the kitchen may cause fatigue, and cause the homemaker to dislike the task. At the same time the poorly designed sink center consumes more time and energy on the part of the homemaker. Therefore, its design needs to be assessed for various designing aspects. The need was also felt to educate and motivate the homemaker about the correct design of their sink center that require minimum of energy, save time and give an increased output, which in turn will cause minimum ill-effects to their health. Therefore the design of the sink center needs to be assessed not only from the point of view of various design aspects but also from the point of view of the problem faced by the homemaker while working on it.

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## INTRODUCTION

Sustaining a home and healthy family was a full time job for middle class women in late nineteenth century. Home is woman's world, as well as her empire<sup>1</sup>. A home is the basic unit of society everywhere. It could be just a shelter, which is a roof above one's head. A house also means a home which reflects one's identity and creates a base to develop relationships with others. It is a space where one expects to live with peace<sup>2</sup>. In home a group of people live together with different responsibilities carried in the same place. They have their own identities. The most important role is played by a homemaker in a home who manages the household of her own family, especially as her principle occupation<sup>3</sup>.

Homemaking is mainly an American term for the management of a home, otherwise known as housework, housekeeping or household management. The common tasks in the home include cleaning, cooking, and looking after children<sup>4</sup>. In countries like US and Canada a homemaker is generally termed as a person in charge of the homemaking activities and who is not employed outside the home<sup>5</sup>.

### **Kitchen as an important space in home**

A homemaker spends a large part of her day in kitchen. This consumes more amount of energy daily. The kitchen is primarily a food preparation center. It is a nerve center of the house hence the activities carried out in kitchen is time consuming that requires paying of attention continuously.

A kitchen is a room or part of a room used for cooking and preparation. In the West, a modern residential kitchen is typically equipped with a stove, a sink with hot and cold running water, a refrigerator and kitchen cabinets arranged according to a modular design. Many households have a microwave oven, a dishwasher and other electric appliances. The main function of a kitchen is cooking or preparing food but it may also be used for dining, food storage, entertaining and dishwashing<sup>6</sup>.

The kitchen is the heart of the home. Today kitchen is gradually assuming greater and greater importance. This is so, because servants are becoming scarce and expensive and the middle class homemaker of the house has to spend a good deal of her time and energy in the kitchen. Therefore, it has become necessary that the kitchen should be an efficient, comfortable and pleasant place (Mitter, 1971).

### **Work Centers in Kitchen**

The important aspects of kitchen are work centers, where each working center is a complete unit in itself which serves the purpose assigned. Mitter (1971) stated that, a good arrangement of work center in the kitchen might minimize the problems of a homemaker. Steidl (1967) defines a kitchen center as:

“A place where one can do a particular type of work because the equipment, supplies, utensils, storage space for these and the counter space needed for the activity, are located together.”

There are different centers in the kitchen such as range center, refrigerator center, sink center, preparation center, mix center and china center. The preparation center is used for pre-preparations like cleaning, cutting, chopping and blending of food. A cooking center is used for preparing the food, whereas sink center for cleaning the food and utensils and refrigerator for storage of food.

Among all the centers sink center is considered the most essential area in the kitchen where different tasks are performed which are interrelated to other centers.

### **Sink Center and its Importance**

A sink center provides water and drainage for food preparation and cleanup. To facilitate work with water, not only the sink is essential but also work surface and storage (Steidl, 1967). According to Cartoer (1951), all the most important jobs in the kitchen are associated with the sink and to most people it means nothing more than drudgery and mess. Sink-centre is one of such center which is used to perform various activities of the kitchen namely washing dishes, washing vegetables, food items and hand washing. Each center has its own importance but they cannot function without water. Water is the basic necessity of kitchen as it is used for different purposes like washing of vegetables and fruits before using them for cooking, for drinking purpose, cleaning the centers after use, washing of utensils, for cooking food and for the cleaning of kitchen. The water outlet are situated in the sink center only, hence one cannot imagine a single kitchen activity without the use of sink center.

### **Designing of Sink Center**

The design and placement of the sink requires careful consideration for a number of factors if fatigue from work is to be reduced among its users. Working on a sink center for a considerable amount of time should help the worker to maintain proper posture. (Steidl, 1967).

Bratton (1958) pointed out that, in order to work efficiently the body must be kept in suitable posture for each task. The body is one's most valuable appliance and can be the most effective one hence good design allows homemaker to work in proper posture for accomplishing the tasks.

According to Steidl (1967), the ideal sink design should have the thickness of the front barrier 3 inches or less, depth of the sink bowl 4-8 inches which is sufficient for washing food items and cleaning utensils and the height of the sink bowl from the floor 36-38 inches. The ideal design of the sink center assists the homemaker to be free from fatigue and to maintain a good posture.

Sethi (1978) stated that, good posture involves establishing the centre of gravity so that the whole weight of the body falls directly on the weight bearing areas below. If any part of the body is off-centre, to that degree some other part must be held off-centre to balance it and to that degree the strain results. The proper posture helps the homemaker to maintain an easy balance upon the support which aids in ease and freedom of movement of the body and its parts during the work, which is important for the fatigue reduction. If working position requires the head or trunk to bend forward continually, ligaments and tendons undergo strain 59



because natural balance does not function. In addition, such positions may require steadily maintained contractions in a localized group of muscles with the resultant fatigue in the group of muscles so used. If the above mentioned information is not properly implemented then the center will be considered as poorly designed sink center.

### **Effects of Poor Design of Sink Center**

A considerable amount of time as well as energy of the middle class homemaker is utilized working at the sink. The washing of dishes is the major activity to be performed that may cause fatigue and disliking of the task. If fatigue from work is to be reduced, the duration of work at the sink makes it important to help the homemaker maintain good posture during dish washing by providing the sink of a suitable design. Guyton (1963) stated:

“Maintaining the head in a position to see or raising the shoulders to position the hands above a work-surface requires a steady contraction of muscles not directly involved in the work which could result in pains and aches”.

According to Bratton (1958) Poor posture and strain caused by excess or improper stooping, reaching, pushing or pulling can slow down and tired the homemaker quickly. The physical cost of work can be too high in fatigue even for light work if the natural structure and functions of the body are disregarded during work performance.

Agan (1956), emphasized the work-place should be so designed that the conditions expedite the activity, exert the minimum of strain on the homemaker and require minimum effort. Metheny (1952) found that a 'hump' results from habitually carrying the head in a forward position while working. A protective cushion of fact is built-up because of excessive strain at the point where the muscles cross the large vertebra at the base of the necks.

Grady (1954) described that maintaining the correct alignment of body segments affects the functioning of all the body organs. The heart and lungs may be partially affected when they are crowded by a bowed back. A tilted pelvis may be the other cause of back-strain and improper functioning of abdominal organs, caused by the poor posture. Unbalanced weight distribution, with resultant strain may produce strain in the back, legs and feet. The thoracic, abdominal and pelvic organs suffer from faulty of nerve supply because of lack of tone of muscles on the back. These shifts in positions affect the organs so extensively that they could not be expected to function properly.

### **Need for Assessment of Sink Center**

Poor design of sink center is always associated with health problems among the users of sink center specially the middle class income group in this age of commercialization. Hence, this requires to be looked into critically so that improvements can be made by considering more of the human factors involved. Steidl (1967) stated that, a good arrangement can reduce time, attention and

dissatisfaction. The location of the centers in the arrangement often influences the design of refrigerator center, sink center and range center- the amount of work surface or its allocation, and the location of the storage facilities. The work area especially in kitchen sink center should be adequately designed and properly arranged in order to reduce the physical, psychological and temporal cost of the homemaker (Saha, 1990). The arrangement can be planned to minimize the amount of movement for the homemaker to provide sufficient space for free and easy movements.

The user who uses sink center in kitchen regularly for longer periods might experience many health problems which sometimes become a serious problem for them. Hence, there is a need to assess kitchen sink center of middle class households of Vadodara city.

### **Justification of the study**

In middle class households the kitchen plays an important role. The role of kitchen is important because the homemaker of middle income group has to spend majority of her time in the kitchen itself. The kitchen has various centers of which sink center is the one which is frequently used for the functioning of other centers like refrigerator and cooking. It is also used for other purposes like washing of food and utensils, providing water for drinking, cooking and cleaning of other centers. The design of the sink center may affect the homemaker physically and mentally, as poorly designed sink center in the kitchen may cause fatigue, and cause the homemaker to dislike the task. At the same time the poorly designed sink center consumes more time and energy on the part of the homemaker. Therefore, its design needs to be assessed for various designing aspects. The need was also felt to educate and motivate the homemaker about the correct design of their sink center that require minimum of energy, save time and give an increased output, which in turn will cause minimum ill-effects to their health. Therefore the design of the sink center needs to be assessed not only from the point of view of various design aspects but also from the point of view of the problem faced by the homemaker while working on it.

The review of literature in the related field has highlighted that few studies have been conducted outside India on kitchen designing and adjustable sink. (Maguire, et. al., 2010, Bonanni, et. al., 2005 and Smith, 1984). The review of literature in the related field has also brought to light that few studies on kitchen design, designing of storage in kitchen, work centers, have been conducted in India (Barbarlall, 1964, Bhavnani, 1965, Patel, 1971, Mitter, 1971, Nadvi, 1971). The researcher also came across few studies on kitchen sink heights, surface materials used in kitchen, the assessment of environmental conditions of domestic and canteen kitchens and artificial lighting in kitchens (Sethi, 1978, Ateka, 1966, Solanki, 1969, Patel, 1986, Singh, 1986, Veer, 1990, Jaju, 1999).

The researches regarding sink center in relation to the design aspects covering height, width, depth, depth of the sink, space on either side, faucet height and flow is limited. In view of this, the present study is planned.

The findings of the study will help the interior design students of the Department of Family and Community Resource Management to become aware about the

existing status of sink center being used in the middle class households of Vadodara city. The findings of the present study will enhance the designer's knowledge regarding the appropriate sink center designing and ways of incorporating methods to efficiently utilize the time and energy of the users. The findings will also help the members in the households to gain and insight about the importance of properly designed sink center and its effects on the users.

### **Statement of the Problem**

The study was undertaken to assess the kitchen sink center of middle class households of Vadodara city.

### **Objectives of the study**

1. To assess the sink center of the selected middle class households of Vadodara city.
2. To determine the problems faced by the homemaker while working at the sink center in their households.
3. To invite suggestions from the respondents regarding the design of the sink center.
4. To propose a re-designed sink center for the selected middle class households

### **Delimitations of the study**

1. The assessment of the sink center was limited to kitchen area only.
2. The assessment of sink center was limited to the ones which were constructed by them (not provided by the builders).
3. The study was limited to the respondents who were healthy and were not suffering from any illness/disease.
4. The redesigning of the sink center was limited to the designing on paper only.

### **Hypotheses of the study**

1. The respondents varied in their extent of problems faced while working at the sink center by their personal variable (age of the respondents and employment status of the respondent), family variables (size of the family, type of family and monthly income of the family).
2. There exists a relationship between the extent of problems faced by the respondents while working at the sink center and the number of activity carried, time taken to carry the activity per day at the sink center and assessment of the sink center related to various aspects.

## REVIEW OF LITERATURE

The review of literature is an important chapter of the research. The purpose of this chapter is to give direction to the researcher and guides the researcher on the possible theoretical framework that can be used for the current study. It helps the researcher to identify studies that have been done related to the topic. It avoids possible duplication of similar studies and assists the researcher in conceptualizing the new research.

The chapter covers literature from journals, books, dissertations, websites and other forms of material, concerning or relevant to the study from both foreign and local sources. The review of literature chapter is divided into two sections (1) Theoretical orientation and (2) Empirical studies. Both the section covers the following subtitles:

### **Section 1: Theoretical Orientation**

- 1.1 kitchen and kitchen work centers
- 1.2 kitchen sink center
- 1.3 ergonomic aspects of work center-sink center
- 1.4 Basic design considerations of sink center
- 1.5 Problems faced due to poor design of sink center
- 1.6 Different brands and companies of the kitchen sink
- 1.7 Types of the kitchen sinks
- 1.8 Type of Installation of kitchen sinks
- 1.9 Different materials of the kitchen sink

### **Section 2: Empirical Studies**

- 2.1 Studies conducted outside India
- 2.2 Studies conducted within India

## **Section 1**

### **Theoretical Orientation**

#### **1.1 Kitchen and kitchen work centers**

Kitchen is an important domain of an Indian woman's life. Many hours are spent in kitchen for different work at different workstations. Various activities like cooking food at range center, storing food at refrigerator center, preparation of food at preparation center and cleaning, washing utensils and food items at sink center (Ateka, 1966). All the centers are equally important and linked with each other.

#### **1.2 Kitchen Sink**

Kitchen sinks are the hardest working fixtures in the kitchen also one of the busiest spots in the kitchen. Lot of importance is given to kitchen cabinets, paint shades, lighting. But very little attention is given to the sink. Kitchen sinks are integral parts of a kitchen, and the most-used area of a kitchen. It can also be the most-neglected parts of the kitchen<sup>7</sup>. A sink in a kitchen is used for dish washing, washing fruits and vegetables, and for various other purposes. It is also interrelated to other centers, range center, refrigerator center and china center. There are different methods for installing them, available in different materials and various types of kitchen sinks are available in the market: single bowl, double bowl, with drain board or without drain board<sup>8</sup>. For designing sink center basic design considerations including ergonomic aspects are also equally important.

#### **1.3 Ergonomic aspects of work center-sink center**

The ergonomic recommendations for the dimensions of work centers are to some extent based on anthropometric data but behavioral pattern of people and specific requirements of the work itself must also be considered. Most standard specifications for ergonomic work centers were worked out by committees in which many interested groups were represented, manufacturers, industry associations, unions, employers and ergonomists. The resulting recommendations seem reasonable and suitable in most cases but they are seldom ideal in the eyes of the human factors specialist under practical conditions. It is therefore not surprising that field studies or practical experience do not always confirm recommended standard dimensions (Koremer and Grandjean, 1997). Hence to design ergonomically designed sink center the personal anthropometric data of homemaker is required so that the homemaker feels comfortable and would be free from fatigue.

An ergonomically designed work center is arrived at by including all relevant information about the characteristics of the homemaker into the design process. The objective of ergonomics in work center design is to achieve a "transparent" interface between the user and the task. Distractions may be due to discomfort or work center usability problems. Good posture is a basic requirement in workspace design. Designers typically design to ensure that 90 per cent of users will be accommodated. Problems may occur with extremely tall, short or obese

individuals and special arrangements may need to be made to accommodate them (Bridger, 1995).

#### **1.4 Basic design considerations of sink center**

Bridger, 1995 suggested that all object which are to be used by standing workers should be placed between hip and shoulder height to minimize posture stress caused by stooping or working with the hands and arms elevated. Work surface heights should approximate the standing elbow height of workers, depending on the task. For fine work, a higher work surface is approximate to reduce the visual distance and allow the work to stabilize the forearms by resting them on the work surface. For heavy work, a lower work surface is needed to permit the worker to apply great vertical forces by transmitting part of the body weight through the arms. The standard working heights are given but should be taken only as a guide because the actual working height depends on the size of the work objects as well as the height of the surface they are resting on.

While designing the sink center various basic designs should be considered. The countertop height: 36" finished from floor, countertop depth: 25 ½", backsplash heights: 4"-18" high from countertop. The minimum requirements for countertop workspace: usable counter space between cook top/range & sink: 18-36", counter space on either side of sink: 18-24", landing space next to refrigerator: 15-18" and counter space between refrigerator & sink: 36" 4. It also includes correct work triangle. Work triangle means, distance between refrigerator, stove & sink, kitchen's most-traveled areas. According to NKBA (National Kitchen & Bath Association) each leg of the work triangle should be of 4-9 feet in length. Total length of all 3 legs should be between 12-26 feet, cabinets should not intersect any leg of the triangle by more than 12 inches and major traffic shouldn't move through the triangle<sup>9</sup>.

