

CHAPTER III

METHODOLOGY

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In order to execute the inquiry and to achieve the desired objectives, a systematic approach adopted for the present study is described in this chapter. The research design, conceptual framework showing the relationship of variables, description of the variables and operational definitions of the terms used in the study are explained briefly. The sampling technique, selection and construction of the tool for the data collection for the study are also reported. The procedure of data collection through survey and experiments and the scheme for analysis of data are also described.

The research procedure followed are described under the following subheads.

- 3.1 Research Design
- 3.2 Conceptual Framework of the study
- 3.3 Variables Under the study
- 3.4 Operational Definitions
- 3.5 Development of the Instrument
- 3.6 Selection of the Sample

3.7 Method of Data Collection

3.7.1 Phase I - Collection of Empirical Data

3.7.2 Phase II - Experimental Work

3.8 Analysis of Data

3.1 Research Design

The research design is the specification of methods and procedure used for acquiring the information needed for the study. The main aim of the study was to find out the existing micro environmental quality of household kitchens.

In addition, respondent's exposure to media in relation to various aspects of environment, level of knowledge of the respondents regarding quality of environment, practices followed by the respondents influencing the quality of their work environment and the health status of the respondents and their family members were also assessed. Therefore, descriptive cum experimental research design was thought to be appropriate for this study. Descriptive survey method was used because of its usefulness in making an extensive exploration of a problem, in the present case, the micro environment quality of the household kitchens. The experimental design was used to assess the quality of micro environment in the household kitchens.

Interview technique was employed to gather required information and was supported by the observations made on the spot by the investigator regarding the existing quality of micro environment in the household kitchens.

Inspite of being time consuming, the interview technique was chosen for the present study for the following specific reasons :

- i) To get authentic data by establishing rapport with the respondents.
- ii) To gain confidence and full co-operation from the respondents as well as to ensure completely filled-in data sheets.
- iii) To record information through observation for supporting the data since it makes an important contribution to determine the existing quality of micro environment in the kitchens.

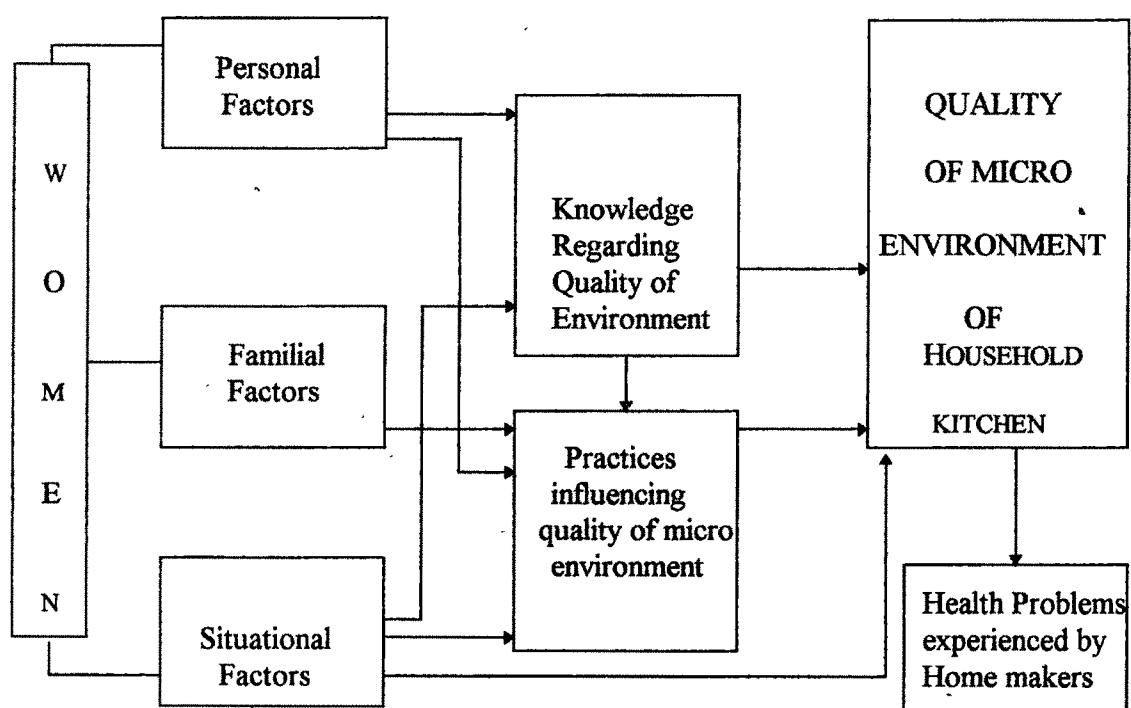
Since the study focussed on assessment of the quality of micro environment of the household kitchens, the investigator did not wish to confine the data collection technique to descriptive data collection only but also planned to supplement the data through experimental work. The experiments were conducted to measure the environmental quality of kitchens in terms of quality of air, water, sound levels, temperature level and illumination level in the selected household kitchens.

3.2 Conceptual Framework of the Study

In order to give direction to the investigation a conceptual framework was developed. The components of the framework are as follows :

- i) Personal Factors
- ii) Familial Factors
- iii) Situational Factors
- iv) Knowledge Regarding Quality of Environment
- v) Practices Influencing Quality of Micro Environment
- vi) Quality of Micro Environment of Household kitchens
- vii) Health Problems Experienced by the Homemaker

It is conceptualized that certain factors related to women's personal, familial and situational life affect their knowledge regarding quality of environment and practices influencing quality of micro environment. Which in turn, affect the quality of micro environment of household kitchen. It is also conceptualized that knowledge would influence the practices followed by the women. Locality of the household - one of the situational factors - would have direct influence on the quality of micro environment of household kitchens. It is presumed that health problems experienced by the women may be influenced by the quality of micro environment of household kitchen (Figure - 1).

FIGURE 1**CONCEPTUAL FRAMEWORK TO STUDY THE QUALITY OF
MICRO ENVIRONMENT OF HOUSEHOLD KITCHENS**

3.3 Variables Under the Study

The three sets of variables selected for the present study are described below (Figure - 2).

3.3.1 Dependent Variables

Dependent variable for the present investigation were quality of micro environment of household kitchens and health problems experienced by the Homemakers.

3.3.1.1 Quality of Micro Environment of Household Kitchens : Quality denotes something which is valued. As a value related concept it is assessed as good or bad. The quality of environment is a crucial and vital determinant of quality of life (Wallace, 1974). Quality of micro environment of household kitchens in the present study was measured in terms of good or poor quality on the basis of the scores given to various aspects of micro environment of the household kitchens. It was found that quality of micro environment in the household kitchen is influenced by the locality of households and knowledge of homemakers regarding quality of environment (Rachana, 1988; Veerbala, 1990). Quality of environment may influence the health problems experienced by the homemakers. Hence, it was considered as an important output component in the present study. For the present study it was thought that

the quality of micro environment might be influenced by the women's knowledge and practices influenceing quality of micro environment. It was also though that the locality of residence would directly infleunce the quality of micro environment of kitchen.

3.3.1.2 Health Problems Experienced by the Homemaker :

It was assumed that the health problems experienced by the homemaker may be influenced by the quality of micro environment of household kitchen.

3.3.2 Intervening Variables

Intervening variables in the study were knowledge regarding quality of environment and practices influencing 'quality of micro environment, which in turn might influence the quality of micro environment of the kitchen. Here they would act as independent variables. The same would act as the dependent variables in relation to the independent variables that is, presonal, familial and situational variables of the study.

