Methodology means description, explanation and justification of methods. A method is a tool or a technique used to collect data. It is the procedure of obtaining knowledge based on empirical observations and logical reasonings.

As stated by Ahuja (2005), methodology is a plan and procedure for carrying out the research. It refers to research techniques and strategies for obtaining valid information and it is an approach to understanding phenomenon. In short, methodology refers to philosophy on which research is based.

There are different methods of data collection. As such, the researcher must judiciously select the method or methods for a specific study. The method selected should be such that it suits the type of enquiry that is to be conducted by the researcher (Kothari, 1996). This enquiry or the search for answers to research questions generates data. According to Krishnaswamy, (2004) data are facts, figures and other relevant materials, past and present, serving as basis for the study and analysis.
Bearing these factors in mind, the methodology of the present study on “Health and Nutritional Status of Women and Preschool Children in Urban Slums of Kochi" was designed suitably, to comprise the following steps:

3.1. Locale of the study  
3.2. Sample selection  
3.2.1 Selection of slums  
3.2.2 Selection of subjects  
3.3. Tools and techniques of data collection  
3.3.1 Socioeconomic survey  
3.3.2 Nutritional Assessment  
- Diet Survey  
- Clinical assessment  
- Estimation of blood haemoglobin  
- Anthropometric assessment  
3.3.3 Morbidity profile  
3.4. Data Analysis

3.1 Locale of the Study  

Seventy two percent of India’s population as per Census of India (2001) live in rural areas while the remaining 28 percent live in the urban areas. Among the urban dwellers, 40.6 million people are living in slums. It was also reported that every seventh person living in the urban areas is a slum dweller (NSSO, 2002). In Kerala, the proportion of slum population to the total urban population is estimated as 1.81 percent and the bulk of the urban poor are concentrated in the urban slums.

Further, Kochi the largest agglomeration in Kerala, is the nerve centre of all commercial and economic activities in the state. The coastal areas of Kochi are thickly populated with a density of 6300 persons per square kilometer, as against an average density of 819 persons per square kilometer in the state.

As given by UN Habitat Report (2003), Kochi is the single metropolis in Kerala, with a total area of 94.88 square kilometer with 280
slums within the corporation area. In each slum the number of households ranged between 30 to 700 and the total population comes upto 1.27 lakhs (Urban Poverty Alleviation Cell, 2009 and City Development Plan, 2006).

Therefore in the present study, urban slums located in the Corporation area of Kochi, Ernakulam district, Kerala were identified as the potential area. The map of Kochi Corporation, the study area is given in Figure 1.

![Map of Kochi Corporation](image)
3.2. Sample Selection

Sampling is simply the process of learning about population on the basis of a sample drawn from it. Under this, a small group of the universe is taken as the representative of the whole mass and the results are drawn. It is a method to make social investigation which is practically applicable (Gupta, 2003).

3.2.1 Selection of Slums

Selection of slums formed the first step in sample selection. The list of slums in Kochi Corporation was obtained from the Urban Poverty Alleviation Department. Out of the 280 slums, eight slums were randomly selected by drawing lots. Figure 2 shows the location of selected slums.

3.2.2 Selection of Subjects

To select the subjects of study (mothers and their preschool children), the list of households in the selected slums was procured from the corporation office, and the availability of the sample in the households were ascertained with the help of local agencies such as anganwadis of ICDS, self help groups and mahila samajams functioning in the respective slums. The sample for the study (mothers and preschool children) was then selected by purposive random sampling technique.
In this technique the researcher purposely choose the subjects, who are in his judgment about some appropriate characteristic required of the sample members, who are thought to be relevant to the research topic and who are easily available to him (Ahuja, 2005). The following points were also taken into consideration before finalizing the sample population:

Figure 2 Map showing the selected slums (★ 8 Numbers)
• Willingness and support of local authorities and agencies
• Willingness of the sample to cooperate with the study
• Support of family members
• Availability of infrastructure facilities to conduct the study

Young mothers (334 numbers) and their preschool children (376 numbers) were thus selected for the study, to form a total sample size of 710. The details on the selected slums, total number of families in each slum and the selected sample are furnished in table 1.