#### **1.5 Problems faced due to poor design of sink center**

Homemaker faces many problems due to poor designing of the sink. Working height is of critical importance in the design of workplaces. If work is raised too high the shoulders must frequently be lifted up to compensate, which may lead to discomfort, even painful cramp in the neck and shoulders. If the working height is too low the back must be excessively bowed, which often causes back ache. Hence, the work surface must be of such a height that it suits the stature of the home maker while standing at the work. Grasping and working space over a counter top should be deployed within the space to stretch up of 700-800 mm is not harmful. The most severe problem involves the spine in the muscles of the back, which in many sitting positions are merely not relaxed, but positively stressed in various ways (Koremer and Grandjean, 1997).

Some workspace design faults which increase postural stress in standing workers can be summarized as follows (Bridger, 1995).

1. Working with the hands too high and/or too far away- compensatory lumbar lordosis.
2. Work surface too low-trunk flexion and back muscle strain.

3. Constrained foot position due to lack of clearance- worker standing too far away.
4. Working at the corner of the bench-constrained foot position, toes turned out too much.
5. Standing with a twisted spine (having to work at the side rather than directly ahead).

Postural constraint in standing homemakers can be relieved by providing stools to enable them to rest during quiet periods or to alternate between sitting and standing. Adequate space for the feet should be provided to permit homemaker to change the position of their feet.

### 1.6 Different brands and companies of the kitchen sinks

The list of manufactures available in the market was made through market survey. Their branches are also available at Vadodara in different areas such as Jetalpur road, Atladara. At Jetalpur road there are two showrooms dealing with Nirali sinks, Carysil sinks, Frankie sinks, Neelkanth sinks. The main branches of manufacturing companies of Nirali kitchen sinks are located at Mumbai, Delhi and Carysil kitchen sinks are located at Bhavnagar-Rajkot, Ahmedabad, Delhi, Mumbai, and Bangalore. (Vadodara, 2013)

I.	Cera kitchen sinks	II.	Carysil sinks
III.	Anupam sink	IV.	Nirali sinks
V.	Kaff kitchen sinks	VI.	Jayna sinks
VII.	Frankie	VIII.	Neelkanth

### 1.7 Types of the kitchen sinks

There are different types of kitchen sink which are available in different brands and companies. The survey was done and the information was gathered. The kitchen sinks are available in two ranges (1) Premium range, in this range two types of kitchen sinks are available; (2) Classic range, in this range four types are available. The types are further divided into different pattern and have different features<sup>10</sup>.



Fig 1: Type of kitchen sinks in different range

## I. PREMIUM RANGE

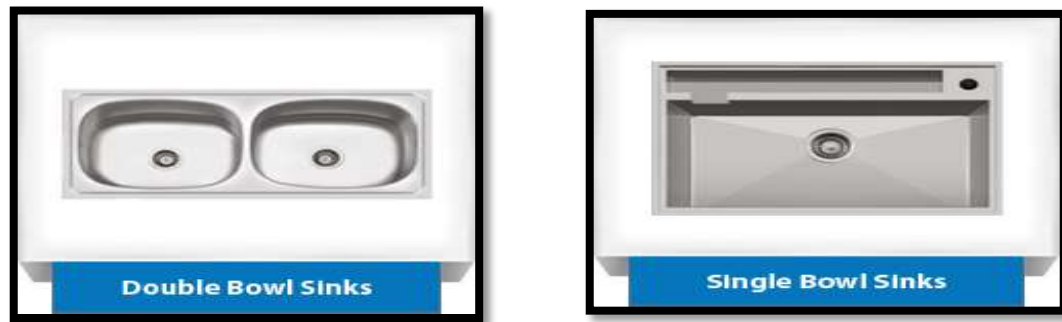








Fig 2: Two types of kitchen sinks available in premium

**Table1. First type of kitchen sinks with their names and features available in Premium range.**

In this the details are there regarding double bowl sinks of premium range.



Sr. No	Types of Double Bowls	Features
1	<b>CALVERT</b> 	Double bowl sink 815 x 440 mm (32" x 17.5") Cut-out dimension 787 x 412 mm (31" x 16.25") Depth: 230 mm (9") Installation: Under mount
2	<b>CARSON</b> 	Double bowl sink 819 x 457 mm (32.25" x 18") Cut-out dimension 789 x 427 mm (31" x 17") Depth: 229 mm (9") Installation: Under mount
3	<b>CRIZ</b> 	Double bowl corner sink with drain board and waste bin Depth: 200 mm (8") Installation: Top mount with installation clips






Sr. No	Types of Double Bowls	Features
4	<b>COTLEY</b> 	Double bowl sink with drain board 970 x 480 mm (38.25" x 19") Cut-out dimension 950 x 460 mm (37.5" x 18.25") Depth: 215 mm (8.5") Installation: Top mount with installation clips
5	<b>CLYME</b> 	Double bowl sink with drain board and waste bin 960 x 485 mm (38" x 19") Cut-out dimension 940 x 467 mm (37" x 18.5") Depth: 197 mm (7.75") Installation: Top mount with installation clips
6	<b>CLORIA (Gloss)</b> 	Depth: 190 mm (7.7") Installation: Top mount with installation clips Double bowl sink with single drain board 1268 x 468 mm (50" x 18.5") Cut-out Dimension 1242 X 442 mm (49" x 17.5")

**Table2. Second type of kitchen sinks with their names and features available in Premium range.**

In this the details are there regarding single bowl sinks of premium range.

Sr. No	Types of Single Bowls	Features
1	<b>CANNING</b> 	Single bowl sink 670 x 484 mm (26.5" x 19") Cut-out dimension 648 x 463 mm (25.5" x 18.25") Depth: 220 mm (8.5") Installation: Under mount and top mount with installation clips*
2	<b>CUTLER</b> 	Single bowl sink 820 x 520 mm (32.25" x 20.5") Cut-out dimension 800 x 500 mm (31.5" x 19.6") Depth: 216 mm (8.5") Installation: Top mount with installation clips

Sr. No	Types of Single Bowls	Features
3	<b>CADDO</b> 	Single bowl sink 570 x 450 mm (22.5" x 17.75") Cut-out dimension 535 x 415 mm (21" x 16.5") Depth: 220 mm (8.5") Installation: Under mount
4	<b>CHAZY</b> 	Single bowl sink 800 x 500 mm (31.5" x 19.75") Cut-out dimension 774 x 474 mm (30.5" x 18.75") Depth: 215 mm (8.5") Installation: Top mount with installation clips
5	<b>COMAL</b> 	Single bowl sink with drain board and waste bin 778 x 482 mm (30.75" x 19") Cut-out dimension 758 x 462 mm (30" x 18.25") Depth: 210 mm (8.25") Installation: Top mount with installation clip





## II. CLASSIC RANGE



Fig 3: Four types of kitchen sinks available in classic range.


**Table3. First type of kitchen sinks with their names and features available in Classic range.**








In this the details are there regarding double bowl sinks with drain board of classic range.

Sr. No	Double bowl sinks with drain board	Features
1	<p><b>SUPER JUMBO (Gloss)</b></p> 	<p>Double bowl sink with drain board 1210 x 510 mm (48" x 20") Depth: 200 mm (8") Installation: Counter top with installation kits</p>
2	<p><b>SUPER JUMBO (Matt)</b></p> 	<p>Double bowl sink with drain board 1210 x 510 mm (48" x 20") Depth: 200 mm (8") Installation: Counter top with installation kits</p>
3	<p><b>JUMBO NCKS 314(Gloss)</b></p> 	<p>Double bowl sink with drain board 1156 x 533 mm (45.5" x 20.5") Depth: 205 mm (8") Installation: Over mount</p>
4	<p><b>JUMBO NCKS 314 (Matt)</b></p> 	<p>Double bowl sink with drain board 1156 x 533 mm (45.5" x 20.5") Depth: 205 mm (8") Installation: Over mount</p>

**Table 4: Second type of kitchen sinks with their names and features available in Classic range.**






In this the details are there regarding double bowl sinks of classic range.







Sr. No.	Double bowl sinks	Features
1	<p><b>DELUX (Matt)</b></p> 	<p>Double bowl sink 1155 x 515 mm (45.5" x 20.5") Depth: 250 mm (10")</p>



Sr. No.	Double bowl sinks	Features
2	<b>Delux NCKS 312(Matt)</b> 	Double bowl sink 1155 x 515 mm (45.5" x 20.5") Depth: 205 mm (8") Installation: Over mount
3	<b>OPUS (Matt)</b> 	Double bowl sink 1000 x 510 mm (40" x 20") Depth: 205 mm (8") Installation: Over mount
4	<b>KING (Matt)</b> 	Double bowl sink 940 x 490 mm (37" x 19.25") Depth: 205 mm (8") Installation: Over mount
5	<b>DELUX (Gloss)</b> 	Double bowl sink 1155 x 515 mm (45.5" x 20.5") Depth: 250 mm (10")
6	<b>Delux NCKS 312 (Gloss)</b> 	Double bowl sink 1155 x 515 mm (45.5" x 20.5") Depth: 205 mm (8") Installation: Over mount
7	<b>KING (Gloss)</b> 	Double bowl sink 940 x 490 mm (37" x 19.25") Depth: 205 mm (8") Installation: Over mount
8	<b>OPUS (Gloss)</b> 	Double bowl sink 1000 x 510 mm (40" x 20") Depth: 205 mm (8") Installation: Over mount

**Table 5: Third type of kitchen sinks with their names and features available in Classic range.**

In this the details are there regarding single bowl sinks of classic range.



Sr. No.	Type of Single bowl sinks	Features
1	<b>COSSET NCKS 116A (Matt)</b> 	Single bowl sink 600 x 500 mm (24" x 20") Depth: 255 mm (10")
2	<b>COSSET NCKS 116(Matt)</b> 	Single bowl sink 600 x 500 mm (24" x 20") Depth: 205 mm (8") Installation: Over mount
3	<b>QUEEN NCKS 111A(Matt)</b> 	Single bowl sink 610 x 460 mm (24" x 18") Depth: 250 mm (10")
4	<b>QUEEN NCKS 111(Matt)</b> 	Single bowl sink 610 x 460 mm (24" x 18") Depth: 205 mm (8") Installation: Over mount
5	<b>MAPLE NCKS 115(Matt)</b> 	Single bowl sink 535 x 460 mm (21" x 18") Depth: 205 mm (8") Installation: Over mount



Sr. No.	Type of Single bowl sinks	Features
6	<b>LILAC NCKS 113(Matt)</b> 	Single bowl sink 510 x 430 mm (20" x 17") Depth: 205 mm (8") Installation: Over mount
7	<b>DAISY NCKS 112(Matt)</b> 	Single bowl sink 460 x 405 mm (18" x 16") Depth: 180 mm (7") Installation: Over mount
8	<b>COSSET (Gloss)</b> 	Single bowl sink 600 x 500 mm (24" x 20") Depth: 255 mm (10")
9	<b>COSSET NCKS 116(Gloss)</b> 	Single bowl sink 600 x 500 mm (24" x 20") Depth: 205 mm (8") Installation: Over mount
10	<b>QUEEN NCKS 111A(Gloss)</b> 	Single bowl sink 610 x 460 mm (24" x 18") Depth: 250 mm (10")
11	<b>QUEEN NCKS 111(Gloss)</b> 	Single bowl sink 610 x 460 mm (24" x 18") Depth: 205 mm (8") Installation: Over mount

Sr. No.	Type of Single bowl sinks	Features
12	<b>MAPLE (Gloss)</b> 	Single bowl sink 535 x 460 mm (21" x 18") Depth: 205 mm (8") Installation: Over mount
13	<b>LILAC (Gloss)</b> 	Single bowl sink 510 x 430 mm (20" x 17") Depth: 205 mm (8") Installation: Over mount

**Table 6: Fourth type of kitchen sinks with their names and features available in Classic range.**

In this the details are there regarding single bowl sinks with drain board of classic range.

Sr. No.	Types of Single bowl sinks with drain board	Features
1	<b>JUMBO NCKS 213A(Matt)</b> 	Single bowl sink with drain board 1155 x 515 mm (45.5" x 20.5") Depth: 250 mm (10")
2	<b>CELEBRITY JUNIOR (Matt)</b> 	Single bowl sink with drain board 810 x 455 mm (32" x 18") Depth: 205 mm (8") Installation: Over mount

Sr. No.	Types of Single bowl sinks with drain board	Features
3	<p><b>JUMBO NCKS 213A(Gloss)</b></p> 	<p>Single bowl sink with drain board 1155 x 515 mm (45.5" x 20.5") Depth: 250 mm (10")</p>
4	<p><b>CELEBRITY (Gloss)</b></p> 	<p>Single bowl sink with drain board 940 x 465 mm (37" x 18") Depth: 205 mm (8") Installation: Over mount</p>

### 1.8 Type of Installation of kitchen sinks

There are basically three types of installation for kitchen sinks. They are installed according to the need and demand of the house owner. The following are the types of installation for kitchen sinks

- a) Self-rimming (drop-in)
  - b) Under-mount
  - c) Flush mount
- a) **Self-rimming** or drop-in sinks is the easiest method for installing sinks. They simply fit into a cutout in the countertop on top of a base cabinet, supported by the flanges of the sink that overlap the cutout<sup>11</sup>. The main disadvantage is the barrier between the countertop surface and the bowl that's formed by the lip. Sweeping of food and liquids into the sink becomes difficult as it catch up the waste at the edge where the sink and countertop meet<sup>11</sup>.



Fig 4: Self rimming sink



- b) **Under-mount** sinks are attached under the countertop. They either hang from the underside of the countertop or are supported from underneath by the base cabinet structure. Under-mount sinks allow sweeping items from the countertop directly into the sink without any "catch points" that can capture food particles and moisture. They require clips and other mechanical fastening devices to attach them to the countertop. Heavier kitchen sinks like ones made from stone require a well-designed mounting system in an under-mount installation<sup>11</sup>.

A solid surface sink combined with a solid surface countertop is another form of under-mount sink. In this situation the sink is glued to the underside of the solid surface countertop, the fabricator then smoothes the joint between the two surfaces making the seam between them invisible. An under-mount sink's "reveal" refers to the degree that the countertop extends over the edge of the sink. A positive reveal means the rim of the sink extend out slightly from the edge of the countertop. A negative reveal means the countertop surface overlaps the edge of the sink<sup>11</sup>.



Fig 5: Under-mount

- c) **Flush mount** sinks are also called "tile edge" sinks. They're similar to a drop-in sink except they're used with a tiled countertop. The tile is installed so that it's flush with the mounting flange of the sink providing a flush surface with the countertop. There's usually a grout line between the edge of the sink and the tile<sup>11</sup>.



Fig 6: Flush mount sink

### 1.9 Different materials of the kitchen sinks

Kitchen sinks are available in different materials like marble, Kota stone, granite and stainless steel. One of the old materials for kitchen sinks that has become new again is stone. Depending on the type of stone used and the care it receives, the sink can last for longer period of time. High-end farmhouse sinks in the early 1900's were often constructed of limestone, but today the more popular options are Kota and Granite. The other type of natural stone sometimes used for kitchen sinks is marble, though it's expensive makes it less affordable than some of the other choices. Now-a-day stainless steel has replaced stone as it is available in different types and features including the facility of drain board. Following are the different materials of kitchen sink<sup>12</sup>.

#### Stone kitchen sinks

Stone kitchen sinks are not readily available in the local market but it can be customized. The following are the advantages of the stone kitchen sinks<sup>12</sup>.