3.3.2.1 Knowledge Regarding Quality of Environment :

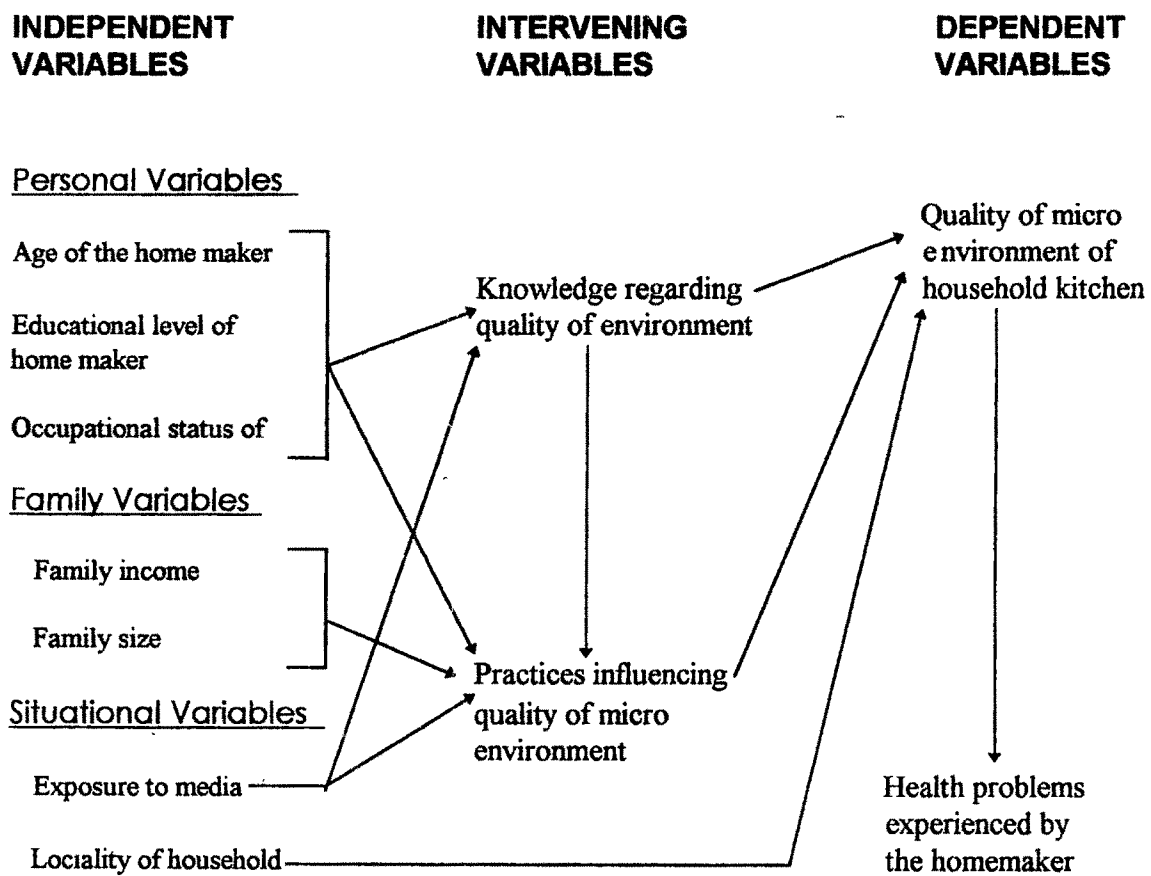
It was found in earlier research studied that respondents having better knowledge with regards to environmental quality maintained better quality of micro environment in Kitchen (Kaur, 1984; Rachana, 1988; Veerbala, 1990; Pawar, 1993). On the basis of the above observations, it was thought appropriate to

include this variable in the present study. It was thought that women's personal factors such as age, educational level and occupational status and situational factors such as extent of exposure to media might influence the knowledge level of women.

3.3.2.2 Practices Influencing Quality of Micro Environment : There were no evidences found in the review of literature showing the relationship between practices followed by the homemaker and quality of micro environment of household kitchens and hence, the investigator included this variable in this study. It was thought that women's personal factors namely age, educational level and occupational status; familial factor namely income and size of the family and situational factors namely exposure to media might influence the practices followed by the homemaker. It was also thought that the knowledge of women regarding quality of environment might have an impact on their practices influencing quality of micro environment.

3.3.3 Independent Variables

For the present investigation, the independent variables were classified into three categories namely 1) personal variables, 2) family variables, 3) situational variables.

FIGURE 2**SCHEMATIC REPRESENTATION OF INTERACTION OF VARIABLES**

3.3.3.1 Personal Variables : Personal variables consisted of age of the homemaker, educational level of the homemaker and occupational status of the homemaker.

Age of the Homemaker : Age was found to be a factor significantly influencing the level of knowledge of homemakers regarding quality of environment (Kaur, 1984; Veerbala, 1990). The study showed that the young homemakers had more knowledge than old homemakers. It was found that not many studies were done to find out the significant relationship of age over level of knowledge. Further, significant literature was not found that would provide evidence that there exists definite relation of age over the practices followed by homemakers influencing the quality of environment. Kaur (1884) found that sanitary practices were not affected by age of the respondents whereas, Pawar (1993) reported that practices followed by homemakers significantly differ due to age. Such contradictory findings inspired the investigator to study the relationship between these variables. Hence, it was thought to include age as an independent variable in the present study.

Educational Level of the Homemaker : It was found that higher the education, more would be the extent of knowledge regarding quality of environment (Kaur, 1984; Veerbala, 1990; Pawar, 1993). Educational level of

the homemaker is an important variable which may influence the level of knowledge. It was found that educational level was not significant with practices followed by homemakers (Kaur, 1984). Not much information was available regarding this variable, hence, it was included in this study.

Occupational Status of the Homemaker : Occupational status of the homemaker was considered as an important variable by the investigator but the literature reviewed showed dearth of information regarding the relationship between occupational status and knowledge and occupational status and practices followed by respondents. It was felt that women who are working outside their homes would have wider exposure than those confined to four walls of the house. Hence, this variable was included in the present study.

3.3.3.2 Family Variables : Family variables included family income and family size.

Family Income : As studied by Sardana (1990), family income influences the housing conditions. But Pawar (1993) found that income and practices followed were not significant. It was envisaged that the family income may affect the practices followed by homemaker influencing the quality of micro environment of household kitchens.

Family Size : The influence of the family size on practices followed by the homemaker is not established in studies done in past on micro environment conditions of kitchens. Only one study showed that practices followed by homemaker and family size were not significantly related (Pawar, 1993). Hence, it was considered important to include this variable in the study.

3.3.3.3 Situational Variables : For the present study, situational variables consisted of respondent's exposure to media and locality of households.

Exposure to Media : It is found that association between exposure to media and knowledge regarding quality of environment and association between media and practices influencing the quality of environment has not been studied much. Kaur (1984) found that exposure to mass media increased the level of knowledge of homemakers. Whereas Pawar (1993) reported that exposure to media and knowledge were not significant. Such inconsistent results motivated the investigator to find out the direction of this variable. Hence, the investigator considered this variable to be included for the study.

Locality of Household : It was found that there was significant difference between locality and quality of micro environment in the home (Ramdas, 1988). Not

much information was available to associate locality and quality of micro environment and therefore this variable was considered important for the study.

On the basis of the above information, it was thought appropriate to include all the above mentioned selected variables in the present investigation.

3.4. Operational Definitions

Certain terms and concepts were operationally defined for the measurement of variables in this study.

Quality of Environment : In this study quality of environment refers to living conditions that are safe enough, devoid of accident, free from polluting factors and which promote physical development, health and well being of individual.

Household : It is defined as a unit engaged in production, consumption, socialization, transmission, decision-making and management of resources. It is also an operating economic unit which pools food, labour, land and other resources (Verma, et al., 1989). This definition has been accepted for the present investigation.

