CHAPTER 3

MATERIALS AND METHODS

A study was conducted to assess the nutritional status of children of low birth weight. The methodology applied to conduct the study is presented under the following heads:

3.1. Locale of the study
3.2. Design of the study and sample selection
3.3. Plan of action
3.4. Tools developed
3.5. Pilot study
3.6. Conduct of the study
3.7. Analysis of the data

3.1. Locale of the study

The study was conducted in Thiruvananthapuram, Kozhencherry and Devikulam respectively of Thiruvananthapuram, Pathanamthitta and Idukki districts of Kerala representing urban, rural and tribal population respectively. Figures 1, 2 and 3 represent the locale selected for the study.
Fig.1. Idukki District of Kerala state to represent tribal area
Fig. 2. Pathanamthitta District of Kerala state to represent rural area
Fig. 3. Thiruvananthapuram District of Kerala state to represent urban area.
3.2. **Design of the study and sample selection**

The study was designed as completely randomized design and purposive random sampling technique was employed for the conduct of the study. Based on verification of clinical records, available in hospitals with maternity wards / anganwadis, 300 children born with low birth weight were located in the locale selected for the study. Care was taken to select children who did not show any obvious physical deformity or had suffered from any chronic illness and who were free from birth defects. The selected children were evenly distributed by locality, sex and age.

Uniform sample size of 100 each was drawn from Thiruvananthapuram, Pathanamthitta and Idukki Districts respectively to form a population of size (n=300). Design of the study is represented in Figure 4.

3.3. **Plan of action**

Plan of action of the present study comprised of investigations on macro and micro samples.

3.3.1. **Investigations on macro sample (n=300)**

(i) Surveys were conducted to ascertain socio economic characteristics of the families, food consumption pattern and dietary habits of mothers and children selected for the study.
(ii) Twenty four hour recall method was applied to determine the meal pattern and food intake of the respondents (child and mother) for the past 24 hours.

(iii) The health profile of the children and their mothers were assessed with reference to anthropometric measurements, clinical investigations and biochemical studies.
Fig. 4. Design of the experiment

Kerala

- Thiruvananthapuram
  - Thiruvananthapuram (Urban)
- Pathanamthitta
- Idukki
  - Kozhencherry (Rural)
  - Devikulam (Tribal)

Data from clinical records from hospitals with perinatal care / anganwadis

Details of LBW babies born three years prior to the study

Selection of subjects born with LBW

- Macro sample (n=300)
- Micro sample (n=10)

For Intensive Individual Counseling Programme (n=10)

Collection of data regarding socio economic status of the families nutritional / health variables mothers and children
3.3.2. Investigations on micro sample (n=10)

Earlier studies had indicated that families from the urban and rural sectors, in Kerala, had similar characteristics and can be considered as one group; while those from tribal areas had different characteristics (Baiju, 2011).

Hence 10 preschool children from Thiruvananthapuram district were selected for in-depth study. Changes in food consumption pattern, anthropometric and clinical status were monitored during the experimental period of six months.

Mothers of the children were also exposed to the needy information on the significance of child feeding practices and health care practices from time to time. Information related to changes in knowledge, attitude and practices were elicited.

Major data generated from the micro samples were:

(i) Actual food intake of the children

(ii) Changes in food intake and feeding practices of the children

(iii) Anthropometric and clinical profile of the children in the beginning and their changes during the period of the study
Changes in the knowledge, attitude and practice pattern of the mothers on child feeding practices and child care practices on completion of the experiment.

3.4. Tools developed

Universally accepted tools were developed and employed for the collection of data, from among macro and micro samples.

3.4.1. Assessment of socio economic and dietary profile

Interview method, which is the most commonly used method to conduct surveys among large number of families in a relatively short time, was used for collecting information regarding socio economic, nutritional and health variables which influence the nutritional status of the children of low birth weight.

The schedule consisted of general information about family like type, size, composition, age, sex, educational and occupational status, income, monthly food expenditure pattern of the family and information regarding food consumption pattern and food use frequency. This schedule also includes information on the present health profile of the mother and the child with reference to anthropometric measurements, clinical symptoms, specific child feeding and health care practices followed for the child.

The schedule prepared for the study is given in Appendix I.
3.4.2. Assessment of Nutritional Status

Assessment of nutritional status could be achieved through one or a combination of several methods. In the present study three methods viz., food intake by recall of 24 hours, anthropometric measurements and clinical examination were used to assess the nutritional status of the macro sample.

