Methodology
3. **Methodology**

Many different methods and procedures have to be developed for a study to aid in the acquisition for certain sources of data, yielding information of the kind and in the form that can be most efficiently used (Best and Kahn, 2001). So methods and materials appropriate for the study on "Morbidity Rate and Nutritional Status of Tribal and Nontribal Preschool Children in Backward Districts of Northern Kerala" were selected and used in distinct ways of describing and quantifying the data. The methodology comprises of the following steps:

3.1 **Locale of the study**

3.2 **Sample selection**

3.3 **Tools and techniques of data collection**
   
   3.3.1 **Background information**
   
   3.3.2 **Morbidity pattern**
   
   3.3.3 **Nutritional status**
   
   3.3.4 **Data analysis**

3.1 **Locale of the study**

The scheduled tribal population is not evenly distributed across the state. They are significantly concentrated in Palakkad, Wayanad, Kasaragod and Idukki districts (Government of Kerala, 2001). Hence Northern Kerala comprised of three districts with dense tribal population, such as Palakkad, Wayanad and Kasaragod, was identified as the potential area for the study. The tribal pockets in Northern Kerala selected for the study is shown in figure 1.
Fig. 1 Selected districts with tribal pockets in Northern Kerala
3.2 Sample selection

According to Gupta (2003) sampling is simply the process of learning about population on the basis of a sample drawn from it. Under this, 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.

In the present study, the total sample size comprised of 400 Preschool children of three to six years of age, including 200 children each from the tribal and nontribal communities. The households to obtain the required number of sample (children of three to six years) were selected through stratified random sampling technique. According to Best and Kahn (2001) the characteristics of the entire population, together with the purposes of the studies, must be carefully considered while applying the stratified sampling technique.

As an initial step the list of panchayats, having thickly populated tribal colonies, coming under the jurisdiction of the three revenue districts identified for the study (Palakkad, Wayanad and Kasaragod), was obtained from the office of scheduled caste and scheduled tribe welfare department in the respective district head quarters. From this list, two out of three panchayats in Palakkad district, two out of four panchayats in Wayanad district and one panchayat out of two in Kasaragod district were selected considering the following aspects:
Accessibility to the area
Cooperation of people (especially tribes) in the area
Willingness of the Anganwadi workers, health and social workers of the area to cooperate with the study

Next step was to procure the list of households in the selected five panchayats from the three districts. The list of households was obtained from the concerned panchayat offices and ITDP (Integrated Tribal Development Programme) office in Wayanad and Kasaragod districts, whereas the list of households in the panchayats of Palakkad district was obtained from the office of the AHADS (Attapady Hill Area Development Scheme). Then, through stratified sampling technique the households in the lists were divided into strata to ensure effective sampling from each corner. Subdivision of the population into smaller homogenous group, known as strata, will ensure more accurate representation (Singh, 1997). From each stratum, households comprising children in the age group of three to six years were identified and a total of 611 tribal houses were thus listed out. From this list 142 households were proportionately selected at random to acquire the required sample size of 200 tribal Preschool children (the sampling procedure is illustrated in figure 2).

Similar procedure was followed to select a group of 200 nontribal Preschool children (3 to 6 years) of comparable economic background from the same panchayat areas adjacent to the tribal dwelling places. Here the required number of sample was obtained from 143 nontribal households out of 747 households in total, with Preschoolers. The panchayat wise distribution of households and sample population is shown in table 1 and figure 2.
Fig. 2
Sampling Procedure

Total number of tribal households - 142
Total number of non-tribal households - 143
Number of tribal pre-schoolers - 290
Number of non-tribal pre-schoolers - 200
Table 1  Panchayat wise distribution of households and the sample

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Panchayat</th>
<th>Total No.of households</th>
<th>No. of households</th>
<th>No.of the samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>NT</td>
<td>T</td>
</tr>
<tr>
<td>1</td>
<td>Agali</td>
<td>180</td>
<td>200</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>Puthur</td>
<td>90</td>
<td>218</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>Sultan Battery</td>
<td>195</td>
<td>080</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>Noolpuzha</td>
<td>80</td>
<td>129</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Badiadukka</td>
<td>66</td>
<td>120</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td><strong>Grand total</strong></td>
<td><strong>611</strong></td>
<td><strong>747</strong></td>
<td><strong>142</strong></td>
</tr>
</tbody>
</table>

T Tribes

NT Nontribes

The district and panchayat wise distribution of the selected sample is presented in table 2 and also in figure 3.