Locality : It is the near environment or surroundings in which households are situated.

Micro Environment : In the present study, micro environment refers to the inner environment of the kitchen including physical structure, necessary services, facilities and equipments that the homemakers use in the kitchen.

Quality of Micro Environment : In this study it refers to existing conditions of work environment of homemakers that is, the kitchen. The various aspects of micro environment taken in the present study are ventilation, air, water, sound, temperature, light, sanitation.

Ventilation : Ventilation in this study refers to (a) provision of enough number of doors and windows in proper alignment (b) provision of natural and mechanical ventilation system to have good air circulation and (c) provision of properly located smoke outlet to carry out smoke and odours.

Air Quality : It refers to the quality in terms of purity of air (that is, devoid of pollutants) in the kitchen.

Water Quality : In the present study it refers to the quality in terms of its potability (safe and acceptable for use).

Sound Levels : It refers to the intensity of sound in the kitchen.

Light : It refers to the adequacy of natural and artificial light available in the kitchen in general and at the work place in particular.

Temperature Level : In the present study it refers to the extent of heat stress felt by the homemakers in their work environment.

Sanitation : In the present investigation it includes methods or ways of garbage disposal, problems of insects and pests, provision of drainage system in the house, appearance of kitchen and its surroundings.

Problems Faced by the Respondents : In the present investigation, it refers to the views and feelings of the respondents about the difficulties arising out of their existing environment.

Exposure to Media : Exposure to media in this study refers to the extent of use of various media through which the respondents gained the information on various aspects of environment in general.

Knowledge Regarding Quality of Environment : In this study it was operationally defined as having correctness of information and awareness regarding quality of environment by respondents.

Practices Influencing Quality of Micro Environment:

In this study, the practices followed by the respondents which influence the quality of micro environment refer to the methods/ways of doing certain activities such as, water storage and purification, waste disposal, insects and pest control, sound control and frequency of cleaning the kitchen.

Health Problems Experienced by Homemakers : In the present study it refers to the extent to which the respondents face health problems while working in the kitchen.

3.5 Development of the Instrument

Interview schedule along with observation was used to collect empirical data for the study. The objectives formulated for the study guided the development of an interview schedule. The schedule included structured questions divided into six sections.

Section - I of the interview schedule included questions which provided information pertaining to socio-economic and demographic profile of the respondents.

Section - II of the schedule comprised information on the quality of work environment of the respondents which was supported by the factual observations made

by the investigator. It included questions related to the kitchen size and ventilation, types of fuels used, sources of water supply and storage methods, sources of light, sources of sound and intensity of sound realized by the respondents, questions related to waste disposal, building materials used in the kitchen and problems faced by the respondents in their work environment.

Section - III contained the questions to elicit information about the extent of exposure of respondents to media in relation to various aspects of environment.

Section - IV of the schedule included knowledge test to measure level of knowledge of respondents regarding quality of environment. The knowledge test was designed to elicit information through statements pertaining to various aspects of environment in general.

Section - V of the instrument dealt with the information on the practices followed by the respondents influencing the quality of their work environment.

Section - VI of the schedule contained questions on health problems faced by the respondents while working in the kitchen and also the problems faced by the family members (Appendix III).

3.5.1 Development of Knowledge Test to Measure the Level of Knowledge of the Respondents Regarding the Quality of Environment.

Knowledge tests used in the measurement of level of knowledge have proved to be useful in a variety of research problems. The objective of determining level of knowledge of the respondents requires a standardized knowledge test. For quantitative measurements the concept of scaling method is mostly used. The level of knowledge of the respondents is determined in terms of whether they possess good, medium or low knowledge, this is measured by giving scores to answers for each item in the test and by totalling the scores for each respondent.

To measure the level of knowledge of the respondents regarding quality of environment, an attempt has been made to develop a knowledge test in view of the fact that it plays an important role in achieving and maintaining quality of the micro environment in the household kitchens.

3.5.1.1 Construction and Standardization of the Test

The content of the test comprised of questions called items. The most important factor considered in collecting the items for the knowledge test was to include the various aspects that determine the

quality of environment such as, causes and consequences of pollution, control of pollution at micro level, effects of building materials on quality of micro environments and activities carried out in the work environment, related health problems faced in the work environment and so on.

3.5.1.2 Item Collection

The items were collected from the literature reviewed. Special care was taken to include relevant information. Following criteria were kept in mind while selecting the items for the test:

- (i) The Statements should be as simple as possible.
- (ii) They should be clear, brief and related to the problem.

The items collected for constructing the knowledge test were all framed in the simple statement form so that the respondents could respond to them either positively or negatively. The selection of the items were done keeping in mind the fact that it should differentiate the well informed respondents from the poorly informed respondents and should have a certain difficulty value and that it should promote thinking of the respondents. Sixty two possible and relevant items were framed to constitute the initial test.

3.5.1.3 Content Validity of the Knowledge Test

The aim was to develop such scale that would satisfy content validity. The validity of a scale concerns what the scale measures and how well it does so. The content validity assesses the relevance of the scale to the stated purpose. Content validation is basically judgmental and intuitive. It can be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards.

Therefore, the set of carefully selected 62 items related to the topic was given to a panel of nine judges consisting of experts in the field from Faculty of Home Science, Faculty of Technology and Engineering and Microbiology Department of Faculty of Science, M.S. University of Baroda.

The judges were requested to sort out the statements in terms of its correctness or incorrectness. This was felt necessary so that the investigator could make sure of herself in discriminating correct or incorrect statements. They were also requested to indicate their judgement on clarity and applicability of the statements. All the responses of the judges were coded and tabulated and analyzed for each statement. The screening of the items was done on the basis of the following criteria :

- (i) The statement classified as 'clear' by more than seventy five percent of judges was retained in the scale.
- (ii) The statement which was reported as 'applicable' by more than seventy five percent of judges was included in the test.

Very few statements which were indicated as 'ambiguous' but were very much applicable to the study were modified as per the suggestions given by the experts and were made more clear and approved by the judges after modifications. After the analysis of the judgment given by the panel of experts, nine statement which were not meeting the above criteria were eliminated from the scale. Thus, out of the original set of sixty two items, fifty three items which fulfilled the above criteria were included in the final selection of items in the knowledge test which was to be used in the pilot study (Appendix-I).

3.5.2 Pre-Testing of the Schedule

The schedule so developed was pretested on 30 randomly selected households of a non - sampled group. A pilot study was done to see the feasibility and clarity of the interview schedule and to establish the reliability of knowledge test. Few changes were incorporated in the interview schedule and the tool for data collection was finalized.

3.5.3 Reliability of the Knowledge Test

Reliability refers to the accuracy in terms of consistency and stability of measurement by a test (Anastasi, 1982). The reliability varies from zero to one, having the former value when the measurement involves nothing but error and reading the latter value only when there is no variable error at all in the measurement.

So to ascertain the reliability of the instrument, the following criteria was adopted.

3.5.3.1 Item Analysis of the Knowledge Test

The knowledge test was analyzed quantitatively by doing item analysis to increase validity and reliability of the test. Item analysis was done to eliminate inconsistency of the items. The respondents were asked to answer the items in dichotomous categories i.e. whether the statement is 'correct' or 'incorrect'. Both correct and incorrect statements were included for counter checking. Almost equal number of positive and negative statements were included in the scale. All the right answers were given a score of '2' and wrong answers were given a score of '1'. These scores helped to determine the level of knowledge of the respondents. There was thus possibility of a respondent

scoring maximum of 106 points for all right answers and 53 points for all wrong in the knowledge test. Having totalled the scores obtained by the 30 respondents in a pilot study, the scores were arranged from highest to the lowest in magnitude. The statements for the final test were retained on the basis of the typical item analysis of the knowledge test done for the information such as, Index of Item Difficulty, Index of Validity or Discrimination and Point Biserial Correlation. The Index of Difficulty shows the degree of difficulty of an item while the Index of Validity indicates how well an item measures or discriminates in agreement with the rest of the test. The extent to which an item discriminates the well-informed from the poorly informed respondents is judged from the Index of Discrimination.