3.4.2.1. Twenty four hour recall of food intake

In this recall method of diet survey, a set of standardized cups suited to local condition were used. The individuals were asked a systematic series of questions to ensure recollection and description of all foods and drinks consumed in the 24 hours before the interview with emphasis on food consumption, meal by the mothers as well as the child respondents. Schedule used is presented in Appendix 2.

3.4.2.2. Frequency of use of foods

Frequency of use of different food groups would give an indication about the adequacy of family diet pattern. Food use frequency was measured on a five point scale. On the basis of the frequency of use, the foods were classified into five groups and scored as given in Table 1.
Table 1. Scores given for foods based on their frequency of use

<table>
<thead>
<tr>
<th>Frequency of use</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>0</td>
</tr>
<tr>
<td>Occasionally</td>
<td>1</td>
</tr>
<tr>
<td>Less than three days in a week</td>
<td>2</td>
</tr>
<tr>
<td>More than three days in a week</td>
<td>3</td>
</tr>
<tr>
<td>Daily</td>
<td>4</td>
</tr>
</tbody>
</table>

The total scores for each food groups were calculated (Thimmayamma, 1987).

The consumption pattern was checked against the desirable dietary pattern approved.

3.4.2.3. Anthropometric measurements

Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size proportions and composition of the human body. Table 2 represents the details of different measurements recorded for the preschool children.
Table 2  Details of different measurements recorded for the children

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Vijayaraghavan, 1987</td>
</tr>
<tr>
<td>Weight</td>
<td>Vijayaraghavan, 1987</td>
</tr>
<tr>
<td>MUAC</td>
<td>Jelliffe, 1966</td>
</tr>
<tr>
<td>Head Circumference</td>
<td>Jelliffe, 1966</td>
</tr>
<tr>
<td>Chest circumference</td>
<td>Jelliffe, 1966</td>
</tr>
<tr>
<td>Body Mass Index (BMI)</td>
<td>Beaton et. al., 1990</td>
</tr>
<tr>
<td>Weight Height Product Index (WHPI)</td>
<td>Bhatia et. al., 1988</td>
</tr>
<tr>
<td>Weight Height Ratio Index (WHRI)</td>
<td>Bhatia et. al., 1988</td>
</tr>
<tr>
<td>Broka’s Index (BI)</td>
<td>Balakrishna et. al., 1998</td>
</tr>
</tbody>
</table>

Procedures followed for taking anthropometric measurements are presented in Appendix 3.

3.4.2.4 Clinical Examination

The clinical examination was conducted with the help of qualified physician and details of schedule used to conduct clinical examination are presented in Appendix 4.
3.4.3. Intensive individual counseling

From among the macro sample, micro sample for intensive individual counseling was selected. Ten families from similar socio economic background with uniform nutritional and health profile were the target population in this program.

The level of nutrition and health, knowledge and current practices of the mothers were also assessed using the statements. Using the survey findings and through in-depth interviews and focus group discussions, a simple and relevant Nutrition Health Education Kit was developed and refined by circulation among experts. The Nutrition Health Education Kit thus developed was used to educate the mothers attending the sessions. The details are presented in Appendix 5.

Details of number of mothers attending various sessions, information delivered, exposure rate and decision making for seeking health care were collected for evaluation.

Effectiveness of the education programme was assessed in relation to gain in knowledge by the mothers by eliciting information, administering the same statement used, prior to the implementation of the programme.
3.5. **Pilot study**

According to Krishnaswamy (1985), a pilot study is a small replica of the main study. It was the rehearsal of the study which covered the entire process of the research.

A pilot study was conducted among 30 subjects to check the effectiveness of all the tools mentioned above developed for the study.

3.6. **Conduct of the study**

Interview method was selected in the study since this method was reported to be a suitable way to proceed systematically and quickly to collect information.

Mothers of the preschoolers were interviewed for eliciting required information. Anthropometry of the preschool children of low birth weight and their mothers were also taken through universally approved methods.

A schedule in which clinical signs of various nutritional deficiencies were tested (Appendix 4) and used during clinical assessment.

3.7. **Analysis of Data**

The data collected through the tools developed were coded, classified and tabulated to facilitate analysis.
3.7.1. Statistical treatment of the data

Following statistical tools were administered in the present study:

I. Percentage analysis
II. Mean score comparison
III. Simple correlation analysis
IV. Tests of significance
V. Analysis of variance
VI. Chi-Square analysis
VII. Multiple regression analysis
VIII. Z score

3.7.2. Indices developed for the study

Various indices developed from the data generated are detailed below:

3.7.2.1. Physical Quality of Life Index (PQLI)

PQLI was developed from selected socio economic as well as nutritional variables as suggested by Dhanasekharan (1991). The selected socio economic variables included caste, educational status of the respondent’s mothers, occupational status of the head of the family, family income, per capita income, family size, share of income for food and energy and protein intake of the respondents. Each of the variables was rated by giving scores. The scores given for each parameter ranged from 1 to 10 depending on the intra family variations.
The different variables and their corresponding scores given to find out PQLI as detailed below.