Table 2  District and panchayat wise distribution of sample

<table>
<thead>
<tr>
<th>S.No.</th>
<th>District</th>
<th>Panchayat</th>
<th>Tribes</th>
<th>Nontribes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kasaragod</td>
<td>Badiadukka</td>
<td>60</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>Wayanad</td>
<td>Noolpuzha</td>
<td>40</td>
<td>35</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Palakkad</td>
<td>Sultan Battery</td>
<td>30</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agali</td>
<td>45</td>
<td>40</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Puthur</td>
<td>25</td>
<td>30</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td><strong>Grand total</strong></td>
<td><strong>200</strong></td>
<td><strong>200</strong></td>
<td><strong>400</strong></td>
<td></td>
</tr>
</tbody>
</table>

The caste wise distribution of the tribal Preschool children is illustrated in figure 4.
Fig. 3
District and Panchayat wise distribution of the Selected Sample

<table>
<thead>
<tr>
<th>District</th>
<th>Panchayat</th>
<th>Tribal Households</th>
<th>Non-Tribal Households</th>
<th>Tribal Children</th>
<th>Non-Tribal Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palakkad</td>
<td>Agali</td>
<td>27</td>
<td>25</td>
<td>45 (TC)</td>
<td>40 (NTC)</td>
</tr>
<tr>
<td></td>
<td>Puthur</td>
<td>23</td>
<td>28</td>
<td>25 (TC)</td>
<td>30 (NTC)</td>
</tr>
<tr>
<td>Wynad</td>
<td>Sultan Battery</td>
<td>27</td>
<td>25</td>
<td>30 (TC)</td>
<td>35 (NTC)</td>
</tr>
<tr>
<td></td>
<td>Noolpuzhα</td>
<td>21</td>
<td>29</td>
<td>40 (TC)</td>
<td>35 (NTC)</td>
</tr>
<tr>
<td>Kasaragod</td>
<td>Badidukka</td>
<td>44</td>
<td>36</td>
<td>60 (TC)</td>
<td>60 (NTC)</td>
</tr>
</tbody>
</table>

TH - Tribal Households: $(27 + 23 + 27 + 21 + 44) = 142$
NTH - Non-tribal households: $(25 + 28 + 25 + 29 + 36) = 143$
TC - Tribal children: $(45 + 25 + 30 + 40 + 60) = 200$
NCT - Non-tribal children: $(40 + 30 + 35 + 35 + 60) = 200$

(Figures in the parentheses indicate number of households.)
Fig. 4
The caste-wise distribution of the tribal preschool children
3.3 Tools and Techniques of data collection

Tools and techniques used for the collection of research data should be appropriate and accurate for ensuring credibility and reliability of information. The present study targeted to generate data on the following lines.

3.3.1 Background information

The socioeconomic profile profoundly influences the nutritional status and morbidity pattern. Gracy (1986) reported that generally low standards of housing and hygiene had an important impact on nutritional standards especially of infants and young children among whom malnutrition is widespread.

Circumstances, life styles and events can predispose an individual to diseases. According to Ebrahim (1991) nutritional deficiencies and other illness rarely occur alone; they are commonly associated with poverty, poor family relationships, poor hygiene and living conditions, strong cultural resistance to accepting new ideas and other similar detrimental influences. Many socioeconomic factors, do influence the nutritional status and morbidity of children, like ignorance about hygienic and dietary needs of children (Ramalingaswamy, 1999), weaning practices (Kanjana and Ramasaranya, 2003), basic amenities like drinking water (Bharadwaj, 1990 and Bhasin, 2004) and many familial and environmental factors (Tontisirin and Lamborisut, 1995).