The Item Difficulty Index

The item difficulty index results from a simple analysis, which demonstrates the relative efficiency of items in groups that do and do not possess the characteristics of interest. In its simplest form, the item difficulty index represents the percentage of a given group that fails an item. If one were testing a given ability that was assumed to be randomly distributed within a population and using a sample randomly drawn from that population,

the expected item difficulty for any given would be 0.50. As the item difficulty level moves towards 1.0, a given item is too difficult, since at 1.0 no one is passing the item. As the item difficulty approaches 0.0, a given item is too easy, since hardly anyone is missing the item. Items that are too easy or difficult are useless in a test, since they offer no discriminations among subjects.

There is no format for determining the exact distribution of item difficulties. A common practice is to select some items whose difficulty is at or close to, the 50 percent level and other items with a wide range of degree of difficulty in terms of percent passing (Freeman, 1971). The items with difficulty above 20 and below 80 must be included in the test (Goldstein and Herson, 1984).

The difficulty index 'p' was worked out using the following formula :

$$\text{Item Difficulty Index (p)} = \frac{\text{Number of respondents giving right answer}}{\text{Total number of subject who responded the item}} \times 100$$

The percentage of respondents with 'p' value ranging from 20 to 80 were considered for final selection of items for the knowledge test (Appendix -II).

The Discrimination Index

The discrimination index is a method of differentiating persons scoring high on a given variable from those scoring low on such characteristics. A common practice in item analysis is to compare the proportion of cases who pass an item in contrasting groups. For this, the total scores earned by the respondents are entered in a descending order. The upper and lower criterion groups are selected from the extremes of the distribution. Obviously, the more extreme the groups the sharper will be the differentiation. In a normal distribution, the optimum point at which these two conditions balance is reached with the upper and lower 27 percent. With small groups, any convenient number between 25 percent and 33 percent (that is, one third of the scores) serves satisfactorily (Anastasi, 1982).

The discrimination index may take on values from -1.0 to + 1.0; values above 0.40 suggest effective items, while values between + 0.20 to + 0.39 are considered satisfactory (Hopkins and Antes, 1978). The formula for the discrimination index is given below (Hopkins and Antes, 1978; Goldstein and Herson, 1984).

$$\text{The Discrimination Index} = \frac{\text{Number in the upper group} - \text{Number in the lower group}}{\text{Number of subjects in either group}}$$

The items with discriminating index above 0.20 were considered for the final selection for the knowledge test (Appendix - II).

Point-Biserial Correlation Coefficient

For establishing internal validity of the test, point-biserial correlation coefficient ($r_{p\ bis}$) was estimated. Since the items were scored simply as "2" if right and "1" if wrong response, the assumption of normality in the distribution of right / wrong responses was considered as unwarranted according to Garrett (1979). Point biserial correlation coefficient " $r_{p\ bis}$ " assumes that the variable which has been classified into two categories can be thought of as concentrated at two distinct points along a graduated scale or continuum.

The formula for the point biserial correlation coefficient " $r_{p\ bis}$ " is given below :

$$r_{p\ bis} = \frac{M_p - M_q}{\sigma} \times \sqrt{pq}$$

Where,

$r_{p\ bis}$ = Point biserial correlation coefficient

M_p = Mean score on continuous variable of successful group on dichotomous variable

M_q = Mean score on continuous variable of unsuccessful group on dichotomous variable

σ = Standard deviation on continuous variable for total group

p = Proportion of persons falling in successful group of dichotomous variable

q = $1-p$ or the second group

Point biserial correlations were worked out for all items having difficulty index between 20 and 80 and discrimination index above 0.20 (Appendix-II). The r_{pb} values for all the items were tested for significance with $df\ n-2$, where "n" was number of respondents.

The item having significant point biserial correlation coefficient at 0.05 level of probability were selected for the final knowledge test (Appendix - II).

All the items which satisfied these three criteria i.e. the item difficulty index, discrimination index and point biserial correlation coefficient were considered for inclusion in the final test and other items not falling in these criteria were deleted from the test (Appendix - I). Finally forty two items were selected for the knowledge test.

3.5.4 Reliability Coefficient of the Knowledge Test

Split-half technique was adopted to determine the reliability coefficient of the test. According to this method of calculating reliability, the whole scale was divided into two halves using odd numbered items for one half and even numbered items for the other half. The scores of the subjects for odd numbered and even numbered items were totalled and each of the two sets were treated as separate scale. The respondent who scored high on the odd items should score high on the

even items as well, if empirical errors have been kept to a minimum and the same applies in case of low scores also. The coefficient of correlation "r" between odd and even scores of thirty respondents was computed by using the Pearson's Product Moment correlation Coefficient formula (Gupta, 1981);

$$r = \frac{\sum dxdy}{\sqrt{\sum dx^2 \sum dy^2}}$$

The correlation coefficient of the half test derived was 0.93. This shows that there is a positive correlation of high degree and its magnitude is 0.93.

From the self correlation of the two halves of the test, the reliability coefficient of the whole test was estimated by using the Spearman Brown Prophecy formula (Garrett, 1979);

$$r_{rel} = \frac{2.r}{1 + r}$$

Where,

r_{rel} = reliability coefficient of the whole test

r = correlation coefficient of the half test

The above formula always yields values which are slightly higher than the correlation value on which it is based. The justification for this is that, increasing the number of measurements or increasing the length of the

instrument must enable one to arrive at a better estimate of whatever is being measured that is, the reliability must increase with number of measurements or with length of the instrument. By using the above formula of reliability coefficient, the reliability of the knowledge test calculated was 0.96.

3.5.4.1 The Index of Reliability

The index of reliability " r_{∞} " measures the trustworthiness of the test scores by showing how well obtained scores agree with their theoretically true counterparts. The index of reliability is also taken as a measure of validity. The following formula was used to calculate the index of reliability (Garrett, 1979).

$$\text{Where, } r_{\infty} = \sqrt{r_{\text{rel}}}$$

r_{rel} = the reliability coefficient of the given test

r_{∞} = the correlation between obtained and true scores.

By using the given formula, the index of reliability of the knowledge test was found 0.98. This means, 0.98 is the highest correlation of which this test is capable, since it represents the relationship between obtained test scores and true test scores in the same function.

3.6 Selection of the Sample

To select the sample for data collection, it is important to decide the universe of the study from which small areas are designated and sampling units are selected called as households. The basic sampling units chosen may depend on such factors as the type of area being studied, population distribution, the availability of suitable maps and other informations (Raj, 1984).

3.6.1 Locale of the Study

The study covered household kitchens from selected localities of Baroda city.

3.6.2 Sampling Design

A multistaged purposive cum random sampling design was used to select the study area and household for the present study. The stages included the selection of localities, selection of blocks or small pockets, and selection of households.

3.6.2.1 Selection of Localities :

Selection of the localities was purposive as it was aimed to study the quality of environment in different localities and hence following localities were selected for the study.

- i) Industrial cum residential
- ii) Commercial cum residential
- iii) Residential

The selection of the locality was based on the zoning designated for various land uses in Vadodara Urban Development Area - Draft Development Plan - Proposed Plan 2001 A.D. by VUDA - VADODARA URBAN DEVELOPMENT AUTHORITY (Figure - 3).