#### Advantages of stone kitchen sinks

There are many advantages of stone kitchen sinks, Stone sinks are usually carved out of a solid piece of stone, which means no seams to pull apart or to catch crumbs and dirt in. They are heavily polished and easy to clean. If it is properly sealed with a stone sealant, they are non-porous and will not stain. Stone is also a very hard to chip and is a non-conducting material, making it practically heatproof<sup>12</sup>.

#### Disadvantages of stone kitchen sinks

The disadvantage to stone kitchen sinks is that if they are not sealed properly, they will not last. Stone sinks also absorbs liquids and hence it can crack, chip, and stain more easily. The other disadvantage of marble for kitchen sinks is the cost, as it is expensive<sup>12</sup>.



Marble



Granite



Kota

Fig 7: Kitchen sinks with different materials

### **Stainless Steel Kitchen Sink**

Stainless steel kitchen sinks are among the most popular fixtures for the kitchen. They're easy to clean, go with almost any countertop, and durable. They're also forgiving of rough treatment, and can stand up to many years of use<sup>12</sup>.

#### **Advantages of the stainless steel sinks**

Stainless steel sinks go with everything. Black and white appliances, different countertop and cabinet styles, and many color schemes coordinate with stainless steel kitchen sinks. stainless steel kitchen sinks are available for any budget. The price varies depending on the thickness, style, and type of sink. These sinks are durable and forgiving. Stainless steel is a top choice for people who are worried about practicality and lasting strength in a sink<sup>12</sup>.

#### **Disadvantages of the stainless steel sinks**

Stainless steel may not break, but it does scratch. Over time, the surface will develop scratches and other flaws. Because they're fairly thin, and made of metal, these sinks magnify the banging noises that occur if the tossing of dishes done in the sink. They may not be damaged by a heavy pan, but they'll still make a lot of noise. Some manufacturers include noise deadening pads or coatings to reduce this problem<sup>12</sup>.



Fig 8: Stainlesssteel kitchen sink

## Section 2 Empirical studies

The present section discusses the researches related to the different aspects of kitchen undertaken within India and outside India.

### 2.1 Studies conducted outside India

A study was conducted on “work counter surface finishes for kitchens and utility areas”, by Weaver & Everhart (1955) in U.S.A. The aim of the study was to seek the problems encountered by the homemakers in use of various materials on work counters. The method used for this study was laboratory tests to gain in-depth information regarding the aspects like staining, scratching & burning. The result of the study indicated that only laminated plastic had maximum characteristics than other materials like plastic, linoleum, vinyl, stone, tile, and aluminum. The laminated plastic was resistant to stain, heat, moisture absorption, impact, abrasion & color change. The researcher concluded that the homemaker had faced minimum problems while using laminated plastics.

Kim et al. (1960) carried out a study on “Contemporary Kitchen Design in Urban Multifamily Housing in Korea”. The purpose of the study was to explore current design characteristics of kitchen spaces in Korea urban multifamily housing. Floor plans and interior design images of 207 multifamily housing unit types were collected from web-based marketing catalogs provided by construction companies. The study investigated the design characteristics that included interior design themes, materials, and colors, space planning and applied items. Analysis of the data revealed that strong drivers for new kitchen design in Korea were increasing awareness of environments and healthy lifestyles as well as desires to fully utilize advanced technology and products for safety and convenience.

Cieraad (2002) undertook a study on “Kitchen Designers as Change Agents in Planning for Aging in Place”, to examine how kitchen designers are addressing the special needs of mature clients and assess designers’ perceptions relative to the demand for features that facilitate aging at Netherlands. Questionnaire was selected as a tool and was mailed to a nationwide random sample of 600 Certified Kitchen Designers (CKDs). Respondents’ recommendations for appliances, kitchen configurations, work surface and storage, features that compensate for reduced dexterity and low vision, and flooring generally followed literature recommendations. All though a vast majority of the designers indicated that kitchens were very important in determining whether an older person could remain independent, they infrequently incorporated “special” products or design features for mature clients. The study made conclusions about CKDs’ effectiveness as change agents centered on their knowledge of specialized kitchen design; awareness of products that meet special need; designs of individual special needs; age or disability-specific marketing; and increased activity in promoting kitchen designs that enable older people to age at Netherlands.

The study was conducted at Virginia on “Explore Your Dream Kitchen workshop” to educate the consumer on working with a designer and comparing the multitude of products available to the consumer. Planning a new kitchen was

carried by Lee et al. (2008). This article was reported on a survey of 192 participants in 13 of the workshops who actually remodeled or built a home with a new kitchen (N = 72). Descriptive findings included project cost, reasons for remodeling, professional assistance, choice of design features and products, and satisfaction with the remodeling process and product choices. Analysis of the reasons for product choice showed appearance to be an important factor, while durability and cost were less important.

In the late 1800s negative effects associated with the Industrial Revolution and subsequent urban crowding led to increased health problems and disease transmissions. This interdisciplinary study analyzed how domestic kitchen design was influenced by concerns for public health, the changing role of women, and Victorian disease theory that centered on sanitation and germs. The role of women changed during this time period from being the manager of domestic servants to becoming the provider of domestic service for their families. Public health officials advised the housewife on the best ways to maintain family health and viewed the healthy home as a means to prevent the spread of disease. Other room does not saw more changes to improve health than the kitchen. The changes were seen in overall kitchen design, furnishings, and finishes. The review of the history of kitchen design through a multidisciplinary perspective provided insight into how design concepts evolved and gave a beneficial example of an historical study to educators who desire to convey to students the importance of a comprehensive design perspective. (Vineyard and Moody, 2008)

Maguire et al. (2010) undertook a study on “The age-friendliness of kitchen”. The researchers examined people’s experience of the kitchen across the life course for older people living in a variety of accommodation both ‘ordinary’ and ‘supportive’ in urban and rural locations in England, Loughborough and Bristol. The aim of the project was to understand current issues and problems of the kitchen. An interview schedule was selected as tool for the data collection. Sample size of the study included 40 respondents. It was found that about 42 per cent of the respondents were having problems related to reaching and stretching. The other problems experienced by the respondents were related to the kitchen tasks such as shopping, food preparation, washing dishes, making a hot drink, using microwave, ironing, laundry, cleaning waste disposals/recycling.

## **2.2 Studies conducted within India**

Bhavini (1965) conducted study on, “Selection body reaches of Keymore home maker to develop guides for designing of kitchen storage and working centers”. The purpose of the study was (a) to find out maximum and normal horizontal reaches, maximum, normal and downward vertical reaches of the selected group and (b) to find out the relationship between arm length and height for the same group of the home makers. A random sample of 100 homemakers of Keymore cement works colony, Madhya Pradesh was selected. The findings of the study revealed that the range for the maximum upward vertical range reach of the respondent was 65”-73” whereas the range for maximum horizontal reach was found to be 16”-24”. The above mentioned reaches had wide range of 8” than the other reaches. The range of the arm lengths was 25”-29” which showed a little

variation among arm length of the homemakers. The range for horizontal reaches was 16"-24" which showed a great variation among horizontal reaches. The guides developed on the basis of the findings of the study included that the shelves for frequently used articles would permit ease in handling the articles if built at the height of 38" from the floor. The shelves for storage under the working counter or built in the wall would be most convenient while working in standing position. If built at the height of 25" from the floor, the topmost shelves over the working counters would reduce stretching and straining if built at the height of 62" from the floor and the depth of the counters should not exceed 21". The conclusion of the study was positive and marked relationship between arm length and height of the homemakers.

Another study was on "Development of guides for setting up the storage cabinets at the serving and cleaning centers in kitchen", in Vadodara, Gujarat. The aim of the research was to study the satisfactions and dissatisfactions of homemaker towards the storage adequacy and arrangement of each utensils, tool and container of supplies provided at the serving and cleaning center and to develop the guides for storage cabinets at the serving and cleaning centers in kitchen. An interview schedule was used for the data collection of the study. It was found that total storage space provided at the serving center on the whole was adequate. The researcher concluded that small percent of the homemakers wanted to make certain changes in the location and type of the storage. The rest of the homemakers were satisfied with the location and type of storage setup (Mitter, 1971).

For developing guides for setting up the storage cabinets at cooking and preparation centers in kitchen was conducted by Nadvi in 1971. A group of 10 homemakers of Vadodara city were selected for the present study for determining the total linear space required by the tools, utensils and containers leaving minimum convenience space between the two items. The researcher proposed the guides for storage, cooking center and preparation center. The researcher suggested measurements for different storage units at cooking and preparation center.

Raj (2008) undertook a research on "Study into Problems Faced by Punjabi Housewives While Working on Existing Kitchen Work Space". The study was conducted on 240 Punjabi women from approved and unapproved localities of Ludhiana to know the availability of kitchen work spaces in their houses, to examine suitability of these spaces and to analyze problems faced due to unsuitable work spaces. The results of the study indicated that all the users from approved locality had most of the observed workspaces where as in unapproved locality the availability of these spaces was less. Minimum availability was seen for specified work spaces in kitchen. Minimum suitability was seen with the lowest kitchen storage shelf height by users of all height categories. Maximum respondents felt that highest shelf of dish stacking and kitchen storage was 'too high' for them and their lowest kitchen storage shelves were 'too low' to handle. Few users (from short height category) agreed their sink to be 'too deep'. Some users from all height categories found their sink to be 'too wide', while on the other hand 20-40 per cent users from all height categories agreed to 'too

congested' on sink sides. One –fourth of all users 'felt pain' while working on cooking center. Very few (all height) users 'felt breathless', 'stress in neck, upper and lower back' while working on lowest kitchen storage and dish stacking shelves. The researcher also concluded that different problems were encountered by the respondents while working on the kitchen storage shelf, cooking and kneading center.

## **CONCLUSION**

In this chapter the researcher concluded that the researches conducted outside India were more focused on contemporary kitchen design, work counter surface finishes, kitchen designers as changing agents and age-friendliness of the kitchen. Studies done in India were found to be related to the body reaches of home makers, developing guide for designing kitchen storage and working counters and problem faced by the homemakers while working on kitchen workspace. The studies reviewed highlighted that majority of the studies conducted in India and outside were carried on different aspects of kitchen than on sink center. In the present study various aspects are covered related to different components of sink center. The researcher urged to understand whether new material, design and types of the sink in the kitchen lead to health problems of the homemakers or not. Hence the investigator was the concern in undertaking the present research on "Assessing kitchen sink center of middle class households of Vadodara city".

## METHODOLOGY

The purpose of the research is to discover answers to questions through the application of scientific procedures. Research methodology is a science of study how research is done systematically and scientifically (Kothari, 2012). In order to achieve the desired objectives, a systematic approach was adopted for the present study. The research design, construction of tool, sampling technique and procedure of data collection and analysis of data is described in the proceeding text.

The chapter is divided in two phase. Phase I covered the empirical orientation and Phase II included the design development of the existing and proposed sink center of middle class households of Vadodara city.

### Phase- I

The methodological procedures adopted to carry out the research work under phase are described under the following heads:

- 3.1 Research Design
- 3.2 Variables and schematic diagram
- 3.3 Operational definitions
- 3.4 Locale of the study
- 3.5 Unit of inquiry
- 3.6 Sample size and sampling procedure
- 3.7 Selection and construction of the tool
- 3.8 Description of the tool
- 3.9 Test of validity and reliability
- 3.10 Data collection
- 3.11 Data analysis

### 3.1 Research Design

A research design is arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with the scientific procedures. It consists of the specification of methods for inquiring the information needed. A descriptive study determines and reports the way things are (Kothari, 2012). The main purpose of present investigation was to assess the sink center of middle class households of Vadodara city. Thus, descriptive research design was considered most suitable for the study.

### 3.2 Variables

Any concept which can take quantitative value is called a variable. There are basically two types of variables, dependent and independent. A variable that depends upon or is a consequence of other variable is termed as dependent variable. The variable that is antecedent to the dependent variable is termed as independent variable (Kothari, 2012).

#### Independent variables

For the present study the independent variables are as follows:

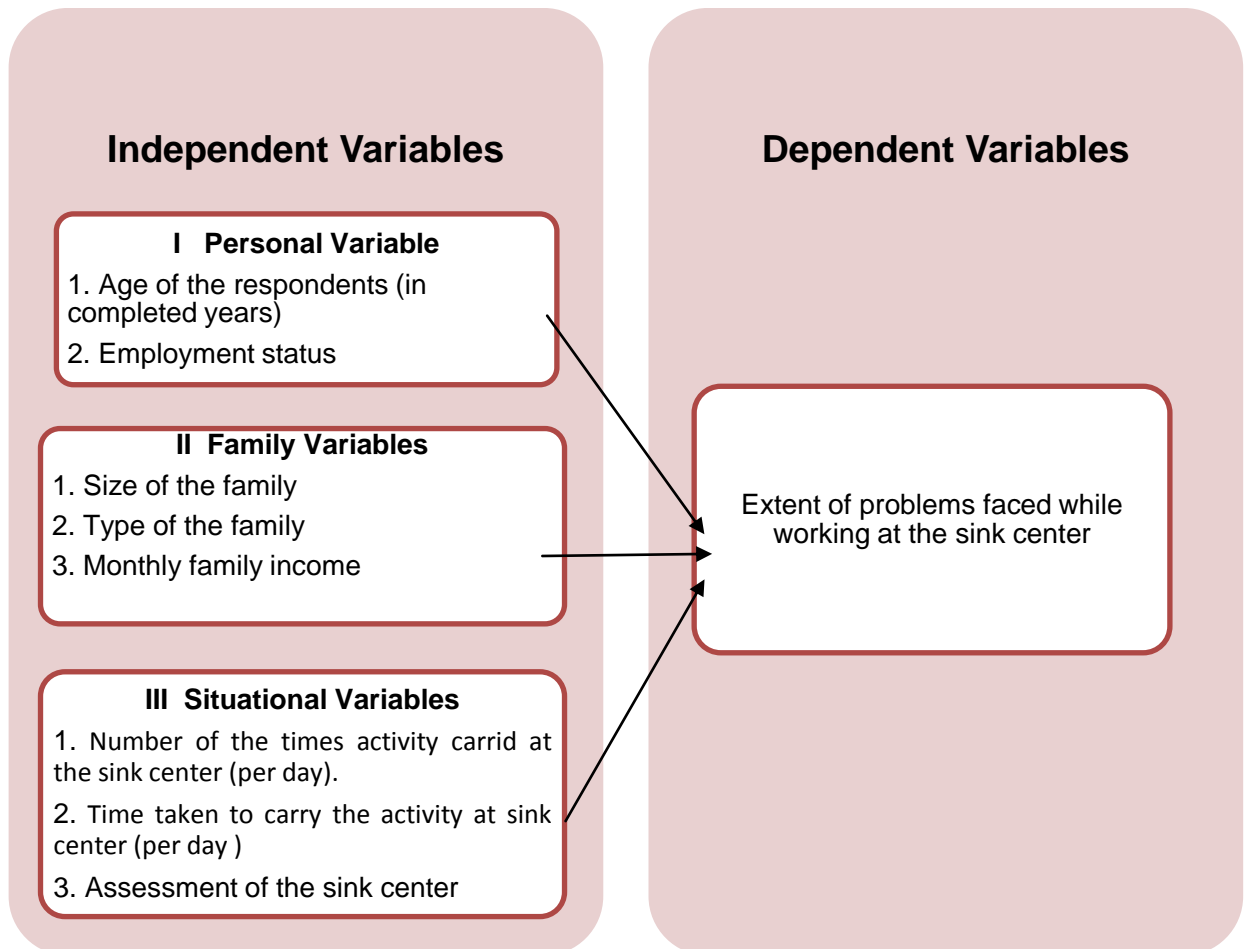


- A. Personal variables of the respondents
  - I. Age (in completed years)
  - II. Employment status
- B. Family variables of the respondents
  - I. Size of the family
  - II. Type of the family
  - III. Monthly family income (in)
- C. Situational variables
  - I. Number of the activity carried at the sink center per day.
  - II. Time taken to carry the activity at the sink center per day.
  - III. Assessment of sink center related to various aspects.