### Table 1 Slum wise distribution of the households and the sample

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Slums</th>
<th>Total No. of families</th>
<th>No. of families selected</th>
<th>Sample Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Women</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Preschool Children</td>
</tr>
<tr>
<td>1.</td>
<td>Atlantis</td>
<td>207</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>2.</td>
<td>Fort Kochi</td>
<td>460</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>3.</td>
<td>Karithala</td>
<td>102</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>Pallichal</td>
<td>550</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>5.</td>
<td>Puthuvypu</td>
<td>980</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>6.</td>
<td>Santhom</td>
<td>180</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Thevara</td>
<td>614</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>8.</td>
<td>Vathuruthy</td>
<td>720</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Pooled</td>
<td>3813</td>
<td>334</td>
<td>334</td>
</tr>
</tbody>
</table>
Sampling procedure adopted for the study is illustrated in figure 3.

Figure 3 Sampling Procedure
3.3. Tools and techniques of data collection

The different tools and techniques used for data collection acquire tremendous importance in a research process. They must be appropriate, reliable and accurate. The data collection process of the present study is given below.

3.3.1. Socioeconomic survey

The demographic and economic transition that many developing countries are undergoing is producing important changes in diet and lifestyle which in turn influence the nutritional status of the family, especially women and children. Socioeconomic status of household, cultural norms, habits and practices all play a crucial role in the food and nutrition security of the family (Leela and Busi, 1995).

Moreover women’s health and nutritional status as stated by World Bank Report (2008) is inextricably bound with social, cultural and economic factors that influence all aspects of their lives and it has consequences not only on women themselves but also on the well-being of their children, the functioning of households and the distribution of resources in the family. A socioeconomic survey was therefore conducted among the sample, covering 334 mothers of preschool children residing in the selected eight slums of Kochi Corporation.
A survey is a fact finding study and it is a method of research involving collection of data directly from a population or a sample thereof, at a particular time (Krishnaswamy, 2004).

Personal interview was the technique adopted for the conduct of survey. The importance of personal interview, as method of collecting research data in a structured way has been highlighted by Kothari (1996). He further stated that interview is a verbal questioning and personal information can be well obtained very easily by this method.

As a research tool or as a method of data collection, interview acquires special significance with regard to its preparation, construction and execution. The preparation and execution of interview should be done in a systematic way and it is controlled by the researcher to avoid bias and distortion.

An interview schedule was used as an instrument or a tool to gather the relevant data with utmost accuracy and appropriateness. A research tool is referred to as a schedule when it is used for interviewing (Krishnaswami, 2004). According to Ahuja (2005) an interview schedule is a set of structured questions in which answers are recorded by the interviewer himself. It can be used for both illiterate and educated persons.

The interview schedule designed and formatted for the present study aimed at eliciting information related to socioeconomic status,
housing condition, sanitation and hygienic practices, availability and use of community facilities. The schedule was then tested for accuracy and reliability by conducting a pilot study among thirty mothers, who were slum dwellers but not included in the study. The interview schedule was then finalized after making necessary modifications. A copy of the interview schedule is given in Appendix I.

The interview schedule was administered personally by the investigator. Each household in the selected list was visited and the mothers were explained about the research purpose and the importance of their cooperation in giving accurate information for the successful completion of the study. Sample were informed well in advance about the date and time of the visit of investigator, for the survey. Approaching the community through local leaders and organizations, gaining confidence of the respondents through frequent visits and developing good rapport with them were some of the factors which facilitated a smooth and effective process of data collection.

3.3.2. Nutritional Assessment

Nutritional status is a global term that encompasses a number of specific components (August et al., 2002). Major factors which modulate nutritional status during early childhood include birth weight, infant and young child feeding practices, morbidity due to infections, treatment of
infections, and nutrition care during infection and convalescence (Ramachandran and Gopalan, 2009).