3.6.2.2 Selection of Blocks (Smaller Pockets) :

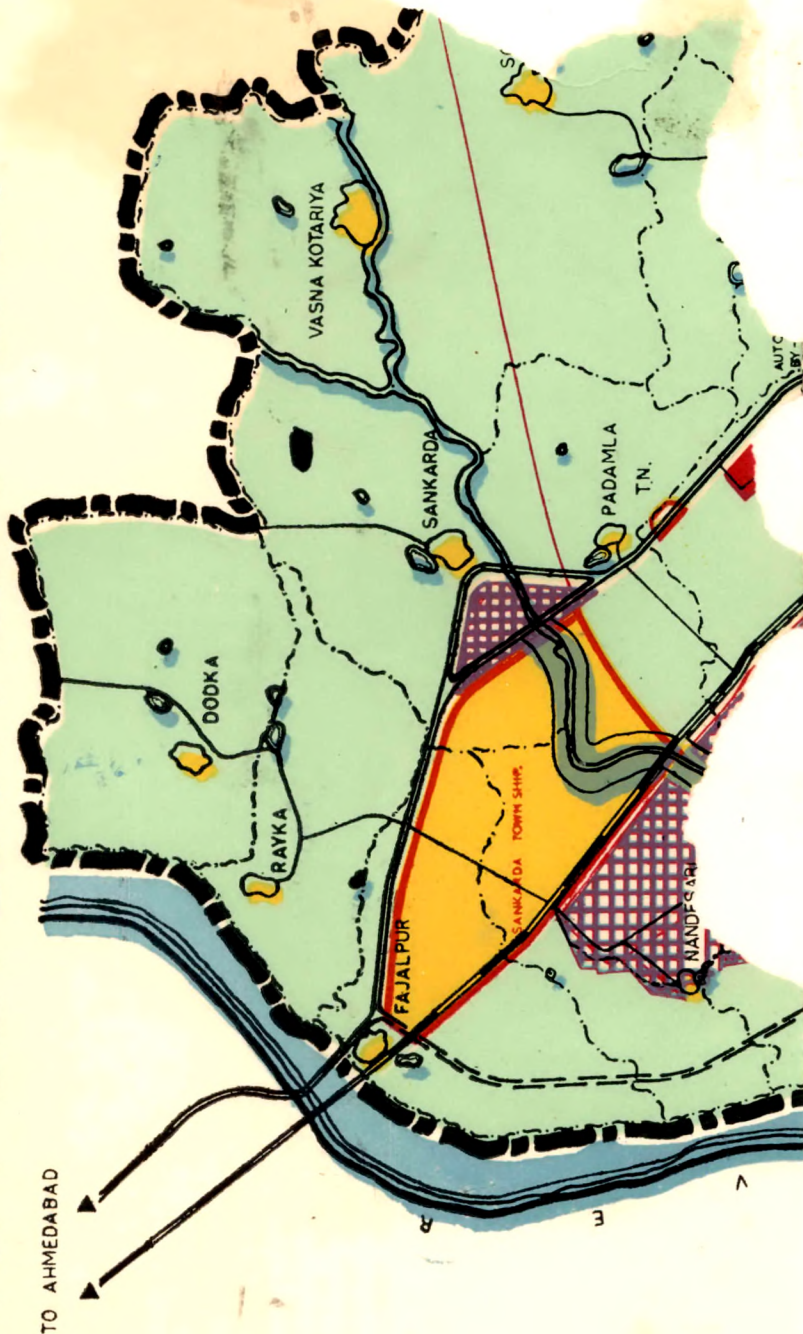
Depending upon the easy accessibility, feasibility, convenience and acquaintance of the investigator following areas were selected randomly.

- i) Sarabhai industrial area
- ii) Dandia Bazar commercial area
- iii) Alkapuri (Southern) residential area.

3.6.2.3 Selection of Households :

It was a purposive selection of household using fuels other than gas such as wood, coal, kerosene, etc. as main fuels for cooking, heating or lighting purposes. As these are the major source of pollution at indoor level, such households were selected to study the quality of micro environment of household kitchens. These households are generally the deprived lot of the society and not much explored in terms of quality of environment they live in.

VADOB AIRA URBAN DRAFT DEVELOPMENT PLAN



It was difficult for the investigator to select households using these fuels such as wood, coal, kerosene, etc. as there was no source of information available on the basis of which sample could be selected. Hence, the investigator contacted the sellers of kerosene, wood, coal, etc. in these selected areas to find out the first hand information of users of kerosene, coal, wood, etc. who were their regular customers. the investigator had to get the information by herself by visiting households and made the list of those households only who were using wood, kerosene, coal, etc. Finally, the investigator used this list for the selection of the sample.

Fifty households were randomly chosen from each locality with total 150 household for descriptive cum experimental study; only for water analysis sample was limited to 90 household. Thus, the unit of inquiry was household and home maker was the key informant in the present study. Only those homemakers who were doing most of the cooking and related activities in the kitchen by themselves were considered eligible to be included in the present study.

3.7 Method of Data Collection

Data collection for the present study was done in two phases as the study was descriptive cum experimental in nature.

3.7.1 Phase I - Collection of empirical data

3.7.2 Phase II- Experimental work

3.7.1 Phase I - Collection of Empirical Data

A survey of selected households was conducted to collect empirical data relevant to the study. The data were gathered personally by using interview technique supported by observations. Home makers were the key informants for the investigation. Several visits were made to the selected households to gather required information utilizing the schedule. In the first visit the investigator introduced herself to the respondent and a rapport was established and the homemaker's working hours in the kitchen were noted down for the next visit because the investigator aimed to study the existing working conditions of the respondents. The visits were made between 9 am to 12 noon as it was reported by most of the respondents as the time for the major activities in the kitchen. Interview schedule being lengthy and comprised several sections, several visits were made to get complete

information. Observations on the quality of work environment were made by investigator and area measurements were taken by the investigator and data were recorded in the schedule. On the whole, all the respondents were very cooperative.

3.7.2 Phase II - Experimental Work

To assess the micro environmental quality of household kitchens, it was necessary to conduct the experiments on certain aspects of environment in terms of:

- 3.7.2.1 Air analysis
- 3.7.2.2 Water analysis
- 3.7.2.3 Sound levels
- 3.7.2.4 Temperature levels
- 3.7.2.5 Illumination levels

3.7.2.1 Air Analysis

Air analysis was carried out to determine the quality of air by measuring level of pollution in indoor air. For the present study households using various fuels such as coal, kerosene, cowdung cake, wood, wood scrap and crop residue for cooking purpose in their kitchens were selected. Combustion of these fuels produce quantum of pollutants and cause air pollution in household kitchens and affect the health of the home makers.

In the present study the level of gaseous pollutants like Carbon Monoxide (CO), Sulfur Dioxide (SO₂) and Nitrogen Dioxide (NO₂) were measured with the use of Technovation Multi Gas Monitor (Plate - 1).

Carbon Monoxide (CO) : Carbon Monoxide results from incomplete combustion of carbonaceous matter in all combustion processes. It is a colourless, odourless and tasteless gas which is toxic at sufficiently high levels. It is present in vehicular exhaust and to a large degree in cigarette smoke. CO can cause physiological and pathological changes and ultimately result in death. It is a poisonous inhalent that deprives body tissues of necessary oxygen. It has long been known to cause death when exposure to a high concentration (750 ppm) is encountered (Wark and Warner, 1976).

Sulphur Dioxide (SO₂) : Sulphur Dioxide is gas with a choking smell. It is formed in considerable quantity when coal, coke or certain fuel oil are burnt. It is emitted in much greater quantity and is capable of doing much harm.