### Dependent variable

- I. Extent of problems faced by the respondents while working at the sink center.

### Schematic presentation of hypothetical relationship among the variables of the study



### 3.3 Operational definitions

**Middle income household** for the present study was the family whose income per month fell in the range of ₹ 30,000-60,000.

**Healthy** refers to those respondents who were not suffering from any physical and mental problems like pregnancy, sickness, body aches, pains, accidents and injury at the time of the data collection.

**Sink center** for the present study included the space below and above the sink, and the space on the either sides of the sink.

**Designed sink center** was the one which was designed considering the anthropometric measurements of the homemaker.

**Assessment of the sink center** for the present study was carried based on whether various aspects related to sink center were appropriate or inappropriate that were judged against the recommended with in statements of the sink center

### 3.4 Locale of the study

Vadodara city is governed by Municipal Corporation which comes under Vadodara Metropolitan region. The Vadodara city is located in western part of Gujarat State of India. According to Indian Census 2011 the population of Vadodara was 1,666,703; of which male and female were 866,701 and 800,002 respectively<sup>1</sup>. The present study was conducted in different areas like Gorwa, Vasna, Subhanpura, Manjalpur and Maneja-Makarpura of Vadodara city, Gujarat State.

### 3.5 Unit of Inquiry

The home makers of selected middle income group of Vadodara city were the unit of inquiry who were performing the task of dish washing at the sink center of their kitchen.

### 3.6 Sampling size and Sampling Procedure

**3.6.1 Sampling size** constituted 60 homemakers of Middle Income Group of Vadodara City.

**3.6.2 Sampling procedure** the samples for the present study were selected through snowball method. The samples were approached through the known contacts of the researcher and her friends. The sample that showed their willing for extending their co-operation in the research was selected as samples of the present research. The other criteria for the selection of the respondents included that they must be doing the dishwashing activity on their sinks only those households were selected for the present research those who had constructed the sink center on their own in their houses.

### 3.7 Selection and Construction of the tool

Two tools were used to carry out the present investigation. The first was interview schedule and the second was observation sheet. An interview schedule was selected as a tool to collect the data of the study because of the following reasons:

1. The queries of the respondents can be solved at the spot only.
2. The face to face contact with the respondents assist in building good support.
3. It ensure complete data.
4. The Personal information can obtain easily taking the respondents in confidence.
5. The misinterpretation can be avoided as the information required can be asked in time with the understanding of the interviewee.

The observation sheet was selected as a second tool to assess the existing status of sink center of middle class households of Vadodara city. It was selected because:

1. The investigator get the exact status of the existing condition.
2. The subjective biasness is eliminated in this method.
3. The researcher can record observed information correctly and systematically on a sheet.
4. It is a direct and speedy method of collecting the information (Kothari, 2012).

### 3.8 Description of the tools

Interview schedule and observation sheet were selected as tools for the present study. The tools were constructed on the basis of given objectives and hypothesis of the present study. The detailed description of the tools is given below:

#### Tool - 1

The Interview Schedule comprised of the following four sections:

**Section 1** covered the information on the background data of the respondents. It included personal data and family data of the respondents including their age in completed years, occupational status of the respondents, type of the family, size of the family and income of the family per month( in `).

**Section 2** dealt with the information related to the activities carried at sink center. It included the type of activity carried at sink center, number of times the activity was carried and time taken to carry the activity in a day.

**Section 3** collected the information regarding the problems faced by the respondents while working at the sink center.

**Section 4** included open structured questions inviting suggestions from the respondents regarding the design aspect of their sink center.

**Tool -2**

The observation sheet as a second tool collected the detailed information regarding the existing status of the sink center of middle class households of Vadodara City, with a purpose to assess the sink center of the respondents related to various aspects.

**3.9 Test of validity and reliability of the tool****3.9.1 Establishment of content validity**

Validity indicates the degree to which a tool measures what it is supposed to measure (Kothari, 2012). The tool of the present research was subjected to establishment of content validity. To establish the content validity the tool was given to a panel of seven judges comprising of experts from Faculty of Family and Community Sciences and practicing Architects of Vadodara city. The judges were requested to judge whether the content in the tool was relevant, irrelevant, clear and ambiguous complying the objectives of the research.

**3.9.1.1 Problem scale**

It was the tool that covered 33 items depicting different nature of problems faced by the respondents while working on the sink. The three point continuum was used to obtain the response on respondents which was scored as 1 “to no extent”, 2 “to moderate extent”, 3 “to high extent”. The responses of the experts were analyzed. The content of the tool and items in the problem scale that had 80 per cent or more agreement by the experts were selected for its final execution in the present research.

**3.9.2 Test for Reliability**

Reliability is the accuracy or precision of a measuring instrument (Kothari, 2012). Thus, the reliability of the tool was judged for the present study.

**3.9.3 Pretesting** of the scale was done on 30 non sampled respondents selected from Vadodara city.

**3.9.4 Establishment of Reliability of the problem scale**

Guttman Split-Half Coefficient method was used to establish reliability of the problem scale for the present study. The method was considered to be good. The first half had odd number of statements and second half had even number of statements. The scores of the first half of the test were correlated with scores on the second half of the test. The SPSS 15 software was used to compute the value of problem scale.

<u>Scale</u>	<u>“r” value</u>
Extent of problem faced by the respondents while working at the sink	0.701

center.

### 3.10 Data Collection

The data was collected through personal interviewing the respondents and observations made by the investigator. The rapport building was developed before initiating to collect data from the selected samples. On an average an interview continued for 20-30 minutes with each respondent. The interviews were conducted during the period of December-January 2013-14.

### 3.11 Data Analysis

The procedure of analyzing the data comprised of categorization, coding, tabulation and statistical analysis.

#### **Categorization**

Categories were made to enable the researcher for further analysis of the data. The categories were made as follows:

1. Age of the respondents  
Age referred to the number of years completed by the respondents at the time of data collection. It was categorized as:  
24-34 years  
35-44 years  
≥45 years
2. Employment status of the respondents  
Employment status of the respondents was categorized into two as:  
Employed  
Not employed
3. Size of the family was categorized as:  
Small (2-4 members)  
Large (5-6 members)
4. Type of the family was categorized into:  
Joint family and  
Nuclear family
5. Income of the family per month  
It was categorized as follows:  
₹ <30,000  
₹ 30,001 – 40,000  
₹ 40,001 – 50,000  
₹ 50,000 – 60,000
6. Number of times the activity was carried at the sink center per day by the respondents was divided into the following categories:  
2 – 4 times  
5 – 8 times  
≥9 times

7. Time spent in carrying out the activity at the sink center per day was categorized as follows:
- 10 – 30 minutes
  - 31– 60 minutes
  - 61– 90 minutes
  - ≥91 minutes
11. Extent of problems faced by the respondents while working at the sink center was categorized as:

	<u>Scores</u>
To high extent	3
To moderate extent	2
To no extent	1

In order to have in-depth analysis related to the problem faced by the responses was categorized into two as:

	<u>Score range</u>
To high level	1.29-2.00
To low level	1.00-1.28
(Mean score 1.09)	

**Coding:** The data were transferred to coding sheet after being categorized. For doing so, the coding plan was developed by the researcher and appropriate numbers were assigned to all the items and responses.

**Tabulation:** The data were tabulated from the coding sheet into a tabular form for arriving at the frequencies and percentages for analyzing the data.

**Statistical Analysis:** The descriptive statistics was used to analyses the data for the frequency, percentage, mean and standard deviation. Relational statistics like ANOVA test, “t” test and correlation of coefficient was computed to test the hypotheses.

‘Analysis of the Variance’ was computed for the selected independent variables like age of the respondents and the monthly family income of the respondents with the extent of problems faced by the respondents while working at the sink center.

‘t’ test was completed to find out the mean difference between groups of the type and size of the family with the extent of problems faced by the respondents while working at sink center.

Co-efficient of correlation was computed to find out the relationship between the extent of problems faced by the respondents while working at the sink center and the number of activities carried, time taken to carry the activity at the sink center per day and assessment of the sink center related to various aspects.

## Phase II

The design development in phase II focused mainly on two aspects of design that is:

- a) Re-designing of the sink centers for the selected middle class households of Vadodara City.
- b) Working drawing
  - a) The re-designing of the sink center for three selected households ranked in descending order of problems faced by them on the problem. The design aspects that were considered while re-designing the sink center included
    - Total height of the center from floor level to the counter top.
    - Width of the sink from front to back
    - Length of the sink from left to right
    - Depth of the sink from top to bottom
    - Depth of the counter top from front to back
    - Thickness of the rim of the sink
    - Space on the right and left side of the sink
    - Width of the front barrier
    - Fall of water flow in the sink
    - Height of the faucet and shape of the sink

The re-designing was also based on the related anthropometric data of the three respondents.

- b) Working drawings

The schedule of drawings for the existing and proposed sink center will be as follows:

Sr.No	Drawings title	No. of Drawings
1	Existing floor plan of the selected kitchen	3
2	Proposed modified floor plan of the selected kitchen sink center	3
3	Front elevation of the existing kitchen sink center	3
4	Front elevation of the proposed kitchen sink center	3
5	3D view of the proposed kitchen sink center.	6
<b>Total</b>		<b>18</b>

In order to make the drawings related sink center, the support of “**AUTO CAD**” and “**GOOGLE SKETCH UP**” was taken by the researcher. The architectural scale in default was used for the present study.

## FINDINGS AND DISCUSSION

The data was collected through interview schedule and observation sheet to obtain the findings of the present study which are presented in this chapter. The findings are supported by relevant discussions and interpretations.

This chapter is discussed in two phases. Phase I covered the empirical data whereas Phase II included the design development of the existing and the proposed sink center of middle class households of Vadodara city.

### Phase I

It included the findings based on interview schedule and observation sheet. That covered demographic data of the respondents, information related to the activities carried at the sink center, extent of the problems faced by the respondents while working on the sink center, suggestions given by the respondents regarding different aspects of the sink center and testing of hypothesis as mentioned bellow.

Section 1- Demographic data of the respondents

Section 2- Information related to the activities carried at the sink center

Section 3- Extent of problems faced by the respondents while working at the sink center

Section 4- Assessment of the sink center

Section 5- Suggestions given by the respondents regarding different aspects of the sink center

Section 6- Testing of hypotheses



## Section 1

### 4.1 Demographic data of the respondents

Section 1 included findings related to the personal variables i.e. age of the respondents, employment status of the respondents, and family variable viz type of the family, size of the family and the family income of the respondents per month.

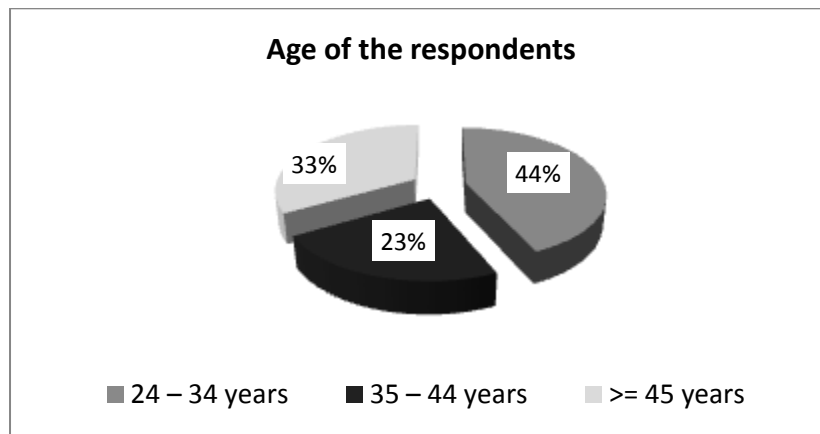
#### 4.1.1 Age of the respondents (in completed years)

The data revealed in table 7 highlighted that a higher percentage of the respondents (44 per cent) belonged to the age group of 24-34 years. A little less than one-fourth (23.0 per cent) of the respondents belonged to the age group of 35-44 years.

**Table 7: Distribution of the respondents according to their age**

Age (in years)	Respondent (n=60)	
	f	%
24 – 34	26	44.00
35 – 44	14	23.00
>= 45 and above	20	33.00
<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Mean</b>	<b>38.00 years</b>	
<b>SD</b>	<b>9.38</b>	

One-third of the respondents (33.0 per cent) were aged 45 years and above. The mean age of the respondents was 38 years (fig. 9).



**Figure 9: Age of the respondents (in completed years)**

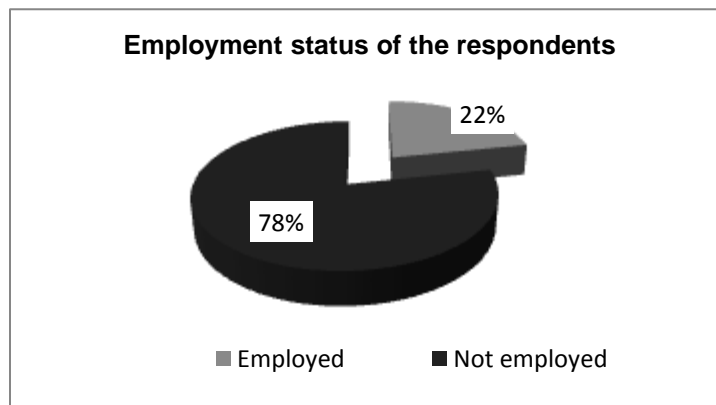
#### 4.1.2 Employment status of the respondents

According to table 8, (fig. 10) the majority of the respondents (78.0 per cent) were not employed. A little less than one-fourth of the respondents (22.0 per cent) were found to be employed.

**Table 8: Distribution of the respondents according to their employment status**

Employment Status	Respondent (n=60)	
	f	%
Employed	13	22.0
Not employed	47	78.0
Total	60	100.0

Of the total 13 respondents who were employed, three of them were employed in a Private office, 6 of them were the school teachers and the other 4 were employed in Government sector.



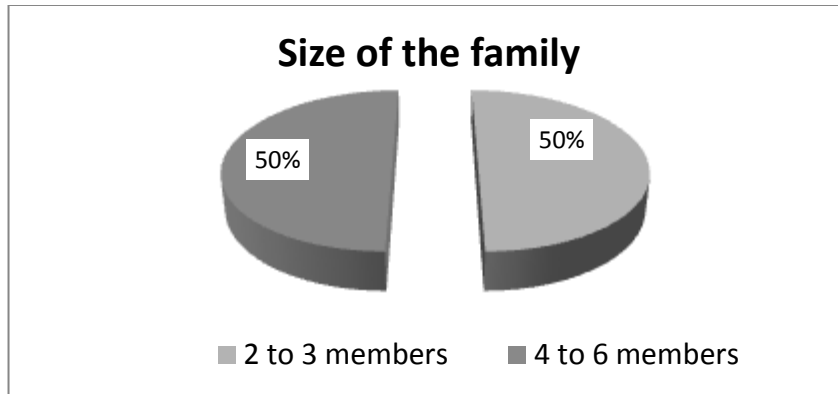
**Figure 10: Employment status of the respondents**

#### 4.1.3 Size of the family of the respondents

Table 9 (fig. 11) highlighted that one-half of the respondents were having small size of the family with 2-3 members in their family where as another one-half were having large family size with 4-6 members in their family.