Maternal nutrition deprivation could also be referred to as a critical determinant of health and growth potential of both mother and child in developing countries. Nutritional assessment therefore forms an integral component of any study pertaining to health and development of women and children.

Assessment of nutritional status as stated by Jelliffe (1966) aims at determining the type, magnitude and distribution of malnutrition among the target population. A number of techniques for nutritional assessment has been suggested by experts. The most appropriate and effectively used ones by the researchers were adopted in the present study.

**Diet survey**

Diet is a vital determinant of health and nutritional status of people. As stated by Park (2004), the nutritional status of an individual, although is a product of many interrelated factors, the direct ones are the adequacy of food intake both in terms of quantity and quality. The dietary habits of individuals, families and communities vary according to socioeconomic factors, regional customs and traditions. Precise information on food consumption patterns of people, through application of appropriate methodology is often needed not only for assessing nutritional status of
people but also for elucidating the relationship of nutrient intake with deficiency as well as degenerative diseases (Thimmayamma et al., 1982).

The two most commonly used techniques of diet survey - 24 hour dietary recall and one day food weighment survey (weighment of cooked foods) were employed in the present study to assess the food consumption pattern of the target groups (mothers and preschool children). A pretested interview schedule was also used to procure information on the dietary habits and practices of women and preschool children, as they are likely to influence the food consumption pattern of the sample. A copy of the schedule used for the purpose is given in Appendix II.

Dietary Recall

In this method, the actual food and drink consumed in the immediate past 24 hours is recorded, in a specially framed checklist. The dietary recall was conducted among all sample (Appendix-II).

Food Weighment Survey

Weighment of cooked food was the method used. In this method, as the name implies, foods were actually weighed using an accurate balance. Grocer’s balance with standard weights and measures formed the main equipment. Weighment of cooked food is relatively more accurate as it involves direct weighing of raw and cooked foods (Bamji, 1998).

In this present study, one day weighment of cooked food was conducted on a sub sample of 30 mothers and their preschool children.
The investigator personally visited the household before and after the preparation of each meal. The raw weight of the ingredients prior to cooking and total cooked weight of the items were recorded along with the actual weight of the cooked food consumed by the subjects.

From the actual food consumed by the sample, the raw equivalent was calculated and the food and nutrient intake by the sample was arrived at. The mean intake by mothers and children were compared with the RDA for the respective groups given by ICMR (2004).

**Clinical Assessment**

Clinical examination has always been and remains an important practical method for assessing nutritional status (Jelliffe, 1989). Clinical examination also helps to assess the level of health of individuals or of population groups in relation to the food they consume. It involves external examination of the body for changes in superficial epithelial tissues especially hair, face, skin, gums, teeth, eyes and lips with the help of a qualified physician, using a clinical assessment schedule (Appendix-III).

The clinical nutrition survey was conducted by arranging medical camps at all the eight slums included in the study such as Kalvathy School at Fort Kochi, Pallichal at Palluruthy, Santhom Colony, Vathuruthy, Thevara, Atlantis, Karithala, and Puthuvypu (plate 1-4).
Plate 1 Clinical examination by physicians
Plate 2 Clinical examination by physicians
Plate 3 Clinical examination by physicians
Plate 4 Clinical examination by physicians
The first step in this direction was approaching the councillors and other local leaders of the area, to get their support and cooperation. The camp sites were arranged in such a way that the sample population from the respective slums and the neighbourhood, had an easy access to the venue.

In order to conduct the medical camp, authorities of T. D. Medical College, Alleppey were approached and services of medical professionals (one assistant professor and two house-surgeons) were obtained. All Kerala Chemists and Druggist Association supplied medicine free of cost to be distributed in the camp. Additional requirement was met by purchasing them from outside. Plates 5 to 7 present glimpses of medical camps conducted at various slum locations.

The target population was informed well in advance about the camp, its venue, time and date by issuing notices through the anganwadis and other local organisations of women such as mahila samajams, self-help groups etc.