Nitrogen Dioxide (NO₂) : Man's greatest contribution to the family of Nitrogen oxides arises from the combustion of fuels. Other sources contribute very little by comparison. NO₂ acts as an acute irritant and in equal concentrations is more injurious than NO.

Vehicles emit large concentrations of Nitric Oxide which is rapidly oxidized in the atmosphere to Nitrogen Dioxide - a reaction heavily implicated in the formation of photochemical smog. Nitrogen dioxide is a brown gas with odour.

The details of the instrument used for monitoring above gases and the procedure of sample collection are given below.

The Instrument

Technovation Multi Gas Monitor is a portable PPM Carbon Monoxide, PPM Nitrogen Dioxide and PPM Sulphur Dioxide analyser which simultaneously displays 0 - 1999 PPM Carbon Monoxide on one display and the remaining gases on the second display depending on the gas selected by the press button switch. The instrument is equipped with three separate electrochemical sensors which are also known as "fuel cells".

The instrument is powered with NI/CD batteries of rating 2.2 AH 12 V. which are to be charged periodically, or when its voltage falls below a certain pre-set value. However, its capacity is several hours on continuous use before recharging again.

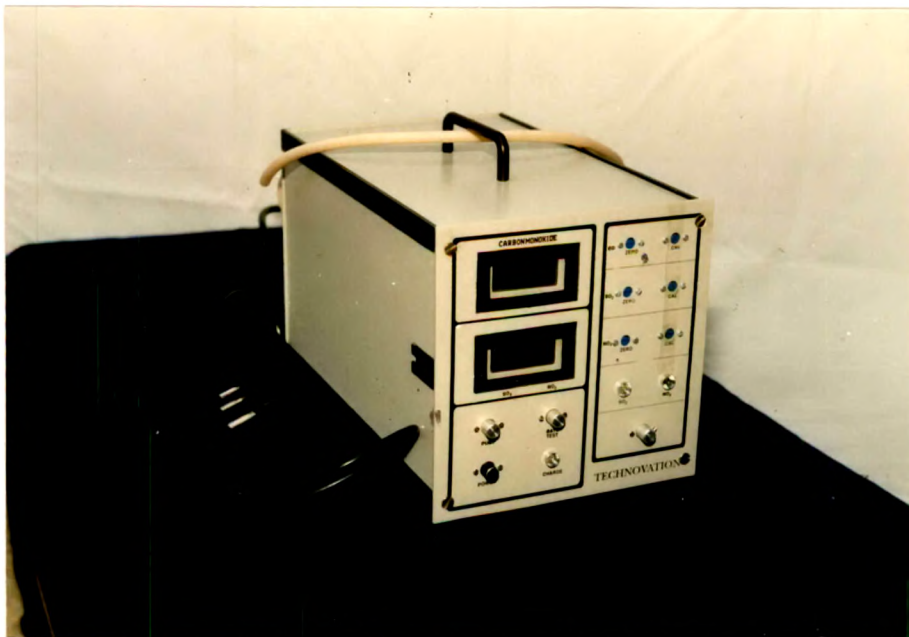


Plate 1 : Multi Gas Monitor

The instrument is supplied with toxic gas sensors (CO, SO₂ and NO₂) always fitted. The instrument has its own built-in eduction pump, which draws the gas sample to be analysed to the instrument. A flow indicator provided on the rear face shows whether the sampled gas is being drawn through the instrument. A filter tube is provided on the rear of the instrument.

Principle of Operation

The instrument requires cool, clean gas for analysis. Gases heavily laden with water vapour will not affect the cells as long as the vapour does not condense on the cell membrane surface. Particulate matter should not be allowed to enter the instrument.

The toxic gas sensors are electrochemical sensors of the micro fuel type. The sensors are maintenance free and are stable for long periods of time. Active gases diffusing to the sensing electrode reacts and produces a minute current which is sensed, conditioned and amplified. The oxygen required for the reaction is taken from the ambient air. Cross interference by most gases is eliminated.

The filter tube provided on the rear face removes soot, dust and other particulate matter. The small inbuilt pump provides for eduction of the gases from distances.

Standard Specification**Technical Details : Carbon Monoxide**

Display : Digital, range 0-1990 PPM resolution 1 PPM
Accuracy : $\pm 2\%$ F.S.D. at constant temperature
Calibration : Calibration gas
Zero : With CO free air
Sensor : Electrochemical cell

Sulphur Dioxide and Nitrogen Dioxide

Display : Digital, 3 1/2 digit
Range : SO₂ 0-1999 PPM resolution 1 PPM
NO₂ 0 - 1000 PPM resolution 1 PPM
Accuracy : $\pm 5\%$ F.C.D. at constant temperature
Calibration : With calibration gas
Zero : With toxic gas free air
Sensor : Electrochemical cell

General

Response time : 90% in 90 seconds
Working temperature : 10-40°C
Power : NI/CD rechargeable cells
Charge power : 220 V AC / 50 HZ
Dimensions : 192 X 192 x 300 mm
Weight : 5.6 Kgs
Gas sample : Educted by internal pump
Maximum suction 10 inches mercury column
Maximum flow 2.5 L/Min.

Procedure of Sample Collection

The instrument was placed at the source where cooking was going on and care was taken that it did not get affected with direct flame and sunlight. the general power switch was put "ON". Fresh air - free of toxic gases was let in for 5 minutes after putting the pump "ON" to check the "zero" concentration of the gases before taking the sample.

Then the silicon rubber tube of 4 mm ID was attached to the filter tube of the instrument and the other end of the tube was introduced to the fuel gas which was sampled and reading was taken after it was stabilized after one and half minutes. Three such readings were taken at the interval of 15 minutes. After each reading it was let to draw in fresh air to show "zero" reading.

After the use, the pump was allowed to run for some time till the toxic gases were driven out completely and reading showed "Zero" and then pump was put "off" . This care was necessary to avoid damage to the sensor.

It gave readings of two gases simultaneously (CO and the selected gas) and for third gas, toxic gas selection switch was put "ON" and readings were taken following the above procedure. The average of the three readings for each gases was noted down for discussion.

3.7.2.2 Water Analysis

Water analysis was done in terms of its bacteriological quality. The bacteriological impurities are caused by the presence in water of the pathogenic or disease-producing type of bacteria making water dangerous for human consumption and health. Bacteriological analysis offers the most sensitive and delicate test for detecting the contamination of water by sewage or human excreta. However, the methods do not provide for the detection, isolation or enumeration of pathogenic bacteria in water. They are intended only to indicate the degree of contamination of water with wastes from human and animal sources. The most commonly used organism as indicator of faecal pollution is the coliform group as a whole and *Escherichia coli* (*E. Coli*) in particular.

The coliform organisms comprise of all aerobic and facultative anaerobic, Gram - negative, non-sporing, motile and non-motile rods, capable for fermenting lactose with the production of acid and gas at 37°C in less than 48 hours. The coliform group includes both faecal and non - faecal organism. The *E. coli* bacteria inhabit the intestinal tracts of warm blooded animals and human beings and appear in very large number in their daily faecal discharges and also in crude sewage. They

themselves are not harmful but their presence serves to indicate the possible existence in the water of the pathogenic type of bacteria such as the typhoid bacillus, which may be the cause of water pollution. It is therefore important to carry out test that would indicate the presence of E. Coli calling for immediate action before determining its potability and declaring water absolutely fit for human consumption. From the public health point of view, the best assessment of the sanitary quality of water depends on the interpretation of bacteriological results.

There are many tests or techniques for detection of degree of contamination of water. For the present study, the multiple tube fermentation test (M.P.N. test - Most Probable Number) was applied to find out the presence of pathogenic organism. This number based on certain probability formulas, is an estimate of the mean density of coliforms in the sample.