Scores assigned for each parameter for a family were summed up to give the total score for that family which represents the Physical Quality of Life Index of that particular family. The maximum score that can be obtained by this calculation was 80. Based on the variation in Physical Quality of Life Index, the respondents were classified in to five groups of poverty levels such as very very poor, very poor, poor, not so poor and fair.

3.7.2.2. Participation Index

Participation Index was developed from the details collected from the mothers such as number of mothers attending various sessions of social programmes including under nutrition and health intervention programmes and information delivered, (knowledge gain) exposure rate (social participation) and decision making for seeking health care.

The involvement of the mothers in the Health and Nutrition Education programme conducted for the mothers was assessed as the weighted average of participation index. The weights being the frequency of involvement, the scores 2, 1 and 0 were assigned based on their attending the programme regularly (2), occasionally (1) and never (0). Index was worked out with the formula given below.
## Participation index

<table>
<thead>
<tr>
<th>Social participation</th>
<th>Awareness about NIS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Scores given</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

*NIS Nutrition Information System

<table>
<thead>
<tr>
<th>Decision making</th>
<th>Beneficiary of NIP**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Scores given</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**NIP Nutrition Intervention Programmes

Participation index = \( \frac{\text{Total participation score} \times 100}{\text{Maximum score}} \)

### 3.7.2.3. Knowledge score

Knowledge score of the mothers was calculated by using the following formula.

\[
\text{Knowledge Score} = \frac{\text{Number of correct answers}}{\text{Total Number of questions}} \times 100
\]
3.7.2.4. Utilization Efficiency Index (UEI)

UEI is the combined effect of Aggregate Efficiency Index (AEI) and Distributive Efficiency Index (DEI).

UEI was calculated using the following formula:

$$\text{UEI} = \sqrt{\text{AEI} \times \text{DEI}}$$

where as

$$\frac{\text{Percent increase in mean weight status between initial and final reading of the children}}{\text{Ratio between SDs of initial and final values}}$$

i.e.,

$$\text{AEI} = \frac{\left( \sum Y - \frac{\sum X}{\sum X} \right) \times 100 \times SDI/SDF}{n \quad n \quad n}$$

where X and Y are the mean weight status of the children initially and after the experiment and SDI and SDF are the Standard Deviation of the weight status worked out from the initial and final values.

$$\frac{\text{Percent increase in the weight status between initial and final reading of the children}}{\text{Ratio between SD of the initial and final values}}$$

$$\text{DEI} = \frac{\left( \sum W1Y1-\sum W1X1 \right) \times 100 \times SDI}{\sum W1X1 \quad \sum W1X1 \quad \sum W1X1 \quad \sum W1X1}$$

where $\sum W1Y1$ and $\sum W1X1$ are the means of the weight status of the children.
3.7.2.5 Nutrient Intake Index (NII)

Nutrient Intake Index was worked out from the score allotted for various nutrients as detailed below. Percentage of nutrient available to the respondents against the stipulated RDA was worked out and this was the base line data used for working out the scores.

<table>
<thead>
<tr>
<th>NII CALCULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>If RDA met for</td>
</tr>
<tr>
<td>Energy</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Fat</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Iron</td>
</tr>
<tr>
<td>Carotene</td>
</tr>
<tr>
<td>Thiamine</td>
</tr>
<tr>
<td>Riboflavin</td>
</tr>
<tr>
<td>Niacin</td>
</tr>
<tr>
<td>Folic acid</td>
</tr>
<tr>
<td>Vitamin C</td>
</tr>
<tr>
<td>Max score</td>
</tr>
</tbody>
</table>
3.7.2.6. Nutritional Status Index (NSI)

In order to develop NSI, anthropometric measurements and BMI, clinical scores and percentage of RDA met for protein and calories were taken into consideration.

The NSI was worked out by using the formula given below.

If $X_{ij}$ be the observation corresponding to the $j^{th}$ variable for the $i^{th}$ sample (respondent) $w_j$ is the inverse of the sample variance of the $j^{th}$ variable – the weight assigned to the observation corresponding to the $j^{th}$ variable the nutritional status of the individual was calculated as.

$$\text{NSI} = \sum_{i=1}^{n} \sum_{j=1}^{k} \frac{X_{ij} \cdot w_j}{W_{1j}}$$

$n = \text{number of respondents}$

$k = \text{number of variables}$