Taking into account of these factors an interview schedule was developed to elicit background information of the tribal and nontribal children. According to Thanulingam (2000) interview schedule is a proforma containing a
set of questions and are very useful in gathering information. It is generally filled by either the researchers or the ones who are specially appointed for the purpose.

In the newly designed interview schedule adequate provision was given to gather information on various factors predicted to influence the nutritional status and morbidity pattern of Preschool children such as socioeconomic background, housing conditions, personal habits and hygiene, general food habits and practices, food beliefs and health care management.

The pre-testing of the schedule was done by means of a pilot study on a comparable group of 20 mothers and the schedule was then finalised after making necessary modifications. The interview schedule is given in appendix I.

Direct interview method was the technique adopted for data collection. This technique was preferred because:

- Interview method is the suitable way to collect the data as it proceeds systematically and enables to record the collected information quickly (Kothari, 2001).
- Interview method provides opportunity for face-to-face contact with whom the information was collected (Kothari, 2003).
- This technique can be used effectively to gather information regarding an individual's experience and knowledge, his or her opinions, beliefs and feelings and demographic data (Best and Khan, 2001).
The information obtained by this method is likely to be more accurate because the interviewer can clear up doubts of informants and thus obtain correct information (Singh, 1997).

The finalised schedule was then administered personally by the investigator on mothers of Preschool children of tribal (n=200) and nontribal (n=200) groups. They were also previously oriented about the purpose of this study through various methods like orientation by PHC officials, group meetings and home visits to create awareness and ensure their cooperation and participation during data collection. According to Patnaik (2004) the importance of community participation forms the cornerstone of the concept of primary health care adopted by the nations to achieve the goal of "Health for all". This target can be achieved not only by way of utilizing the available infrastructure to improve their quality of life, but also providing the necessary information about the community during documentation of data to formulate effective programmes for development.

The investigator stayed in the locale of the study during the period of data collection to develop rapport with the local people, to gain their cooperation and support and also for facilitating informal observation on their habits and lifestyle.

3.3.2 Morbidity rate

Though significant gains in childhood mortality have been made in India very high incidence of illnesses is noticed especially in Kerala. The immediate
causes of childhood illness and under five deaths according to Soman (1994) and Kerala Women's Commission (2002) are nutritional deficiencies and infectious disease such as diarrhoea, pneumonia, malaria and measles.

Hence the morbidity pattern of the Preschool children belonging to tribal as well as nontribal communities was studied with the help of a pre-tested check list. The copy of check list is given in Appendix II. The morbidity pattern of all the children were (200 tribal and 200 nontribal Preschoolers) studied by interviewing their mothers directly. The details of morbidity during their entire life span of childhood was collected along with the episodes of illnesses occurred during the last one year.

Percentage score for morbidity was calculated using the formula given below. The children under six years of age were scored according to the number of diseases occurred during their entire life time as well as by considering how frequently they were attacked by various diseases.

\[
\text{Percentage morbidity score} = \frac{\sum_{i=0}^{2} m_i \times w_j}{\text{Max}(m_i) \times \text{Max}(w_i)} \times 100
\]

Where,

\( i = 0 \text{ to } 2 \) (Score given to morbidity pattern)

\( j = 0 \text{ to } 3 \) (Score given to frequency of occurrence of disease)

\( m = \text{morbidity} \)
w = weightage given based on the frequency of occurrence of disease

(Score for morbidity: nil - 0, one disease - 1, More than one type - 2; Score for frequency: very often - 3, Occasionally - 2, Rarely - 1, Not at all - 0)

3.3.3 Nutritional status

Nutritional status, especially of children is crucial for their health and survival. A number of methods are recommended specifically to assess the nutritional status of children. Of these anthropometry, clinical and dietary assessment etc. are widely used as parameters of nutritional status (NNMB, 2000). Nutritional status of a person is assessed by anthropometric measurements, biochemical measurements of nutrients or by-products in blood and urine, chemical examination and by, dietary analysis (Swaminathan, 2003; Bamji et al., 2003 and Robinson and Barasi, 2001).