For drinking water examine frequently inoculating tubes of 10 ml double strength medium with 5-10 ml portions which generally provides sufficient definite information. The assessment of probability generally is based on knowledge of the sanitary condition of the supply as determined by bacteriological monitory.

WHO (1971) has given certain international standards for drinking water. Ideally all samples should be free from coliform organisms. In practice, this standard is not always attainable; and following standards are therefore recommended :

- i) Coliform organism or E. Coli should be absent from each 100 ml sample of water entering the distribution system.
- ii) An M.P.N. Index of 8-10 should not occur in consecutive samples.
- iii) None of the samples should have an M.P.N. Index of coliform bacteria in excess of 10.
- iv) 90 percent of the samples should not contain coliform organisms in 100 ml of water.

Laboratory Apparatus

- i) Incubator : Incubator was used to maintain uniform temperature with not more than $\pm 0.5^{\circ}\text{C}$ variation at all time (Plate - 2).
- ii) Autoclave : Autoclave was used to provide uniform temperature within the chambers upto 121°C equipped with an accurate thermometer, pressure gauge and safety valve (Plate - 3).



Plate 2 : Incubator



Plate 3 : Autoclave

iii) Balance : Single pan, rapid weight balance was used which is most convenient having sensitivity of 1 mg under a load of 10 gms.

iv) Pipettes : Pipettes of convenient size that deliver the required volume accurately and quickly were used.

v) Media preparation utensils, dilution bottles and tubes : the equipments of resistant glass, closed with glass stoppers were used that do not produce toxic or bacterio-static compounds on sterilization.

vi) Sample bottles : Sterilized glass bottles with cotton plugs were used to collect the drinking water sample.

Collection of Water Sample

Correct sampling is of utmost importance for dependable results. Care should be taken that there should be no contamination of the sample during the collection and transportation of water samples.

Samples of stored water were collected from 90 randomly selected households kitchen (30 each from three localities). Water samples were collected in the bottles that had been cleaned, rinsed and sterilized carefully. Sodium thiosulphate crystals ($\text{Na}_2\text{S}_2\text{O}_3$) were added for dechlorination of water sample. Same time it was also necessary to add EDTA crystals (Ethylene diamine tetra

acetic acid) to prevent action of heavy metals in the water sample. The bottles were sterilized at 15 lb pressure, at 121°C temperature for 15 minutes in autoclave.

While taking water from the vessels care was taken that air would not enter the bottle and cork was put on each filled bottle and were tied up tightly and immediately taken up for the bacteriological examination in the laboratory. The samples were analysed as quickly as possible and preserved at 4°C temperature in refrigerator. Care was taken to examine samples within 6 hours but never after 48 hours to avoid undesirable results.

Preparation for the Test :

For detection of presence of pathogenic organisms, M.P.N. test (Most Probable Number) was carried out by the multiple tube fermentation technique.

Drinking water sample was examined by inoculating measured quantities of sample water (10 ml) into tubes of McConkey's Lactose Bile Salt Broth with Darhm's tube for the collection of gas (hydrogen plus carbondioxide).

The medium McConkey's Lactose Bile Salt Broth was made up of following ingredients :

<u>Ingredients</u>	<u>per litre</u>
Peptone	20 gms
Lactose	10 gms
Bile salts	5 gms
Sodium chlorides	5 gms
Neutral red	0.075 gms
pH (approx.)	7.4 \pm 0.2

The double strength concentration was made by suspending 80 gms of powder in 1000 ml distilled water. Five test tube series for each water sample was prepared with 10 ml of solution in each with the help of pipette in presence of flame. A Darhm's tube was inserted in each test tube and cotton plugs were pressed in each test tube. The test tubes were put in an autoclave for sterilizing at 15 lb pressure at 121°C temperature for 15 minutes. These prepared test tubes were put into an incubator for fermentation at 35°C. Each test tube was examined at the end of 48 hours. Presence of bacteria was indicated by the presence of gas formation in Darhm's tube due to fermentation of lactose and that was also indicated by the change of colour from red to yellow. The results were recorded in terms of positive and negative numbers out of five test tubes (presence of gas was indicated as positive).

From the number of tubes showing presence of gas (positive tube), M.P.N. Index of coliform organisms in 100 ml of sample water was found out from standard table (Greenberg, et al., 1981) given below.

Table 3.1 M.P.N. Index

Number of tubes giving positive reaction out of 5 of 10 ml each	M.P.N. Index per 100 ml
0	<2.2 (not polluted)
1	2.2
2	5.1
3	9.2
4	16.0
5	>16.0 (highly polluted)

3.7.2.3 Sound Levels

It was necessary to measure the actual levels of sound produced in the household kitchens. For the measurement and evaluation of sound levels, a wide variety of equipments are commercially available. For the present study, the instrument, sound level meter was used.

The Instrument

Sound level meter is a portable model "SLM 101" (Plate - 4). It is designed for simple and accurate sound level surveys. It consists of a microphone, amplifier,

weighing networks and a display meter reading in decibels. It has a built-in microphone and the instrument responds as per the "C" weighing network. The weighing networks in sound level meters attempt to alter the measured signal in a similar fashion as the human hearing mechanism. The microphone is mounted on a cone shaped front for minimum reflections. The instrument has a built-in constant impedent attenuator with 20 dB steps and minimum noise ratio signal device. The meter is a large scale moving coil instrument calibrated between 0 to 20 dB. The total sound level is the sum of the range switch and the meter reading. Fast - slow switch enables short sound bursts to be measured. At the microphone, the sound wave energy is converted into an electrical signal that is boosted in magnitude at the preamplifier.

Decibel or dB is the universally adopted unit for measuring sound intensity. It is not really a unit, but a ratio that provides a measurement of the actual pressure level of the physical sound. The instrument operates on a 9 V battery and a switch permits easy "battery check". It is recommended that care be exercised against reflected sound waves from the operator's body when using a sound level meter.



Plate 4 : Sound Level Meter

Procedure for Measuring Sound Levels

The sound level readings were taken in the kitchen when activities were going on and also an ambient sound levels (background sound) were measured when no activities were being carried out in the kitchen. Three readings in both situations at the interval of 5 minutes were taken and average was taken out and recorded in data sheet. The sound level meter was kept in horizontal position on some flat surface with its nozzle (receiver of sound) facing the source of sound. The instrument was kept 1 m (approx.) away from the source, 1 m (approx.) above the floor level and 1 m (approx.) away from the walls and other reflecting surfaces.

3.7.2.4 Temperature Levels

To find out the feelings of heat stress realized by the homemakers, it was necessary to measure the temperature levels near the cooking area when cooking was going on and in the kitchen in general when cooking was not going on. Thermometers are the instruments used for measuring temperature.

The Instrument

A wide variety of thermometers are available for measuring temperature levels such as dry bulb thermometer, wet bulb thermometer, alcohol thermometer,

kata thermometer and so on. For measuring temperature levels in household kitchens for present study, a simple mercury thermometer (dry bulb) was used which measures temperature in centigrade. This type of thermometer is widely used as mercury boils at the high temperature, has a regular expansion and its level can be easily seen.

Procedure for Measuring Temperature Levels

The thermometer was held atleast 0.5 m (approx.) away from the source, 1 m(approx.) above the floor level, for about 3-5 minutes when cooking was going on. A general kitchen temperature was also recorded keeping the thermometer, in the centre of the kitchen and about 1 m (approx.) above the floor level when cooking process was not being carried out.