**Table 9: Distribution of the respondents according to their family size**

Size of family	Respondent (n=60)	
	f	%
Small (2 to 3 members)	30	50.0
Large (4 to 6 members)	30	50.0
<b>Total</b>	<b>60</b>	<b>100.0</b>



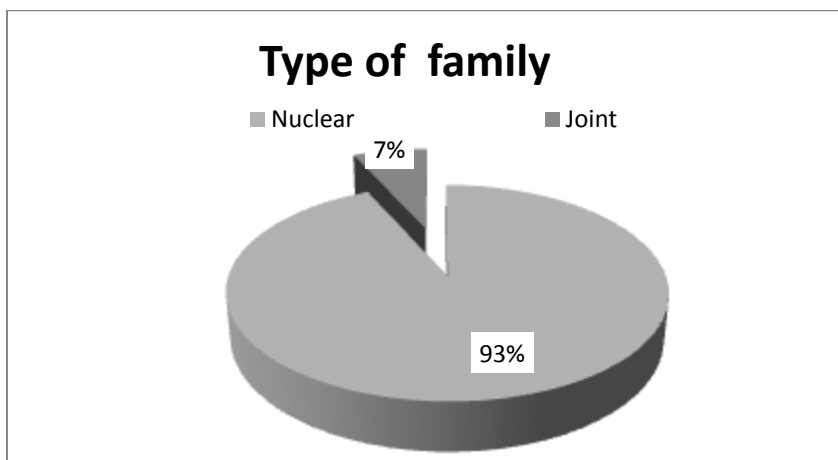
**Figure 11: Family size of the respondents**

**4.1.4 Type of the family of the respondents**

The findings of the table 10 (fig. 12) examined that majority of the respondents (93.0 per cent) were residing in nuclear type of the family. Very few (7.0 per cent) were living in joint family.

**Table 10: Distribution of the respondents according to their family type**

Type of family	Respondent (n=60)	
	f	%
Nuclear	56	93.0
Joint	04	07.0
<b>Total</b>	<b>60</b>	<b>100.0</b>



**Figure 12: Type of family of the respondents**

**4.1.5 Monthly Family income of the respondents**

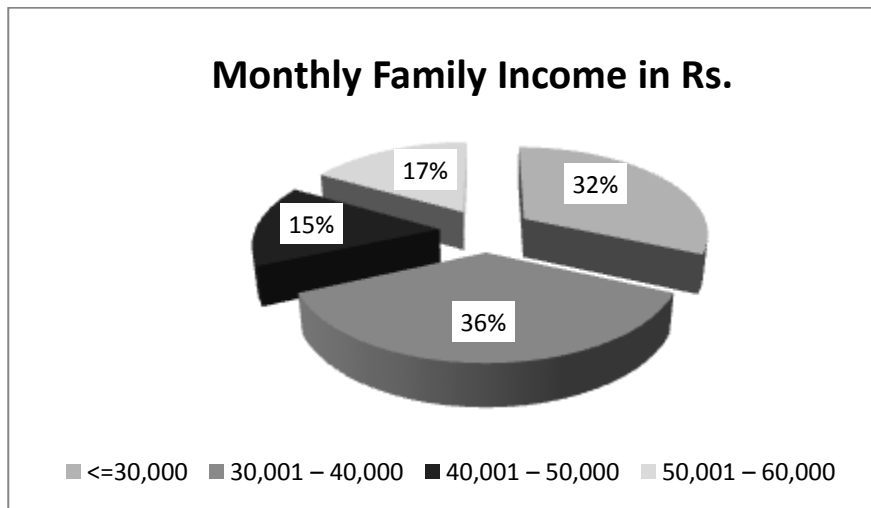
As shown in table 11 (fig. 13) a higher percentages of the respondents were (36.0 per cent) were having their monthly income in the range of `30000-40000

whereas nearly one-third of them (32.0 per cent) were earning less or equal to Rs.30000 per month.

**Table 11: Distribution of the respondents according to their family income per month**

Family income per month in ₹	Respondent (n=60)	
	f	%
30,000	19	32.0
30,001 – 40,000	22	36.0
40,001 – 50,000	09	15.0
50,001 – 60,000	10	17.0
<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Mean</b>	<b>₹ 40133.33</b>	
<b>SD</b>	<b>₹ 10212.10</b>	

Slightly less than one-tenth of the respondents (17.0 per cent) were earning about ` 50, 000 per month. The mean income of the family was ` 40133.03 per month.



**Figure 13: Family income per month**

## Section 2

### 4.2 Information related to the activities carried at the sink center

Section 2 present findings related to the activities carried by the respondents at the sink center in general. It also included the findings related to number of times activity is carried and time taken to carry out the activity at the sink center per day.

#### 4.2.1 Activities carried at the sink center

The respondents reported to carry out three major activities at their sink center i.e. washing of the dishes, washing of food items and cleaning of the sink center.

#### 4.2.2 Numbers of times activity carried per day

An in-depth probe was made to find out the number of times the activity was carried by the respondents in a day. Table 12 revealed that the activities like washing of food items were done 2-4 times by the majority of the respondents (73.3 per cent), daily. One fourth of the respondents carried the same activity for 5-8 times per day whereas very few respondents (1.7 per cent) did it for more or equal to 8 times per day. Washing of dishes was done 2-4 times per day by the majority (95.0 per cent) of the respondents (5.0 per cent) whereas very few respondents did the same activity for 5-8 times daily. Cleaning of the centers was also done 2-4 times per day by the majority of the respondents (95.0 per cent) per day. Very few of the respondents (5.0 per cent) reported to carry the same activity for 5-8 times in a day.

**Table 12: Distribution of the respondents according to number of times activity carried at the sink center per day**

Number of times activity carried per day	Respondent (n=60)	
	f	%
Washing of food items		
2- 4 times	44	73.3
5 – 8 times	15	25.0
>= 9 times	01	01.7
<b>Mean</b>	<b>3.73 times</b>	
Washing of dishes		
2- 4 times	57	95.0
5 – 8 times	03	05.0
>= 9 times	00	00.0
<b>Mean</b>	<b>3.00 times</b>	
Cleaning of the sink center		
2- 4 times	57	95.0
5 – 8 times	03	05.0
>= 9 times	0	0
<b>Mean</b>	<b>3.36 times</b>	

While comparing the data on the mean number of time the activity was carried by the respondents, it was found that washing of food times was comparatively done more number of times at the sink center by the respondents compared to cleaning of the sink center and washing of the dishes (Table 12).

#### 4.2.3 Time taken to carry out the activity at the sink center per day

While the data was examining in the data in Table 13 it was found that, little less than one half of the respondents (48.3 per cent) took 15-20 minutes for washing of food items and cleaning of the centers per day (48.3 per cent) whereas nearly most of little more than half (58.3 per cent) of the respondents (58.0 per cent) took 30-60 minutes for washing of the dishes per day.

**Table 13: Distribution of the respondents according to time spent in carrying out the activity per day at the sink center**

Time taken to carry the activity per day ( in minutes)	Respondent (n=60)	
	F	%
<b>Washing of food items</b>		
5 -10	05	8.4
11 – 15	23	38.3
16-20	29	48.3
20 – 25	03	5.0
>= 26	00	0
<b>Mean</b>	<b>15.21 minutes</b>	
<b>Washing of dishes</b>		
10-30	35	58.3
31-60	21	35.0
61-90	03	05.0
>=91	01	01.7
<b>Mean</b>	<b>31.28 minutes</b>	
<b>Cleaning of the sink centers</b>		
05 – 10	03	05.0
11 – 15	11	18.3
16 – 20	29	48.3
21 – 25	07	11.7
>=26	10	16.7
<b>Mean</b>	<b>18.65 minutes</b>	

A comparative review on the mean time taken to carry the activity at the sink center by the respondents clearly made it evident that washing of dishes consumed more time as compared to cleaning of the sink center and washing of food items (Table 13).

### Section 3

#### **4.3 Extent of problems faced by the respondents while working at the sink center**

The section describes the extent of problems faced by the respondent's concised under five categories viz: Pain in body and its parts, inappropriate dimensions of the sink, maintaining appropriate posture, availability of lighting and insufficient space at their sink center. The discussion about each follows in the proceeding paragraphs:

##### **4.3.1 Effects on body and its parts**

The data in table 14 clearly highlighted that a comparatively higher percentage of the respondents reported to experience tiredness after the task performed at the sink center (66.7 per cent), pain in their waist (53.3 per cent), pain in their lower back (51.7 per cent), and pain in their ankles/ feet (46.7 per cent) to moderate extent while working at their sink center. The findings revealed that majority of the respondents did not experience pain in their elbows, upper back, wrist/ hand, shoulders, knees and neck while carrying at their sink center.

##### **4.3.2 Inappropriate dimensions of the sink**

While reviewing the data under the above category it is very much evident that majority of the respondents experienced discomfort while working on the sink center due to splashing of water (table 14). The second problem in the rank order based on weighted mean scores obtained was reported to be discomfort arising in work due to more width of front barrier of the sink followed by discomfort arising in work due to more depth of the sink bowl. The least problems faced by the respondents were reported to be regarding the opening of the faucet/tap while working on the sink center.

##### **4.3.3 Maintaining appropriate posture**

The findings in this category pointed that majority of the respondents (73.3 per cent) faced the problem of bending their body forward while working on their sink center to moderate extent. At the same time majority of the respondents did not report to face problems regarding the twisting of their body while working at the sink center (table 14).

##### **4.3.4 Availability of lighting at the sink center**

The problems faced by the respondents related to the availability of lighting at the sink center was not found to be prominent as majority of the respondents reported to have sufficient natural and artificial light with no glare arising from these lights. However, only 26.7 per cent of the respondents faced the problem of insufficient natural light at their sink center to moderate extent. Only one respondent was facing the problem of insufficient natural light at the sink center to high extent. One respondent reported to suffer to great extent from glare arising from natural artificial light at the sink center (table 14).

#### 4.3.5 Provision of space at the sink center

While probing the data on the problems faced by the respondents for provision of space at the sink center it was found that the respondents faced the problem of less space of the left side of the sink (43.3 per cent), right side of the sink (45.0 per cent), small size of the sink (36.7 per cent) and no space to keep the washing detergents (20 per cent) to moderate extent (table 14).

**Table 14: Distribution of the respondents according to the problems faced by the respondents while working at the sink center**

Sr. No	Problems faced while working at the sink center	Respondent (n=60)						Weighted mean scores out of 3
		Extent of problem faced						
		To high extent		To moderate extent		To no extent		
		f	%	f	%	f	%	
A	<b>Pain in body parts</b>							
1	Tiredness experienced during the task.	0	0	17	28.3	43	71.6	1.28
2	Tiredness experienced after the task.	4	6.7	40	66.7	16	26.6	1.8
3	Pain in the Neck.	1	1.7	13	21.7	46	76.6	1.25
4	Pain in the upper back.	1	1.7	4	6.7	55	91.6	1.1
5	Pain in the lower back.	2	3.3	31	51.7	27	45.0	1.58
6	Pain in the waist.	2	3.3	32	53.3	26	43.3	1.6
7	Pain in the shoulders.	1	1.7	10	16.7	49	81.7	1.2
8	Pain in the elbow.	2	3.3	3	5	55	91.7	1.12
9	Pain in the wrist/hand.	1	1.7	7	11.7	52	86.7	1.15
10	Pain in the knees.	2	3.3	11	18.3	47	78.3	1.25
11	Pain in the ankles/feet.	2	3.3	28	46.7	30	50.0	1.53
		<b>TOTAL</b>						<b>1.35</b>
B	<b>Inappropriate dimensions of the sink</b>							
1	Discomfort in work due to more height of the sink center.	1	1.7	12	20	47	78.3	1.23
2	Discomfort in work due to less height of the sink center.	1	1.7	8	13.3	51	85.0	1.16
3	Discomfort in work due to more depth of the sink bowl.	1	1.7	14	23.3	45	75.0	1.26



Sr. No	Problems faced while working at the sink center	Respondent (n=60)						Weighted mean scores out of 3
		Extent of problem faced						
		To high extent		To moderate extent		To no extent		
		f	%	f	%	f	%	
4	Discomfort in work due to less depth of the sink bowl.	0	0	12	20	48	80.0	1.2
5	Discomfort due to high faucet height.	1	1.7	10	16.7	49	81.7	1.2
6	Discomfort due to low faucet height.	0	0	15	25	45	75.0	1.25
7	Problem in reaching the faucet/tap/water source.	2	3.3	10	16.7	48	80.0	1.23
8	Discomfort while opening the faucet/tap.	1	1.7	5	8.3	54	90.0	1.12
9	Discomfort in work due to splashing of water.	2	3.3	28	46.7	30	50.0	1.53
10	Discomfort in work due to more width of front barrier.	1	1.7	18	30	41	68.3	1.33
11	Discomfort in work due to less width of front barrier.	2	3.3	4	6.7	54	90.0	1.13
		<b>TOTAL</b>						<b>1.24</b>
<b>C</b>	<b>Maintaining appropriate posture</b>							
1	Bending forward during the activity	1	1.7	44	73.3	15	25.0	1.77
2	Twisting during the task is performed.	1	1.7	6	10	53	88.3	1.13
		<b>TOTAL</b>						<b>1.45</b>
<b>D</b>	<b>Availability of lighting at the sink center</b>							
1	Insufficient day light	1	1.7	16	26.7	43	71.7	1.3
2	Inadequate artificial lighting.	1	1.7	2	3.3	57	95.0	1.07
3	Hindrance in work due to glare during day time.	1	1.7	3	5	56	93.3	1.08

Sr. No	Problems faced while working at the sink center	Respondent (n=60)						Weighted mean scores out of 3
		Extent of problem faced						
		To high extent		To moderate extent		To no extent		
		f	%	f	%	f	%	
4	Hindrance in work due to glare in artificial lighting.	1	1.7	3	5	56	93.3	1.08
<b>TOTAL</b>								<b>1.13</b>
E	<b>Provision of space at the sink center</b>							
1	Less space on left side of the sink	5	8.3	26	43.3	29	48.3	1.6
2	Less space on right side of the sink	4	6.7	27	45	29	48.3	1.58
3	Small size of the sink	1	1.7	22	36.7	37	61.7	1.4
4	Large size of the sink	1	1.7	0	0	59	98.3	1.03
5	No space to keep the washing detergents	1	1.7	12	20	47	78.3	1.23
<b>TOTAL</b>								<b>1.37</b>

#### 4.3.6 Weighted mean scores for the problems faced while working at the sink center.

Thus, the findings on the problems faced by the respondents in the rank order based on the weighted mean score obtained concluded that the problems faced due to maintaining appropriate posture ranked first followed by provision of space at the sink center and pain in body parts. (Table 15).

**Table 15: Distribution of the respondents according to the weighted mean scores for the problems faced by the respondents while working at the sink center**

Type of problems faced while working at the sink center	Weighted mean scores Out of 3
Maintaining appropriate posture	1.45
Provision of space at the sink center	1.37
Effects on body and its parts	1.35
Inappropriate dimensions of the sink	1.24
Availability of lighting at the sink center	1.13
<b>Total</b>	<b>1.31</b>

#### 4.3.7 Levels of problems faced by the respondents while working at the sink center

The levels of problem faced by the respondents while working at the sink center highlighted that a higher percentage of the respondents (55.0 per cent) were facing problems while working at the sink center to a low level (table 16). 45.0 per cent of the respondents reported to face problems while working at the sink center to a high level (table 16).

**Table 16: Distribution of the respondents according to the levels of problems faced by the respondents while working at the sink center**

Levels of problems faced by the respondents while working at the sink center	Respondents (n=60)	
	f	%
To high level (below mean score range 1.29-2.00)	27	45
To low level (above mean score range 1.00-1.28)	33	55
<b>Mean score 1.29</b>		

## Section 4

### 4.4 Assessment of the sink center

The sink center of the respondents was assessed based on the observations made by the researcher on an observation sheet. The appropriate and inappropriate of the dimensions were judged against the recommended minimum standard dimensions of the sink center. The sink was assessed on various aspects like the height of the faucet, width of the front barrier, depth of the counter top, fall of water flow in the sink, space on the right side of the sink, height of the sink center, width of the sink, space on the left side of the sink, thickness of the rim of the sink, shape of the sink, length of the sink bowl and depth of the sink bowl.