Anthropometry

Nutritional anthropometry was adopted in this study because the pattern of growth and physical fitness of an individual as pointed out by Gai (1996) though genetically determined, are profoundly influenced by diet. So the various anthropometric measurements namely height, weight, mid-upper arm circumference (MUAC), head and chest circumferences were used to assess the growth pattern of the sample. Importance of various anthropometric measurements in the assessment of nutritional status of an individual is also stressed by several investigators like Srilakshmi (2002), Balgir et al. (2002),

**Weight - for - Age**

According to Rao and Vijayaraghavan (1996) and Swaminathan (2003) body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status. Onins et al. (1993) stated that weight-for-age represents a convenient synthesis of both linear growth and body proportion. Importance and reliability of weight as a measure to assess nutritional status was also emphasized by Elizabeth (2002), Rolfes and Whitney (2002) and Bamji et al. (2003).

A portable weighing machine with an accuracy of 0.5 kg was used to record the weight of the children (n=200 tribes and 200 nontribes). Checking the scale with a known weight was done frequently and adjustment to zero was done every time for accurate reading. Children were made to stand straight on the platform of the weighing machine bare footed with minimum clothing. The mean weight for different age groups was computed and compared with the standard weight for age recommended by NCHS (1987) and ICMR (2002). The nutritional grades of the children were assessed according to their weight for age by Indian Academy of Paediatrics (IAP, 1972) classification.

**Height - for - Age**

Height is a linear measurement made up of sum of the four components - legs, pelvis, spine and skull. Height of an individual is principally a measure of
skeletal body tissue. (Jelliffe and Jelliffe, 1989). Height as reported by UNICEF (1993) is associated with a number of factors including chronic insufficient food intake, frequent infections, sustained incorrect feeding practices and low socio economic family status. Height is one of the best set of measurements found useful for nutritional status of preschool children (Rao, 1999).

The height of the subjects (n=200 tribes and 200 nontribes) were measured using anthropometric rod capable of measuring to an accuracy of 0.1cm. The children were made to stand bare footed on a flat floor with the feet parallel and with heels, buttocks, shoulder and occiput touching the upright anthropometric rod, hands being hanging by the sides. The head was held comfortably upright, with the top of the head making firm contacts with the horizontal headpiece. The mean height for age was then calculated and compared with NCHS (1987) and ICMR (2002) standards. Children were also classified according to the grades of nutrition using the height measurements as per Waterlow's classification (1992).

**Mid Upper Arm Circumference (MUAC)**

The mid upper arm circumference according to Sharma and Bora (1998) is a simple, sensitive and cost effective measurement for community assessment of early childhood malnutrition. Mei et al. (1997) opined that mid upper arm circumference has been used for many years as an alternative index of nutritional status of children. MUAC may be useful not only for identifying malnutrition but also in determining the mortality risk in children (Rao and
Vijayaraghavan, 1996). The measurement of MUAC was done on all the sample (n=400) of both tribes and nontribes in centimetres. The site of measurement was the point halfway between the acromion process of the scapula and the tip of the elbow as suggested by Mahan and Escott (2004). The children (tribes and nontribes) were grouped as per Waterlow (1992) classification according to their nutritional grades based on their MUAC measurements as suggested by Ghosh (1976).

**Head Circumference**

Head circumference is related to mainly brain size, to small extent to the thickness of the scalp tissues and the skull (Swaminathan, 1998). The measurement of head circumference is a standard procedure in paediatric practices (Jelliffe and Jelliffe, 1989).

Head circumference was measured by placing a new flexible tailor’s tape over the most prominent part of the occiput and around the forehead, just above the supraorbital ridge. Slight pressure was exerted to allow for the thickness of hair. The circumference is read to the nearest 0.1 cm and then recorded. Head circumference was measured (n=400) as suggested by Mahan and Escott (2004) and comparison of tribal and nontribal children based on their head circumference was also done.