A total of 334 mothers and their 376 preschool children attended the medical camps and underwent clinical examination. Besides, general health and morbidity conditions, the incidence of common illnesses, infection and other degenerative health problems were also diagnosed and medicines prescribed. The medicines were supplied free of cost in the camp. A specially appointed pharmacist was in-charge of medicine distribution (Plate 8).
Plate 5 Glimpses of medical camp
Plate 6 Glimpses of medical camp
Plate 7 Glimpses of medical camp
Plate 8  Medicine distribution by pharmacists
Estimation of blood haemoglobin

Haemoglobin level is an useful index of the overall status, irrespective of its significance in anaemia (WHO, 1995). The estimation of haemoglobin was done on all the sample - both mothers (n=334) and their preschool children (n=376) using the cyanmethaemoglobin method suggested by ICMR (2001).

Collection of blood sample

The disinfected finger tip was pricked hard with the help of a sterile lancet (Plate 3). A micro pipette was used to pipette out 0.02 ml of blood which was transferred to a vial containing 5ml of Drabkins reagent and the sample was read colorimetrically at 540 mm. The blood haemoglobin was then estimated (procedure is given in Appendix-IV). The mean haemoglobin values of the subjects were compared with that of standard values recommended by WHO (1968) and Sinha et al. (2008) for the corresponding groups and categorized based on the severity of anaemia (Plate 9).

Stool Examination

Stool examination for intestinal parasites also formed part of the clinical assessment as history of parasitic infestations, chronic dysentery and diarrhoea provided useful information about the nutritional status of persons (Park, 2004).

Stool examination was done on a sub sample (n=30). The mothers and children were met two days before the camp and they were made
aware of the significance of this test, as the co-operation of the mothers was essential in conducting this. The collected stool was examined in the laboratory for worm infestations.

Plate 9 Collection of Blood sample for Hemoglobin Estimation
Anthropometric Assessment

Jelliffe (1966) has defined nutritional anthropometry as measurement of the variations in physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition. According to WHO (1995), anthropometry is the single most universally applicable, inexpensive and noninvasive method available to assess the size, proportion and composition of human body. Anthropometry therefore has been accepted as an important tool for assessing nutritional status of children as well as adults (Rao and Vijayaraghavan, 1996).

Anthropometric measurements such as height, weight, skin fold thickness and mid-upper arm circumference are valuable indicators of nutritional status. In the case of adults waist-hip ratio also acquires significance.

Body weight

Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status. It indicates the body mass and is a composite of all body constituents like water, minerals, fat, proteins, bones, etc. Bodyweights and heights of children reflect their state of health and growth rate (ICMR, 2004).

According to Bamji et al. (1998), body weight is sensitive even to small changes in nutritional status due to childhood morbidities. Rapid
loss of body weight in children should be considered as an indicator of potential malnutrition. Similarly low body weight of mother is indicative of undernutrition or chronic energy deficiency with serious health consequences for themselves and their children.

**Measurement technique**

Portable weighing machine with 0.5 kg accuracy was used to measure weight of the sample. The weighing scale was checked for zero error before each measurement and corrected as and when required. The subjects were made to stand straight, bare footed on the platform of weighing machine with minimum clothing. The body weight was recorded to the nearest 0.5 kg (Appendix V and VI). All other standard procedures outlined by Jelliffe (1989) while measuring weight of the sample were also followed. All measurements were made in the morning hours.

The body weight of 334 mothers and 376 preschoolers were thus recorded. The mean values were computed and compared with the standard measurements recommended by NCHS (1987) for children and ICMR (2004) for mothers Body mass index values suggested by James et al. (1988) was also used to find out the severity of malnutrition in the case of mothers.
Height

Height is a linear measurement made up of the sum of the four components - legs, pelvis, spine and skull. Height of an individual is influenced by genetic and environmental factors. Inadequate dietary intake or infections reduce nutrient availability at cellular level resulting in growth retardation. During periods of severe deprivation, linear growth rates slow down and lead to stunting. Since height is affected only by long term nutritional deprivation, it is considered an index of chronic or long duration of malnutrition (UNICEF, 1993). However the association of body height with body weight especially among children is still considered as a valuable index to predict childhood malnutrition.