#### 4.4.1 Height of the faucet

The findings on the assessments of the sink center (Table 17) revealed that the faucet height was found to be inappropriate in only 6.7 per cent of the sink center of the respondents. The majority of the respondents had appropriate height of the faucet in their sinks. The finding is very well supported with the findings related to the problems faced by the respondents regarding the faucets. The majority of the respondents did not face discomfort in using the faucet at their sink center due to its height, reach and opening of the faucet while working at their sink center.

#### 4.4.2 Width of the front barrier

The findings further revealed (Table 17) that width of the front barrier was not appropriate at the sink centers of the majority of the respondents. The researcher found that the width of the front barrier of the sink of the respondents was too much resulting in bending of the body of the respondents while working at their sink center. The observations are very well supported with the problems faced by the respondents as majority of the respondents faced the problems of bending forward while working at their sink center to moderate extent.

#### 4.4.3 Depth of counter top

The researcher observed that majority (76.7 per cent) of the respondents were having inappropriate depth of counter top (from front to back) as very few (23.3 per cent) respondents were having appropriate depth of counter top (from front to back). The minimum standard dimension of the depth of the counter top is 27” inch.

#### 4.4.4 Fall of water flow in the sink

The observation made by the researcher revealed majority of the respondents (71.7 per cent) had inappropriate fall of water flow in their sink area since the flow of water was found to be flowing off center. This was very well supported with the problems faced by the respondents as nearly one-half of them faced discomfort to moderate extent in work due to splashing of water (Table 17)

#### 4.4.5 Space on the right side of the sink

While assessing the sink center of the respondents it was found that majority of the respondents (70.0 per cent) had inappropriate space on the right side of the

sink center. It was observed that the space at right side of the sink area was not according to the recommended standard space (18-24 inches) (Table 17).

#### **4.4.6 Height of the sink center**

The observations made by the researcher highlighted that most of the respondents (16.7 per cent) were not having appropriate height of the sink center for working in their households. The height was reported to be too high due to which nearly one-half of respondents were facing problems to moderate extent while working at their sink center.(Table 17).

#### **4.4.7 Width of the sink**

While assessing the sink center of the respondents it was found that a higher percentage of the respondents (56.7 per cent) had inappropriate width of the sink at the sink center. The sink width was reported to be quite less especially when dish washing activity was carried by the respondents (table 17).

#### **4.4.8 Space on the left side of the sink**

It was observed (Table 17) that only 40.0 per cent of the respondents had inappropriate the left side of the sink area, left side of the sink should be 18- 13.6 inches as it was as per the minimum standard space that is 18-36 inches.

#### **4.4.9 Thickness of the rim of the sink**

The standard recommended dimension of the thickness of the rim of the sink ranged between 2” to 3” inch in size. Nearest of the respondent (63.3 per cent) of the respondents were having appropriate thickness of the rim of the sink slightly more than one-third of (36.7 per cent) respondents were having inappropriate thickness of the rim of the sink.(Table 17)

#### **4.4.10 Shape of the sink**

The findings (Table 17) revealed that the shape of the sink (rectangular) was appropriate for majority of the respondents (73.3 per cent) in their sink centre. Although the shape of the sink was found to be inappropriate for inappropriate because it was slightly more than one fourth of the respondents. It was inappropriate because it was circular in shape and smaller in size.

#### **4.4.11 Length of the sink bowl**

It was noticed by the researcher that majority of the respondents were (81.7 per cent) having appropriate length of the sink bowl (from left to right) whereas very few (18.3 per cent) respondents were having inappropriate length of the sink bowl (from left to right). The standard dimension of the length of the sink bowl ranged from 18” to 24” inches (Table 17)

#### **4.4.12 Depth of the sink**

It was dictated by the researcher that majority (81.7 per cent) of the respondents were having appropriate depth of the sink bowl (from top to bottom) as very few (18.3 per cent) respondents were having inappropriate depth of the sink bowl

(from top to bottom). The standard dimension of the depth of the sink bowl is between 6” to 8” inches.

**Table 17: Distribution of the respondents according to the assessment of the sink center**

Aspects of sink center	Appropriate		Inappropriate	
	f	%	f	%
Height of the faucet	56	93.3	04	6.7
Width of the front barrier	10	16.7	50	83.3
Depth of the counter top (from front to back)	14	23.3	46	76.7
Fall of water flow in the sink	17	28.3	43	71.7
Space on the right side of the sink	18	30.0	42	70.0
Height of the sink center (from floor level to the counter top)	23	38.3	37	61.7
Width of the sink (from front to back)	26	43.3	34	56.7
Space on the left side of the sink	36	60.0	24	40.0
Thickness of the rim of sink	38	63.3	22	36.7
Shape of the sink	44	73.3	16	26.7
Length of the sink (from left to right)	49	81.7	11	18.3
Depth of the sink (from top to bottom)	49	81.7	11	18.3

An overview of the assessment of the sink centre in table 17 concluded that the majority of the respondents were having inappropriate width of the front barrier of the sink centre, “depth of the counter top”, “fall of water flow in the sink and space on the right side of the sink”. The findings further concluded that majority of the respondent were having appropriate length and depth of the sink and the appropriate shape of the sink.

## Section 5

### **Suggestions given by the respondents regarding different aspects of the sink center**

Findings related to the suggestions given by the respondents regarding different aspects of the sink center are presented by the researcher in this section.

#### **4.5.1 Suggestions regarding design of the sink center**

The respondents suggested that the height of the sink center should be accordingly to the height of the user. The respondents also gave suggestions regarding the depth of the sink center. They suggested that the depth of the sink center should also be user friendly with a major consideration of comfort and edge of work at the sink center.

#### **4.5.2 Suggestions regarding design of the sink bowl**

Majority of the respondents suggested that in general the over all size of the sink bowl should be large enough to accommodate more numbers of dishes and ease of carrying the activities in it.

#### **4.5.3 Suggestions regarding design of the faucet**

Majority of the respondents recommended that the placement of the faucet should be centered and should be at a height suiting the user. All the respondents suggested that the water from the faucet should fall directly on the drain hole.

#### **4.5.4 Suggestions regarding drainage in the sink center**

Most of the respondents were satisfied with the existing drainage facility. Some suggestion that “ L “ shaped drainage pipe below the sink center should be the part of all the sink center in view of space consideration in storing the necessary supplies needed at the sink center.

#### **4.5.5 Suggestions regarding drainage in the sink center**

Very few respondents suggested storage facility above the sink center. Majority of the respondents gave suggestions for having storage facility below the sink center.

#### **4.5.6 Suggestions regarding lighting at the sink center**

Majority of the respondents suggested that there should be a window near the sink center for proper natural lighting and ventilation during the day time. Very few respondents suggested for having more artificial lighting above the sink center to facilitate working on it daily. The time when natural light was not focused to be sufficient to carry the work.

## SECTION 6

### 4.6 Testing of Hypotheses

The present section covers in detail the statistical analysis of the hypothesis of present study. The relational statistical tests utilized to test the hypotheses were 'Analysis of the Variance', 't' test and co-efficient of correlation. 'Analysis of the Variance' was computed for the selected independent variables like age of the respondents, with the extent of problems faced by the respondents while working at the sink center. 't' test was utilized to find out the mean difference between the family type and size with the extent of problems faced by the respondents while working at the sink center. Co-efficient of correlation was computed to find out the relationship between the extent of problems faced by the respondents while working at the sink center and the number of activities carried per day, time taken to carry the activity per day at the sink center and assessment of the sink center related to its various aspects.

**H<sub>01</sub>: The respondent will not vary in their extent of problems faced while working on sink center by their personal variable (age of the respondents and employment status of the respondents) and family variables (type of the family, size of the family and monthly income of the family).**

**Table 18: Analysis of Variance for age and monthly income of the family of the respondents with the extent of problems faced while working at the sink centre.**

Variable	df	Sum of squares	Mean of squares	F-ratio	L.Sig
Age					
Between groups	3	1045.417	41.817	0.592	N.S
Within groups	56	2403.567	70.693		
Monthly income of the family					
Between groups	7	426.956	60.994	1.050	N.S
Within groups	52	3022.028	58.116		

**4.6.1** The computation of f-test in table 18 revealed that the respondents did not vary in their extent of problems faced while working on the sink center by their personal variable (age of the respondents) and family variable (monthly income of the family). Thus, null hypothesis was accepted for the age and monthly income of the family of the respondents.



**Table 19: ‘t’ test showing the mean difference in the extent of problems faced by the respondents while working at the sink center by their personal variable and family variables**

Variables	Mean	‘t’ value	df	Level of significance
<b>Family</b>				
Size of the family				
Small	30	.359	58	N.S
Large	30			
<b>Type of the family</b>				
Nuclear	56	1.135	58	N.S
Joint	4			
<b>Employment status of the respondent</b>				
Employed	13	1.437	58	N.S
Not employed	47			

**4.6.2** The computation of f-test in table 19 revealed that the respondents did not differ significantly in their extent of problems faced by the respondents while working at the sink center by their personal variable (employment status of the respondent) and family variables (type of the family, size of the family and monthly income of the family). Thus, null hypothesis was accepted for the above variables (table 19).

**Ho2: There exists no relationship between the extent of problems faced while working at the sink center and the number of activities carried, time taken to carry the activity at the sink center per day and assessment of the sink center related to its various aspects.**

**Table 20: The co-efficient of correlation showing the relationship between the extent of problems faced while working at the sink center and the number of activities carried, time taken to carry the activity per day at the sink center per day and assessment of the sink center related to its various aspects.**

Variables	‘r’ value	df	Level of Sig
Problems faced by the respondents while working at the sink center	.417	58	N.S
Number of activities carried at the sink center per day	.283	58	N.S
Time taken to carry the activities per day at the sink center	.652	58	N.S
Assessment of the sink center related to its various aspects.	.302	58	0.05

**4.6.3** (Table 20) indicates there existed a significant relationship between the extent of problems faced by the respondents while working at the sink center and assessment of the sink center related to its various aspects. Thus, null hypothesis was rejected for this variable (table 20). It can thus be concluded that more the inappropriate of the aspects found during assessment at the sink center, higher would be the extent of problems faced by the respondents while working at their sink centre.

The findings further revealed that no significant relationship was found between the numbers of activities carried at the sink center, time taken to carry the activity at the sink center with the extent of problem faced by the respondents while working at the sink center. Thus the null hypothesis is accepted for the above mentioned two variables (Table 2)

## Phase II

Phase II includes the design development of the sink center for the selected households of Vadodara city. In this section the researcher had proposed three redesigned sink center for the selected households of Vadodara city.

### SECTION 1

#### Design development

The design development of the sink center for selected households of Vadodara city was the main focus of the present study. This section shows the detailed designs of the sink center for the three selected households of Vadodara city.

These designs were developed considering the information gathered in phase I of the study regarding the problems faced by the respondents while working at their sink center. The redesigning of the sink center was done on the basis of highest number problems faced by the respondents on the problem scale while working at their sink center.

The redesigning of the sink center of the three selected respondents covered designing aspects related to:

- a) Total height of the sink center from floor level to the counter top.
- b) Width of the sink from front to back.
- c) Length of the sink from left to right.
- d) Depth of the sink from top to bottom.
- e) Depth of the counter top from front to back.
- f) Thickness of the rim of the sink.
- g) Space on the right and left side of the sink.
- h) Width of the front barrier.
- i) Fall of water flow in the sink.
- j) Height of the faucet and shape of the sink.

The redesigning was based on the related anthropometric data of the three respondents (Appendix III, IV and V).

#### Design Concept

The design concept of the present project was discussed for three cases which are as follows:

##### Case I

The selected respondent faced highest number of problems while working at the sink center hence redesigning was proposed on paper. The designer gathered the detailed data of the existing status of the sink center along with the related anthropometric data of the home maker for designing her sink center. The following modifications were proposed in the selected kitchen after having discussion with the respondent. Following are the detailed of the proposed modifications made by the designer.

**Depth of the counter top (from front to back)**

The depth of the existing counter top was 1'9". Hence due to inappropriate depth the respondent was facing problem. The researcher gave the depth of 2'3" in the proposed plan so that problem can be avoided by the respondent (Figure 14).

**Shape of the sink center**

The shape of the existing sink was in a circular form due to which respondent faced a problem of discomfort while carrying activities. The sink bowl was having diameter of 1'2" which was inappropriate and small in size. Hence the rectangular shape was proposed by the researcher (Figure 14). In this the shape was changed the existing to facilitate the respondent to carry her work with ease and comfort.

**Width of the sink (from front to back)**

The sink was in circular shape with diameter of 1'2" hence in proposed sink the width of the sink was 1'6" (Figure 14).

**Length of the sink (from left to right)**

Due to the circular shape length was not there. In the modified plan the length proposed is 2'2" which will be enough for the respondent to carry the activities at the sink center.

**Thickness of the rim**

In the existing plan of the respondent's sink the thickness of the rim of the sink was 1", whereas in the proposed plan the thickness of sink was increased to 2".

**Height of the faucet**

The height of the faucet was very low due to which the respondent faced problems in carrying the activity at the sink center. The existing height of the faucet of the respondent was 1' where as the height proposed by the designer is 1'3" to avoid the problem.

**Space on the right side of the sink**

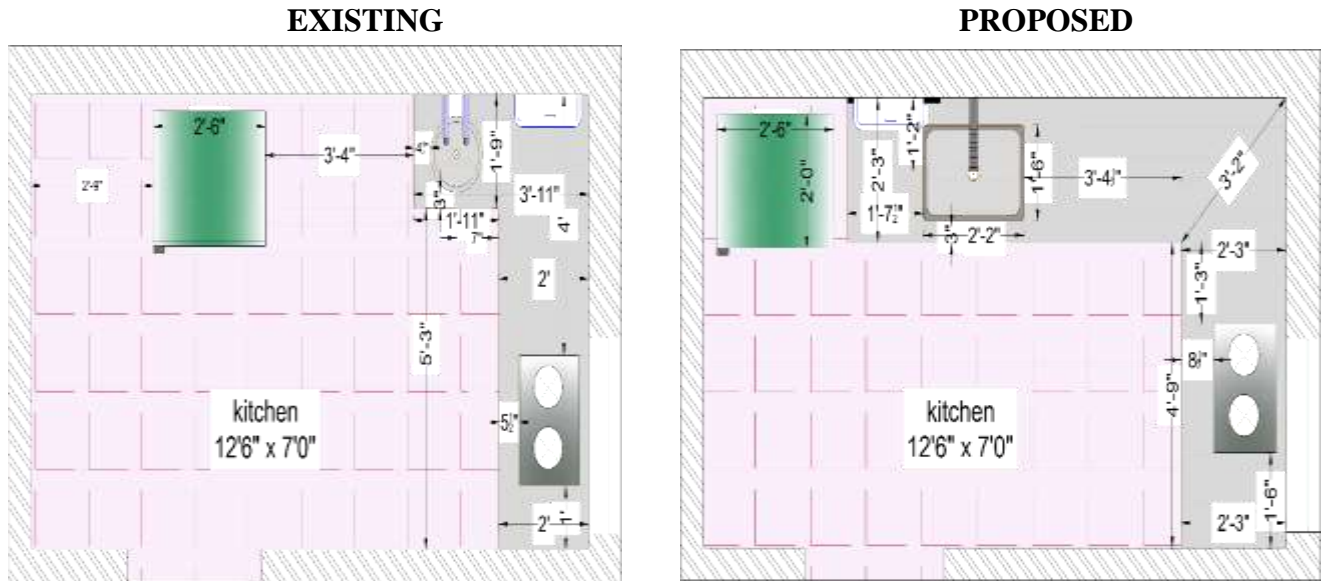
There existed space on the right side of the sink of the respondent but the existing placement of the sink was not appropriate. Hence after the replacement of the sink there added an additional space of about 3' at the right side of the sink. The additional space proposed could be used for pre-preparation work or any other work which was leaking when the sink was placed earlier.