**Chest Circumference**

The chest circumference was measured (n=400) with the new flexible tailor’s tape used for measuring arm and head circumferences. The
chest circumference was taken at the nipple level preferably in mid inspiration. The chest in a normally nourished child grows faster than head during the second and third year of the child. As a result, the chest circumference overtake head circumference by about one year age (Rao and Vijayaraghavan, 2003). Between the ages of one year and five years, a chest/head circumference ratio of less than one, may due to failure to develop or due to wasting of the muscle and fat of chestwall. Hence it can be used as an indicator of protein-calorie malnutrition of early childhood (Swaminathan, 1998). Comparison of tribal and nontribal children were done based on their chest circumference.

**Biochemical examination**

Gordon (2000) reported that biochemical tests are the most objective and sensitive measures of nutritional status. As stated by Swaminathan (2003) haemoglobin level of blood is a reliable index of the overall state of nutrition in addition to its diagnostic importance in anaemia. Therefore estimation of blood haemoglobin was done on all sample (n=400) using cyanmethaemoglobin method as suggested by Sood (1990). The procedure for the estimation of haemoglobin is given in appendix V. The haemoglobin values of tribal and nontribal children were compared with the standard values and it was also categorised based on the extent of severity of anaemia as recommended by ICMR (1993).

**Stool examination**

Importance of examining stools of preschool children for worm load was stressed by Singh et al. (1996), Bamji et al. (2004) and Srinivasan and
Prabhu (2004). According to Indira (1993) health disorders prevalent among the tribal preschool children, may be due to the unhygiene environment in which they live and the resultant worm load. Hence, information related to worm infestation through stool examination was also obtained.

The children (tribes=200, nontribes=200) were subjected to stool examination to find out the prevalence of parasitic infestation. The mothers were asked to collect the stool sample of children in clean bottles supplied to them by investigator and sample were examined for worm load by a lab technician on the same day.

**Clinical investigation**

Clinical examination is an important, practical, sound and simplest means of assessing nutritional status (Kamath, 1986 and Swaminathan, 2003) and the ultimate objective of clinical examination is to assess levels of health of individuals in relation to the food they consume (Park, 2002). Clinical investigation on a sub-sample of 300 children (150 tribes and 150 nontribes) were carried out with the help of a physician. The schedule given by National Advisory Committee-Indian Council of Medical Research (NAC-ICMR) as recommended by Swaminathan (2003) was used to collect information on these lines. The copy of the schedule is given in Appendix IV.

**Diet**

Diet surveys constitute an essential part of any complete study of nutritional status of individual or groups and provide essential information on
nutrient intake levels, source of nutrients, food habits and attitudes in general (Gopaldas and Seshadri, 1987) and gave reasonably accurate values of dietary intakes of tribes (NNMB, 2000). According to Thimmayamma (1987), collection of data regarding family dietary pattern gives us information mostly on the quality of diets consumed and various food beliefs and taboos that are prevalent among the community. This would be helpful in interpreting the individual dietary intake in a more realistic manner. So details in this regard were collected from the mothers (142 tribes and 143 nontribes) of the preschool children along with the background information, by direct interview method. The details are given in appendix III.

One of the most reliable and conventional methods of diet survey generally followed for assessing the food consumption pattern is weighment method. So two day weighment survey for two consecutive days was conducted to determine the actual food intake and to assess the quantity of nutrients consumed by the sample. Weighment survey was conducted on a sub sample of 180 including 90 tribal and 90 nontribal children. For this a kitchen balance having a capacity of weighing five kilogram was used to quantify the food intake of both raw and cooked ingredients. The mean intake of each food item was compared with the quantity recommended for preschoolers by ICMR (2004) and were statistically examined. Similarly mean nutrient intake was also computed and compared with the RDA suggested by ICMR (2004).

Anthropometric measurements together with the results obtained from bio-chemical examinations, clinical investigation and dietary pattern were
used to compute the Nutritional Status Index (NSI) of tribal and nontribal Preschool children.