Measurement technique

Anthropometer was used to measure the height of the subjects. The subjects were made to stand erect looking straight on the platform barefooted with heels together and toes apart. The moving head piece of the anthropometer was placed in the sagital plane over the head of the subject applying a slight pressure to reduce the thickness of hair. The height measurement was recorded to the nearest 0.1cm on all subjects included in the study (Appendix V and VI). An average of three measurements was taken as the final measurement. Plate 10 - 12 shows the recording of anthropometric measurements of the sample.
Plate 10 Anthropometric assessment of Women
Plate 11 Anthropometric assessment of Children
Plate 12 Anthropometric assessment of Children
Mid upper arm circumference

According to Bamji et al. (1998) and Jelliffe (1989) mid upper arm circumference (MUAC) is considered more feasible, simpler and easily accessible in any age and sex, and also is a practical measure. According to Park (2004) arm circumference yields a relatively reliable estimation of body muscle mass, the reduction of which is one of the most striking mechanisms by which the body adjusts to inadequate energy intake.

Mid upper arm circumference is useful not only in identifying malnutrition but also in determining the mortality risk in children, it is said to correlate well with weight, weight for height and clinical signs.

Measurement technique

Mid arm circumference was measured on all preschool children (n=376) using fibre reinforced plastic tape, upto the nearest millimeter following the procedure given by ICMR (2005). The subject was asked to stand erect and the investigator stood on the left side. The left arm of the child was folded at right angle at elbow, keeping close to the body, distance from tip of the bony prominence of shoulder (tip of acromion process) to the tip of the bony prominence of the elbow (tip of olecranon) was measured. Keeping the tape in position, midpoint was marked horizontally (half of the distance measured above). The arm was straightened and placed by the side of the body hanging loosely. Tape was passed round the arm at the midpoint such that it closely covers the arm,
without applying too much of pressure or keeping it loose (the tape should not be elliptical but kept horizontal). The reading on the tape corresponding to “0” mark was measured and recorded (Appendix-VI).

3.3.3 Morbidity profile

Undernutrition is associated with impaired immune function and consequent increased susceptibility to infections; infections aggravate undernutrition. If this vicious cycle continues it can result in death of the child. Interactions between nutrient intake, nutritional status and morbidity in preschool children are complex (Ramachandran and Gopalan, 2009).

Kerala, of all states of India surpasses many national indices of health like infant mortality rate, maternal mortality rate etc. As per reports of IIPS (2007), infant mortality rate in Kerala is 15.3 as against the national figure of 57.0; and the under five mortality is 16.3 in Kerala and 74.3 in India.

But the Kerala paradox of low mortality and high morbidity syndrome is to be dealt with. The morbidity rate in Kerala is the highest in India. This emerging health issue in Kerala that matters for human development as it directly affects the “quality and affordability of Health Care” (Human Development Report, 2005).
As far as preschool children are concerned the morbidity burden, especially due to respiratory and gastro intestinal illnesses is very high among slum dwellers of South India (Marimuthu et al., 2009).

Hence it is felt imperative to study the morbidity profile of women and preschool children in the present research. A schedule for the purpose was specially designed with the help of medical practitioners. The pretested schedule (Appendix V and VI) was administered on the sample (women and preschool children) at the time of medical camp which was arranged for gathering clinical data. A total of 334 women and 376 preschool children were subjected to morbidity screening.

3.4 Data Analysis

Statistical analysis of the data was done using students t-test, Chi square, and coefficient of correlation. Chi square test was used to analyze the association between variables. Besides percentages, mean and standard deviation were also used in data analysis. Spearman rank correlation was used to find out the relation between various indices (AppendixVII). All the analysis was done using the statistical software SPSS version 11.0.