**Space on the left side of the sink**

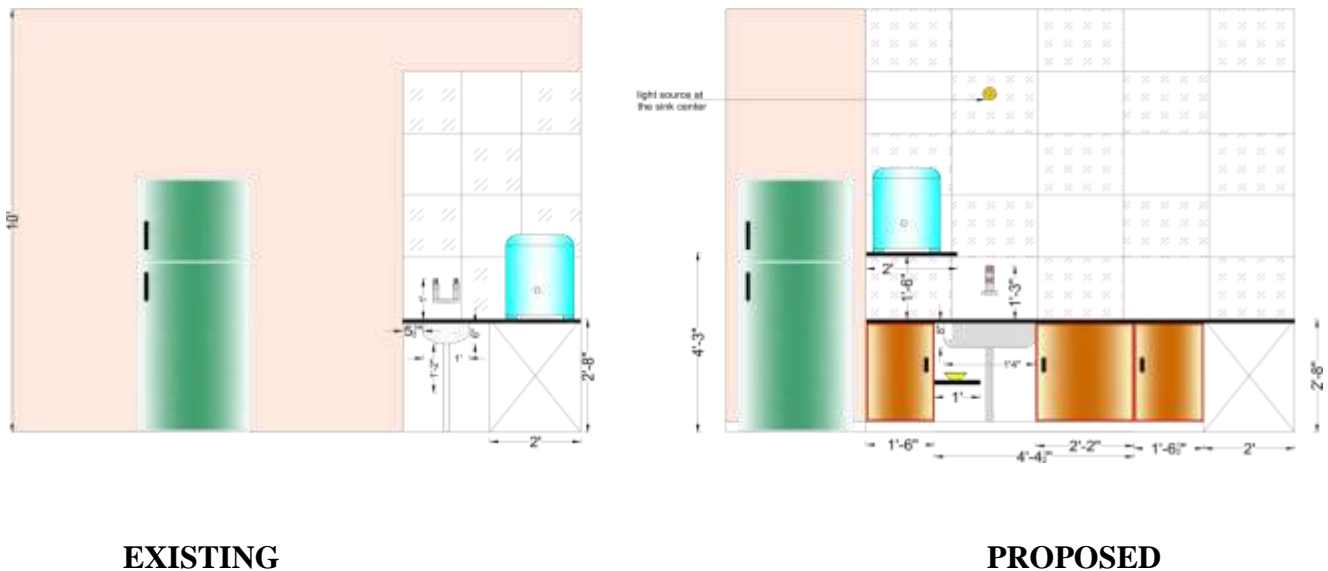
In the existing kitchen the space provided on the left side of the sink was only 4" which was inappropriate for any kind of work. The respondent was not satisfied with the existing length of the counter too. Hence to allot the space towards left of the sink the counter was extended to 17" in the proposed plan so that it can be utilized for keeping utensils and for other work too (Figure 14).

**Fall of water flow in the sink**

Due to the inappropriate height and placement of the faucet the fall of the water flow of both the faucet was off centered towards left and right respectively in the existing sink center. The researcher proposed single faucet with movable facility so that the fall of the water flow can be maintained in the center of the sink on the drainage hole. Due to the inappropriate fall of the water flow in the sink the problem of splashing of water was faced by the respondent. Thus, to avoid this problem the present design was proposed.



**Fig no.14: Floor Plans of Case I**



**Fig. no. 15: Front Elevations of Case I**



**Fig.no.16 (a): 3D View of Case I**



**Fig.no.16 (b): 3D View of Case I**

### **Case II**

The selected respondent faced second highest problems while working at the sink center hence redesigning was proposed on paper. The designer reviewed the existing status of the sink center of the respondent. At the same time the anthropometric data of the home maker was also collected. The following modifications were proposed for the selected sink center after having discussion

with the respondent and incorporating their suggestions. Following are the detailed description of the proposed modifications made in the sink center of the case-II.

#### **Placement of the sink center**

The sink of the respondent was positioned in corner of the counter. The counter was L shaped. The respondent was facing the problem of twisting and bending while carrying the activities at the sink center. Hence to avoid the problem the present design is proposed in which the placement of the sink center is changed from corner to the left side of the counter (Figure 17).

#### **Width of the sink (from front to back)**

The width of the sink was 1'5". The width was increased by 1" only as per the demand of the respondent. Hence the width of 1'6" is the proposed for the sink (Figure 17)

#### **Height of the sink center**

The existing height of the sink center was 2'10". The designer did not changed the height of the counter as it was suitable for work for the height of the homemaker (5'1").

#### **Length of the sink (from left to right)**

The length of the sink was 1'4" which was increased to 1'7" in the proposed plan by the researcher to facilitate working on the sink (Figure 17).

#### **Height of the faucet**

The height of the faucet was 1'3" is the exists sink center of the respondent which was as per the standards but as the height of the home maker was more she was not comfortable in reaching the faucet, hence the designer had proposed an additional 1' height of the faucet for the convenience of the respondent, to use it (Figure 17).

#### **Space on the right side of the sink**

The space was there on the right side of the sink but the existing placement of the sink was not appropriate hence after the placement was changed in the proposed plan the space was 2'5" at the right side of the sink.

#### **Space on the left side of the sink**

In the existing kitchen the space provided on the left side of the sink was 5". The respondent was not satisfied with the existing space on the left of the sink. After the change in placement of the sink center a space of 5'5" was proposed on the left side of the sink which can be used for sink as well other kitchen activities too.

#### **Fall of water flow in the sink**

The height and placement of the faucet were creating problem for the respondent in reaching as well as the fall of the water flow was off center towards left or right as in existing kitchen there was two faucets. The researcher proposed two faucets only but with movable facility so that the fall of the water flow can be maintained in the center of the sink on the drainage jail. Due to the inappropriate fall of the water flow in the sink the problem of splashing of water was faced by the respondent and to avoid this problem the present design was proposed.

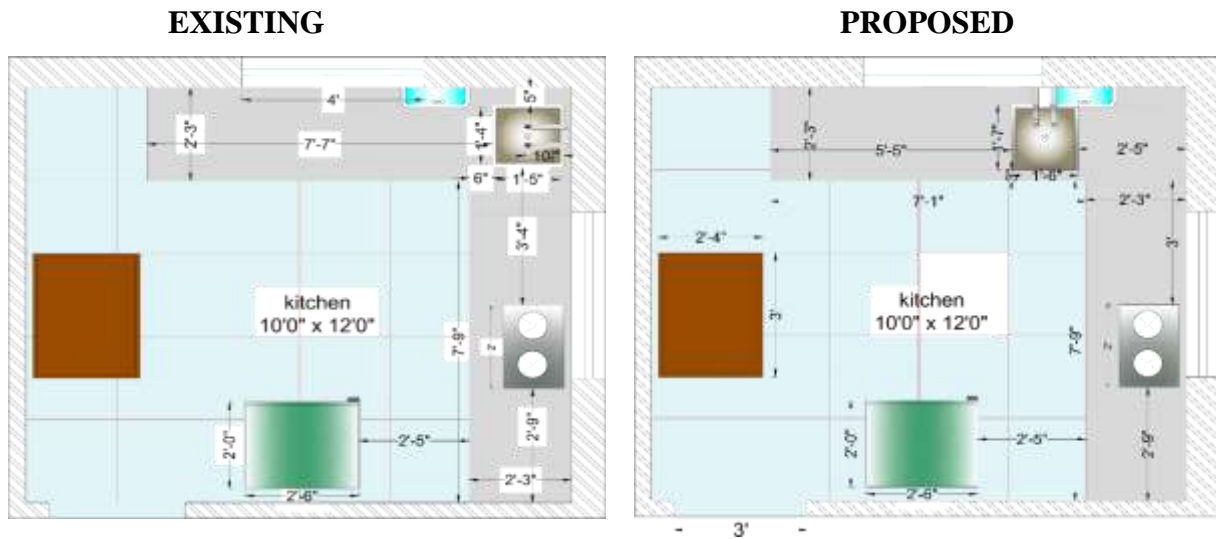


Fig. no.17: Floor Plans of Case II

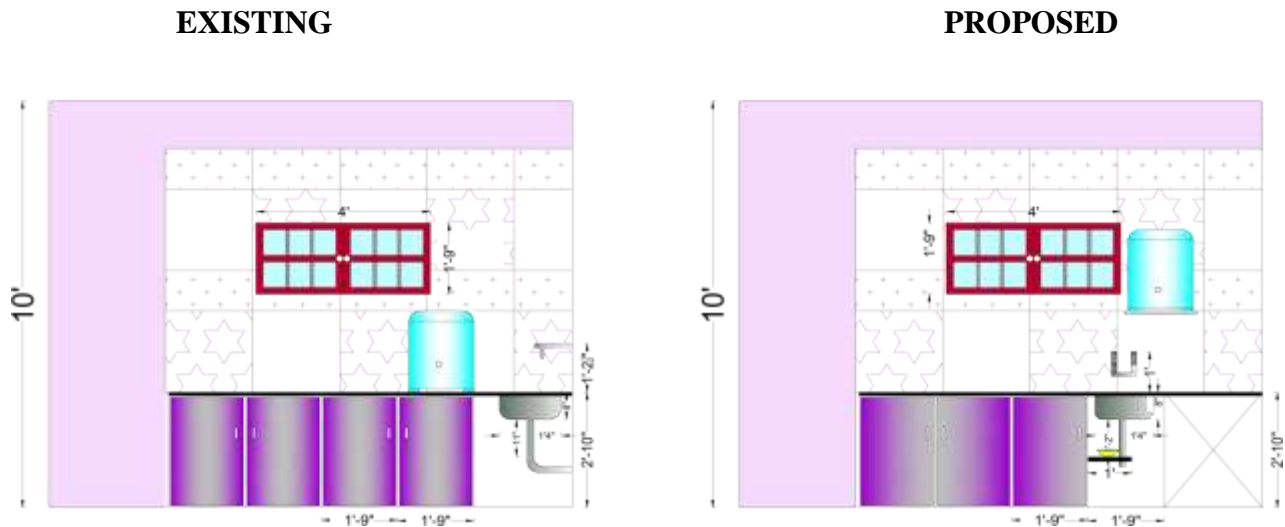
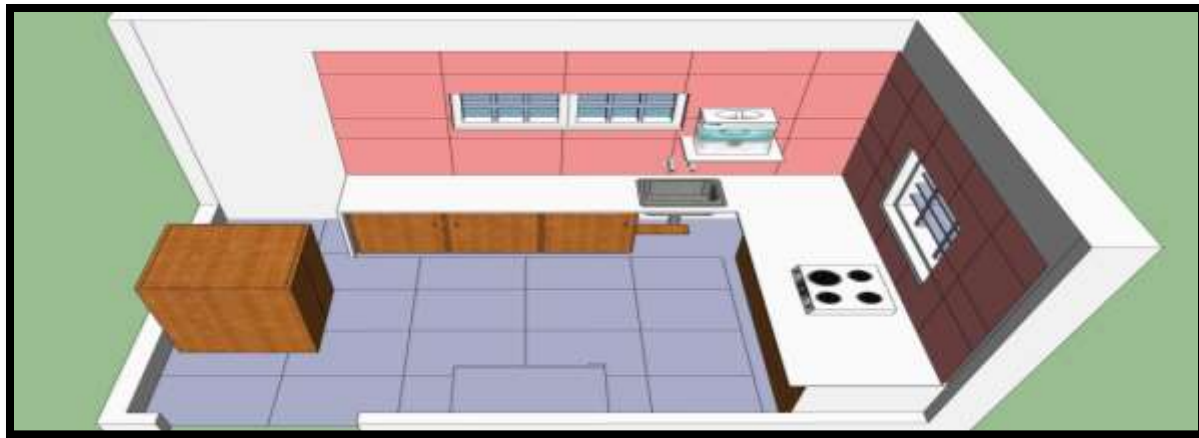


Fig. no.18: Front Elevations of Case II





**Fig.no.19 (a): 3D View of Case II**



**Fig.no.19 (b): 3D View of Case II**

### **Case III**

The selected respondent faced third highest number of problems in rank order while working at the sink center hence redesigning was proposed on paper. The data of the existing kitchen was gathered by the designer. Hence modifications were proposed in the selected kitchen. The proposed details about the sink center case-III are given below by the designer:

#### **Placement of the sink center**

The sink was positioned in the corner of the kitchen counter of the respondent. The respondent was facing the problem of while carrying the activities at the sink center. Hence to avoid the problem the present design is proposed in which the placement of the sink center is changed from corner to the right side of the counter (Figure 20).

#### **Height of the sink center**

The height of the existing sink center was 2'11'' which was not changed as it was matching with the homemaker's height 5'6''.

### Shape of the sink center

The shape of the existing sink was in a circular form due to which respondent faced lot of discomfort while carrying activities on it. The sink bowl was having a diameter of 1'2" which was inappropriate and washes quite small in size. Hence, the rectangular shape was proposed by the designer.

### Width of the sink (from front to back)

The width of the sink was increased by 1" by the designer. The width of the existing sink was 1'5" as it was asked by the respondent.

### Length of the sink (from left to right)

Due to the circular shape of the sink the space for keeping the utensils was restricted. In the modified plan the length of the sink was proposed to 1'8" which was comfortable for the respondent to carry the activities at her sink center.

### Space on the right side of the sink

The existing sink had a space of 2'2" on the right side. In the proposed plan (Figure 20) the space between the right sink edge and gas stove was reduced to 1'9" as 10" space is proposed on the left of the sink.

### Space on the left side of the sink

There was no space on the left side of the sink as it was placed in the corner of the counter in the existing sink center of the respondent. Thus a space of 10" was on the left side of the sink as it was the major proposed.

### Fall of water flow in the sink

In the existing kitchen these were two faucets available at the sink center but the fall of the water flow was off centered towards left and right respectively. Thus the designer proposed 7" protruding movable faucets so that the fall of the water flow can be maintained in the center while carrying out the activities at the sink center.