NSI of the individual was developed using the formula:

\[ NSI = \sum_{j=1}^{k} \chi_{ij} W_i \]

Where,

- \( k \) = number of characteristics namely height, weight, MUAC, head and chest; score obtained in biochemical examination and clinical investigation and no. of meals per day
- \( W_i = \frac{1}{Var.x_i} \)
- \( \chi_{ij} = \) Variance of the \( i^{th} \) variable based on the sample of a respondent
- \( X_{ij} = \) Observation corresponding to the \( j^{th} \) respondent with respect to the \( i^{th} \) variable

3.4 Analysis of Data

Statistical treatments like Pearson's correlation and ANOVA (Analysis of Variance) was used to examine the relationship and association between morbidity pattern and nutritional status and also between the independent variables and morbidity pattern / NSI / Mother's awareness on health care management.
ANOVA was also done to compare tribal and nontribal children of different age groups with respect to their anthropometrical measurements and NSI.

Analysis of Physical Quality Life Index (PQLI) and Poverty Index

Taking into account of the results obtained through the survey on background information as well as dietary pattern of the tribal and nontribal families, Physical Quality Life Index (PQLI) and Poverty Index were developed.

PQLI was developed as suggested by Dhanasekharan (1991) by calculating 10 variables namely, caste, marital status of mothers, number of children in the family, type of house, education of parents, occupation (type of activity) of parents, annual income of parents, number of meals per day, source of drinking water and drainage facilities. The scores assigned for each parameter for a family when summed up would give the total score for that family. The total possible score for a family was 39. Sum total of this score of a family would give the Quality Life Index of that particular family. The scoring pattern is given in appendix VIII.

Poverty Index

An attempt was made to identify the 'at risk' families using the method suggested by Srilatha and Gopinathan (1995). Here poverty is defined on the basis of a risk index called the Poverty Index and a family is considered under 'high risk' if any four or more of the nine risk factors listed on the index are present. The risk factors are given below in table 3. The details are shown in appendix VIII.
Table 3  
**Risk factors of Poverty Index***

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Risk factors of Poverty Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Family belonging to Schedule caste / Schedule tribe</td>
</tr>
<tr>
<td>2</td>
<td>With children under five years</td>
</tr>
<tr>
<td>3</td>
<td>Having even one illiterate adult</td>
</tr>
<tr>
<td>4</td>
<td>With only one or no adult employed</td>
</tr>
<tr>
<td>5</td>
<td>Living in Kutch house</td>
</tr>
<tr>
<td>6</td>
<td>Without a household latrine</td>
</tr>
<tr>
<td>7</td>
<td>With inaccessibility to safe drinking water</td>
</tr>
<tr>
<td>8</td>
<td>Consuming only two or less meals</td>
</tr>
<tr>
<td>9</td>
<td>With an alcoholic or drug addict person or with a major crisis in the family</td>
</tr>
</tbody>
</table>

*Ref: Sreelatha and Gopinathan (1995)*

Test of significance

Morbidity pattern, nutritional status index and physical quality life index of tribal and nontribal children were compared by 't' test and 'F' test.

Mean food intake and nutrient intake of the children were compared with the RDA (ICMR, 2004) using 't' test.

Anthropometric and haemoglobin values of tribal and nontribal children were also compared by 't' test in which,

\[ t_{n-1} = \frac{|\bar{X} - a|}{S / \sqrt{n - 1}} \]
Where,

\[ \bar{X} = \text{Observed mean measurement} \]
\[ a = \text{Standard measurement} \]
\[ n = \text{Sample size} \]
\[ S = \text{Sample standard Deviation} \]

\( \chi^2 \) analysis was done to compare the various levels of socioeconomic, morbidity and nutritional status between the tribal and nontribal communities.

\[ \chi^2 = \sum \left( \frac{(f_o - f_e)^2}{f_e} \right) \]

In which,

\[ f_o = \text{Frequency of occurrence of observed on experimentally determined facts} \]
\[ f_e = \text{Expected frequency of occurrence of the hypothesis} \]
Results