3.7.2.5 Illumination Levels

For comfortable and pleasant work environment, it is important to have good amount of light that helps one to do what he wants to do and makes one feel good while doing it. For the present study, it was necessary to measure the illumination levels at the work place and in the kitchen in general. The measurements were taken with the use of light meter.

The Instrument

A light meter was used to measure the intensity of illumination at the work place and in kitchen in general. The type 213 light meter is a pocket size colour and cosine corrected light indicating device capable of reading upto 500 foot candles and upto 5000 foot candles with the use of switch given for higher level readings (Plate - 5). Foot candle is a measure of light on a given surface and not the amount of light generated from the source. It is the intensity or density of light falling on a surface (William, 1977). It is measured in foot candle (English unit) or lux = lumens per square meter (Metric unit).

Procedure for Measuring Illumination Levels

The illumination levels were measured by placing the light meter on the activity plane with its cosine correcting filter surface facing the light source at about 1 m (approx.) above the floor level. General illumination of the kitchen was estimated by taking four readings by dividing the floor area into four parts. In the center of the each section, the light meter was held horizontally at a height of 1 m (approx.). The average of these four readings was calculated to find out the general illumination level in the kitchen.



Plate 5.: Light Meter

3.8 Analysis of Data

Descriptive as well as relational statistics were used to analyse the data in the study. The data were categorized, tabulated and presented in frequencies, percentages, mean, standard deviation for analysing various information. The statistical analysis was done to test the hypotheses of the study.

3.8.1 Categorization of the Variables for the Purpose of Analysis and Tabulation

For the purpose of analysis, variables of the study were categorized as given below. A detailed description of the scoring procedure adopted for the study is given in appendix (V).

3.8.1.1 Age of the Respondent : Age was measured in terms of number of full years the respondent completed at the time of interview. It was categorized as young, middle aged and older group on the basis of the productive age of the women.

Category -----	Range of Age (in years) -----
Younger group	<= 30
Middle age group	31-45
Older group	>= 46

3.8.1.2 Educational Level of the Respondent :

Education referred to the formal education attained by the respondent. It was categorized as :

Illiterate	: no formal education
Low level	: upto middle school
Medium level	: upto high school (below graduate level)

3.8.1.3 Occupational Status of the Respondent : It was categorized according to gainful employment of the respondent as :

- i) Unemployed : Who are not employed outside home for cash, kind or wages.
- ii) Employed : Who are gainfully employed for wages.

3.8.1.4 Family Income : Family income refers to the monthly family income accrued from various sources by respondent's family such as service, business and other income generating sources. It was categorized into 3 groups according to information from Taxation Inquiry Committee (1991).

Category	Range of Income (in Rupees)
-----	-----
Low Income group	upto 1000
Low-High Income group	1001-2000
Medium Income group	2001 and above

3.8.1.5 Family Size : Operationally, family size refers to the total number of members in the family consisting of husband, wife, children and other dependents, residing under same roof and sharing the same kitchen. The family size was categorized as :

Category -----	Range of Family Size (Number of family members) -----
Small	≤ 4
Medium	5 - 8
Large	≥ 9

3.8.1.6 Time Spent in the Kitchen : Total hours spent by the women per day in the kitchen for cooking and related activities.

Category -----	Range of Time spent (hours/day) -----
Less	2-4
Average	5-7
More	8-10

3.8.1.7 Kitchen Waste : Amount of garbage produced in the kitchen due to cooking, eating and related activities which is mainly organic in nature.

Category -----	Range of Quantity of Waste (in gms) -----
Less	≤ 1000
Average	1001 - 2000
More	> 2000

3.8.1.8 Quality of Micro Environment of Household Kitchens : Quality of micro environment of the household kitchens in the study was measured in terms of good or poor quality based on the scores given to various aspects of micro environment such as :

- (a) Type of house
- (b) Type of kitchen
- (c) Size of kitchen or cooking area (floor area)
- (d) Orientation of kitchen (direction)
- (e) Ventilation and air quality (provision of doors, windows, direction of windows, total open space, natural and mechanical ventilators, immediate surrounding facing the kitchen, types of fuels, types of cook stoves, location of cook stoves, provision of smoke outlet, type of smoke outlet, etc.
- (f) Water supply, materials used for storage of water, changes in quality of water.
- (g) Illumination in the kitchen (adequacy of natural light, use of artificial light, type and location of artificial light source).
- (h) Quality of sound (intensity of various sources of sound in and around the house).
- (i) Sanitation (use of dust bin, placement and problems of it, problems of insects / pests, provision and condition of drainage system, etc.

- (j) Colour of the kitchen walls
- (k) Texture of the kitchen walls
- (l) Overall appearance of the kitchen
- (m) Overall appearance of the surrounding of the house.

Scoring pattern was formulated on the basis of recommended standards and review of relevant research findings.

On the basis of the grand total of the scores obtained from the above aspects (Appendix V), the respondents were grouped into 3 categories based on mean standard deviation. The possible scores ranged from 37 to 156 for quality of micro environment of household kitchens.

Category -----	Range of Scores -----
Poor	37-86
Average	87-111
Good	112-156

3.8.1.9 Exposure to Media Regarding Various Aspects of Environment : It was measured by giving scores to extent of viewing T.V., movies, listening to radio, reading newspapers, magazines, books and communication with friends and relatives. The scoring pattern was formulated as follow :

<u>Exposure per day</u>	<u>Scores</u>
Less than half an hour	1
Half an hour to one hour	2
More than one hour	3

The total score of extent of exposure to each media and extent of exposure to media regarding information on various aspects of environment was categorized into 3 groups using mean - standard deviation. The possible scores ranged from 1 to 30 that is, minimum level of exposure to maximum level of exposure to media.

<u>Category</u>	<u>Range of Scores</u>
Low	1
Medium	2-8
High	9-30

3.8.1.10 Knowledge Regarding Quality of Environment :

It was measured by means of standardized knowledge test and was described in terms of low, medium or high level of knowledge on the basis of scores obtained by the respondents. All the right answers were given a score of '2' and wrong answer were given a score of '1'. Categorization was made with mean - standard deviation. The possible scores on knowledge test ranged from 42 to 84.

Category -----	Range of Scores -----
Low	42-51
Medium	52-63
High	64-84

3.8.1.11 Practices Followed by Respondents Influencing Quality of Micro Environment : Practices were measured in terms of good, fair, poor on the basis of scores given to methods and ways of doing certain activities such as water storage and purification, waste disposal, insect and pest control, sound control and frequency of cleaning the kitchen etc. (vide Appendix - III). It was categorized on the basis of mean - standard deviation. The total possible scores ranged from 26 to 112 for practices followed by respondents influencing the quality of micro environment.

Category -----	Range of Scores -----
Poor	26-54
Fair	55-71
Good	72-112

3.8.1.12 Health Problems Experienced by the Respondent : Health problems were measured in terms of poor, average and good on the basis of scores given to respondents on the extent to which they felt various health problems

while working in the kitchen. The scoring pattern was as follows :

Frequency of Facing Health Problems -----	Scores -----
Most of the time	1
Sometime	2
Never	3

The scores were categorized using mean - standard deviation. The total possible scores ranged from 10 to 30.

Category -----	Range of Scores -----
Poor	10-15
Average	16-28
Good	29-30

3.8.2 Statistical Treatment of Data

The data were statistically analyzed employing descriptive as well as relational statistics for drawing of inferences.

3.8.2.1 Descriptive Statistics : The data were presented in percentages, measures of central tendencies (mean) and measures of dispersion (standard deviation) for analysing the information.

3.8.2.2 Relational Statistics : Relational statistics was applied to test the relationship between selected independent variables with dependent variables of the study. Correlation, analysis of variances and "t" test were employed to test the hypotheses formulated for the present study.