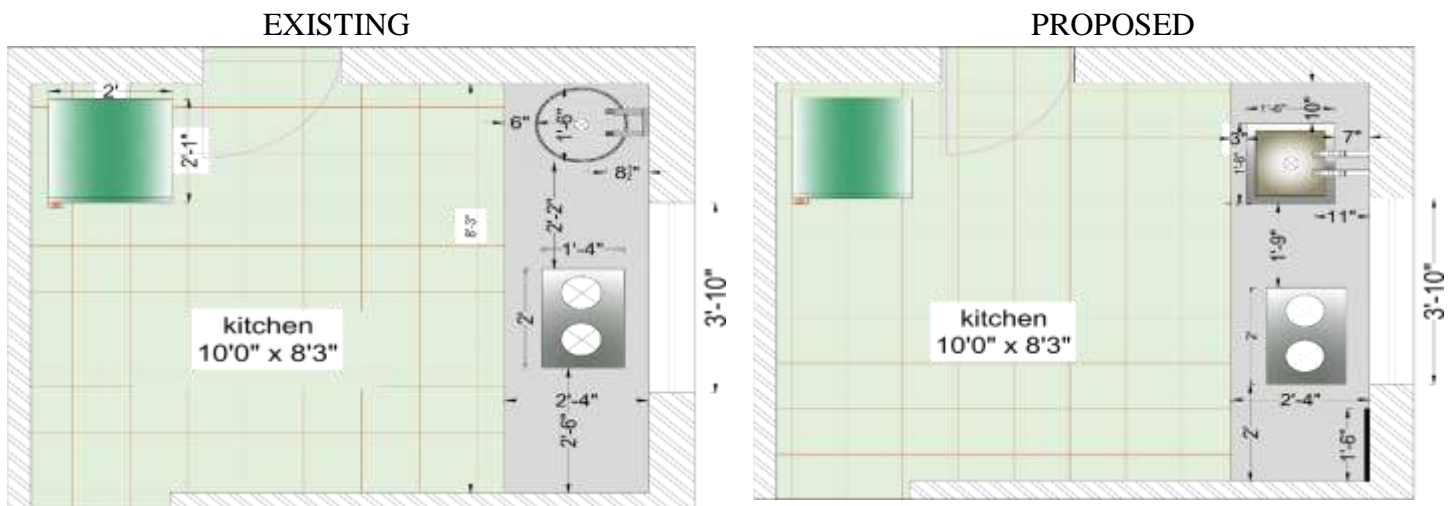


Fig. no.20: Floor Plans of Case III

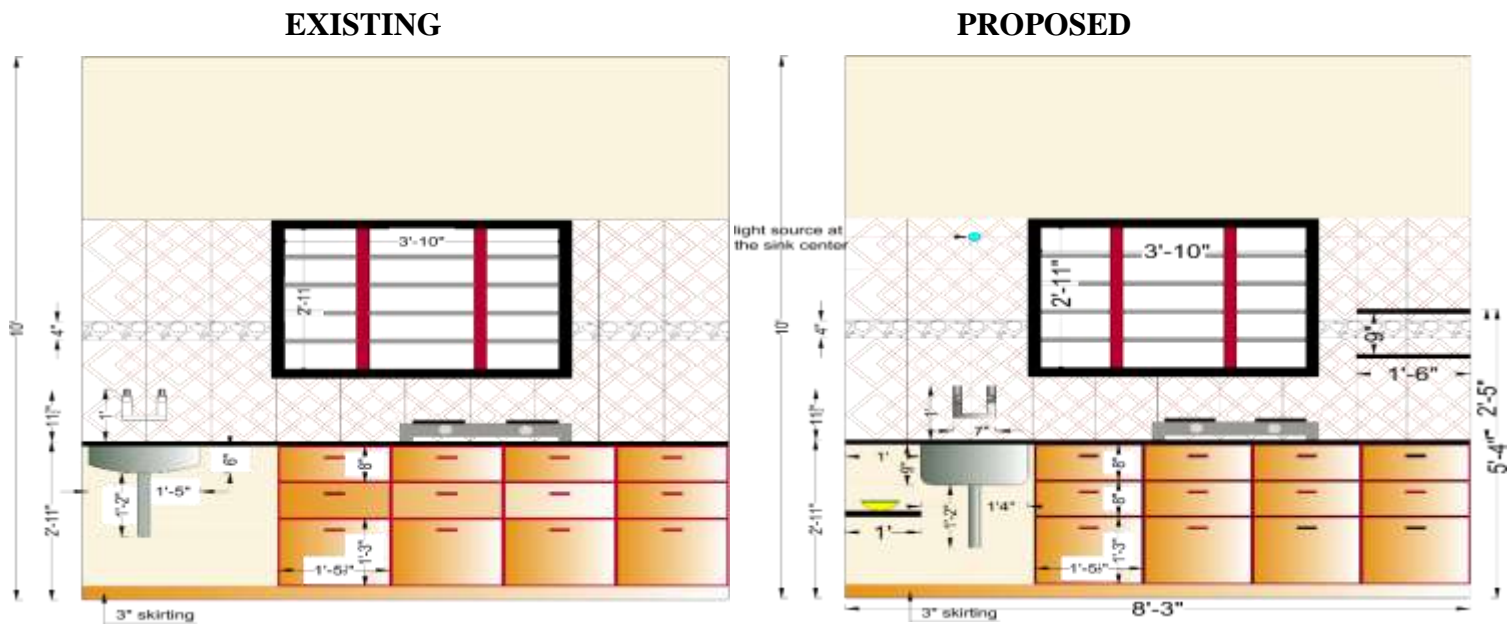


Fig. no.21: Front Elevations of Case III



Fig.no.22 (a): 3D View of Case III



**Fig.no.22 (b): 3D View of Case III**

## SUMMARY, CONCLUSION AND RECOMMENDATIONS

A house also means a home which reflects one's identity and creates a base to develop relationships with others. It is a space where one expects to live with peace<sup>2</sup>. In home a group of people live together with different responsibilities carried in the same place. They have their own identities. The most important role is played by a homemaker in a home who manages the household of her own family, especially as her principle occupation.

In middle class households the kitchen plays an important role. The role of kitchen is important because the homemaker of middle income group has to spend majority of her time in the kitchen itself. A poorly designed sink center consumes more time and energy on the part of the homemaker. Therefore, its design needs to be assessed for various designing aspects.

The review of literature in the related field has highlighted that few studies have been conducted outside India on kitchen designing and adjustable sink. (Maguire, et. al., 2010, Bonanni, et. al., 2005 and Smith, 1984). The review of literature in the related field has also brought to light that few studies on kitchen design, designing of storage in kitchen, work centers, have been conducted in India (Barbarlall, 1964, Bhavnani, 1965, Patel, 1971, Mitter, 1971, Nadvi, 1971). The researcher also came across few studies on kitchen sink heights, surface materials used in kitchen, the assessment of environmental conditions of domestic and canteen kitchens and artificial lighting in kitchens (Sethi, 1978, Ateka, 1966, Solanki, 1969, Patel, 1986, Singh, 1986, Veer, 1990, Jaju, 1999).

The researches regarding sink center in relation to the design aspects covering height, width, depth, depth of the sink, space on either side, faucet height and flow.

The findings of the study will help the Department of Family and Community Resource Management, homemakers, academicians, professional designers, architectures and builders.

### Statement of the Problem

The study was undertaken to assess the kitchen sink center of middle class households of Vadodara city.

### Objectives of the study

1. To assess the sink center of selected middle class households of Vadodara city.
2. To determine the problems faced by the homemaker while working at the sink center of their households.
3. To invite suggestions from the respondents regarding the design of the sink center.
4. To propose a re-designed sink center for the selected middle class households.

### **Delimitations of the study**

1. The assessment of the sink center was limited to kitchen area only.
2. The assessment of sink center was limited to the ones which are constructed by them (not provided by the builders).
3. The study was limited to the respondents who were healthy and were not suffering from any illness/disease.
4. The redesigning of the sink center was limited to the designing on paper only.

### **Hypotheses of the study**

1. The respondents varied in their extent of problems faced while working at the sink center by their personal variable (age of the respondents and employment status of the respondent), family variables (size of the family, type of family and monthly income of the family).
2. There exists a relationship between the extent of problems faced by the respondents while working at the sink center and the number of activity carried, time taken to carry the activity per day at the sink center and assessment of the sink center related to various aspects.

### **Methodology**

The research design of the present study was descriptive in nature. 60 homemakers of middle class households of Vadodara city were the sample size for the present study. The samples for the present study were selected through the extent of problems faced by the respondents while working at the sink center snowball method. The data was collected through an interview schedule and an observation sheet. Descriptive analysis was done for the data (frequencies, mean, standard deviations) as well as relational statistics was done (ANNOVA, 't' test and correlation of co-efficient).

### **Major findings of the study**

- **Demographic**

The data revealed that a higher percentage of the respondents (44 per cent) belonged to the age group of 24-34 years. The mean age of the respondents was 38 years. The majority of the respondents (78.0 per cent) were not employed. A little less than one-fourth of the respondents (22.0 per cent) were found to be employed. The data highlighted that one-half of the respondents were having small size of the family with 2-3 members in their family where as another one-half were having large family size with 4-6 members in their family. The findings examined that majority of the respondents (93.0) were residing in nuclear type of the family. Very few

(7.0 per cent) were living in joint family. a higher percentage of the respondents were (36.0 per cent) were having their monthly income in the range of `30000-40000 (36.0 per cent) whereas nearly one-third of them (32.0 per cent) were earning less or equal to Rs.30000 per month.

- **Information related to the activities carried at the sink center**  
Findings related to the activities carried by the respondents at the sink center included the number of times activity is carried and time taken to carry out the activity at the sink center per day. The data on the mean of the number of time the activity was carried by the respondents, it was found that washing of food times was comparatively done more number of times at the sink center by the respondents compared to cleaning of the sink center and washing of the dishes. A comparative review on the mean time taken to carry the activity at the sink center by the respondents clearly made it evident that washing of dishes consumes more time as compared to cleaning of the sink center and washing of food items
- **Extent of problems faced by the respondents while working at the sink center**  
The findings on the problems faced by the respondents in the rank order based on the weighted mean score obtained concluded that the problems faced due to maintaining appropriate posture ranked first followed by promotion of space at the sink center and pain in body parts. The levels of problem faced by the respondents while working at the sink center highlighted that a higher percentage of the respondents were facing problems while working at the sink center to a low level.
- **Assessment of the sink center**  
An overview of the assessment of the sink centre concluded that the majority of the respondents were having inappropriate width of the front barrier of the sink centre, “depth of the counter top”, “fall of water flow in the sink and space on the right side of the sink”. The findings further concluded that majority of the respondent were having appropriate length and depth of the sink and the shape of the sink.
- **Suggestions given by the respondents regarding different aspects of the sink center**  
Majority of the respondents suggested that the depth of the sink center should also be user friendly with a major consideration of comfort and ease of work at the sink center. Majority of the respondents suggested that in general the overall size of the sink bowl should be large enough to accommodate more numbers of dishes and ease of carrying the activities in it. Majority of the respondents recommended that the placement of the faucet should be countered, with the height suiting the user. All the respondents suggested that the water from the faucet should fall directly on the drain hole.

- **Statistical findings**

The respondents did not vary in their extent of problems faced while working on the sink center by their personal variable (age of the respondents) and family variable (monthly income of the family). There existed no difference significantly in their extent of problems faced by the respondents while working at the sink center by their personal variable (employment status of the respondent) and family variables (type of the family, size of the family and monthly income of the family). The extent of problems faced by the respondents while working at the sink center and assessment of the sink center related to its various aspects. The findings further revealed that no significant relationship was found between the numbers of activities carried at the sink center, time taken to carry the activity at the sink center with the extent of problem faced by the respondents while working at the sink center.

- **Design development**

Three designs were developed considering the information gathered regarding the problems faced by the respondents while working at their sink center. The redesigning of the sink center was done on the basis of highest number problems faced by the respondents on the problem scale while working at their sink center. Three respondents were selected for re-designing on the basis of following aspects; Depth of the counter top (from front to back), Width of the sink (from front to back), Shape of the sink center, Length of the sink (from left to right), Thickness of the rim, Height of the faucet, Space on the right side of the sink, Space on the left side of the sink, Fall of water flow in the sink.



## Conclusion

The mean age of the respondents was 38 years. The majority of the respondents were not employed. The data highlighted that one-half of the respondents were having small size of the family where as another one-half were having large family size in their family. The findings examined that majority of the respondents were residing in nuclear type of the family. A higher percentage of the respondents were were having their monthly income in the range of `30000-40000. The time taken to carry the activity at the sink center by the respondents clearly made it evident that washing of dishes consumes more time as compared to cleaning of the sink center and washing of food items. The findings on the problems faced by the respondents in the rank order based on the weighted mean score obtained concluded that the problems faced due to maintaining appropriate posture ranked first followed by promotion of space at the sink center and pain in body parts. The levels of problem faced by the respondents while working at the sink center highlighted that a higher percentage of the respondents were facing problems while working at the sink center to a low level. Majority of the respondents were having appropriate length and depth of the sink and the shape of the sink. All the respondents suggested that the water from the faucet should fall directly on the drain, hole. The analysis on the statistical findings revealed that there existed no variation in the extent of problems faced by the respondents while working at the sink center by their personal variable (age of the respondents and employment status of the respondent), family variables (size of the family, type of family and monthly income of the family),

The findings of coefficient of correlation highlighted that there existed a relationship between the extent of problems faced by the respondents while working at the sink center and assessment of the sink center related to various aspects. There existed no relationship between the extent of problems faced by the respondents while working at the sink center with the number of activity carried, time taken to carry the activity per day at the sink center. Overall the existing status of the sink center of the respondents was found to be more or less appropriate and hence three respondents were selected for re-designing of their sink center.

## Implications of the study

The findings of the present study will be beneficial for various groups as follows:

- **For the homemakers:** The findings of the present study would provide an insight to the homemakers about the design of sink center so that they can take proper action in solving the problems faced by them.
- **For the academicians:** The findings of the study would assist the academicians in the related field in designing such modules which will help the students to get an insight about the designing of the sink center.

- **For the professional designers, architects and builders:**The findings of the study will be helpful for the designers in gaining knowledge for the appropriate designing of sink center so as to reduce the problems faced by the users.
- **For the Department of Family and Community Resource Management:** The findings of the study will help the interior design students of the department of Family and Community Resource Management to gain an in-depth knowledge about the micro details of sink center assisting them in designing of the sink centers.

### **Recommendations**

1. A similar study can be undertaken to assess commercial kitchen sink centers of food industry.
2. A similar study can be conducted on assessment of the sink center of the households from different locales.
3. A comparative analysis can also be conducted to identify the problems faced by the homemakers working at their sink center across the country.
4. A similar study can be undertaken for assessing the kitchen sink center for physically handicapped homemakers.
5. A similar nature of study can be conducted with a larger sample size.

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**Appendix I**  
**Standard dimensions of the sink centers**

<b>Kitchen sink center</b>	<b>Standard Measurements</b>
Height of the sink center (from floor level to the counter top)	2'8"
Width of the sink (from front to back)	1'10"-2'0"
Length of the sink (from left to right)	1'6"-2'0"
Depth of the sink (from top to bottom)	6"-8"
Depth of the counter top (from front to back)	2'3"
Thickness of the rim of sink	2"-3"
Space on the right side of the sink	1'6"-2'0"
Space on the left side of the sink	1'6"-3'0"
Width of the front barrier	3"
Fall of water flow in the sink	Center
Height of the faucet	1'3"
Shape of the sink	Square/rectangular

**Appendix II**  
**Anthropometric data of the home maker for Case-I**

<b>Anthropometric data</b>	<b>Measurements in feet and inches</b>
Standing height	5'0"
Eye height	4'8"
Shoulder height	4'3"
Elbow height	3'3"
Finger tip	2'0"
Knee height	1'7"
Span	3'11"
One half of the body span	3'1"
Elbow span	2'8"
Standing upward vertical reach (near the counter)	5'5"
Standing horizontal comfortable reach (near the counter)	0'8"
Standing horizontal maximum reach (near the counter)	1'3"

**Appendix III**  
**Anthropometric data of the home maker for Case-II**

Anthropometric data	Measurements in feet and inches
Standing height	5'1"
Eye height	4'7"
Shoulder height	4'2"
Elbow height	3'1"
Finger tip	1'11"
Knee height	1'4"
Span	5'0"
One half of the body span	3'2"
Elbow span	2'6"
Standing upward vertical reach (near the counter)	5'7"
Standing horizontal comfortable reach (near the counter)	0'10"
Standing horizontal maximum reach (near the counter)	1'6"

**Appendix IV**  
**Anthropometric data of the home maker for Case-III**

Anthropometric data	Measurements in feet and inches
Standing height	5'6"
Eye height	5'1"
Shoulder height	4'6"
Elbow height	3'5"
Finger tip	2'1"
Knee height	1'7"
Span	5'6"
One half of the body span	3'5"
Elbow span	2'10"
Standing upward vertical reach (near the counter)	5'10"
Standing horizontal comfortable reach (near the counter)	1'1"
Standing horizontal maximum reach (near the counter)	1'7"

## ABOUT AUTHOR



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