CHAPTER - II

MATERIAL AND METHODS

Karnataka is one of the ancient states of India, situated in the Deccan plateau region of South India. Regarding the origin of the word “Karnataka” different views have been expressed like, Karnataka is derived from the name of two tribes ‘Karna’ and ‘Nata’ who inhabited this region. Another view is that the word is derived from words Kammittu and Nadu (i.e., the land of fragrance), likewise the words come from the words “kari” and “nadu” (Land of black soils), however, the most accepted view is, it is derived from the word, Karu-Nadu meaning “elevated land”.

Karnataka’s antiquity can be traced to the epic period. First reference of Karnataka is made in Mahabharatha. Karnataka in ancient texts is also called Kunthala and Unnathayak. The language Kannada is also considered as one of the oldest Dravidian languages. Its antiquity can be traced back to 3rd century B.C. Thus, one can conclude that Land of Karnataka and Kannada Language are having rich past.

MYSORE DISTRICT: The Mysore district is situated in the southern part of the Deccan Peninsula. It is ranking in sixth position among all the districts of the Karnataka state in its size. It consists of seven taluks. Mysore is the name by which Karnataka state was known prior in 1973. Mysore city is now the headquarters of the district and the revenue division of the same name. It is known as one of the garden cities of India, and is also known throughout the world for the pomp and gaiety of its traditional Dasara festival (http://www.mysore.nic.in).
Irrigation by canals is a characteristic feature of the district, as average rainfall is comparatively low, 785mm per year. The district is third richest district in forest wealth in the state (http://www.indianetzone.com/45/geography_mysore_district.htm). There is predominance of small land holdings. The district is known for its traditional industrial activities like agarbatti, silk-reeling, handloom weaving and the crafts like inlay work. Rearing silkworms is one of the major cottage industries of the district, and in area under sericulture, it stands first. The district occupies the top place in the state with respect to road communications. Mysore district is considered as one of the prosperous districts of the state.

Vokkaliga Gowda community forms the highest population of the taluk and majority of them are tobacco cultivators. Next to tobacco, paddy is the major crop in the district, followed by pulses and ragi (red millet). Other major crops grown in the district are Cotton, Sugarcane, Jowar (great millet) and Oilseeds.

Mysore District is a popular tourist destination, offering several attractions ranging from the royal splendour of Mysore City and its fabulous Dasara Festival to exquisite temples, pilgrimage centres and scenic spots.

Location: The district is located between 11°45' and 12°40' North Latitude and 75°57' and 77°15' East Longitude. It is bounded by Mandya district to the northeast, Chamrajanagar district to the southeast, Kerala state to the south, Kodagu district to the west, and Hassan district to the north. Physiographically, the region may be classified as partly- malnad and
partly semi-malnad. It has an area of 6,854 km² (ranked 12th in the state) (http://en.wikipedia.org/wiki/Mysore_district).

**History:** The Ganga dynasty ruled over the greater part of Mysore till the 10th century A.D. Earlier to this, the area was under the Pallavas for a few decades. Then by Punnata rulers, the Cholas, then Hoysalas, Vijayanagara Sovereigns. Then the Wadeyars of Mysore came to have complete control over the region. Raja Wodeyar made Srirangapattana his capital in 1610. Capital was shifted to Mysore again in 1800 after the fall of Tippu when Krishnaraj Wodeyar III became the ruler. In 1831, the British took over the administration, but later during 1881, the Mysore territory was handed back to Mysore Wodeyars. In 1869, the Mysore district was divided into 14 taluks. About 7 years back, Mysore district was bifurcated and a new district called Chamarajnagar was formed. The present Mysore district has 7 taluks. Periyapatna sub-taluk was created in 1931 and was later upgraded to a taluk with Headquarters at Periyapatna (http://en.wikipedia.org/wiki/Mysore_district).

**Origin of name:** Mysore district, like most of the districts of Karnataka state, takes its name from its headquarters town. The earliest reference to Mysore is in copper-plate inscription dated 862 AD from Kadalur, Mandya, where the place is mentioned as ‘Maysoorie’. By way of literacy flourish, it is also spelt as Mahi Surapura. The name of Mahishur or its anglicized form Mysore is described as derived from Mahishasura or the buffaloe-headed monster who lived in this area, and was killed by Goddess Chamundeshwari. But etymologically the place can be associated with Mayu (an antelope) than Mahisha (buffalo) (http://en.wikipedia.org/wiki/Mysore_district).
Population: As per 2001 India census, Mysore had a population of 26,41,027. Periyapatna had a population of 2,24,254, of which 1,1,5849 were males and 1,08,405 were females (http://mysore.nic.in/population.htm).

Topography: Mysore district is a tableland situated in the angle where the Eastern and Western Ghat ranges coverage into a group of hills called the Nilgiri hills. The lands of the district form an undulating tableland with granitic rocks, protruding at odd intervals. The general elevation is more than 770 mts. above Mean Sea Level (MSL) (http://en.wikipedia.org/wiki/Mysore_district).

Rivers: The district is mainly drained by the Cauvery besides the Kabini, the Lakshmanatirtha and the Suvarnavati which are the tributaries of the Cauvery (http://en.wikipedia.org/wiki/Mysore_district).

Flora: Being on the leeward side and close to the mountain range, it receives a fairly good amount of seasonal precipitation from the South-West Monsoon (June-Sept). The dry season is long. The structure of moist deciduous forests consists of a tree-layer with an open canopy. There are many climbers and epiphytes too. The central portion of the district is under intensive cultivation because of excellent irrigation facilities.

Fauna: The district has a rich and colourful heritage in respect of wildlife. The area harbours a rich and variegated array of wild animals like elephants, tiger, sambhar, spotted deer, panthers, jungle cat, squirrels, toddy cat, langur, bonnet macaque, porcupine, cheetah, wild boar, birds, pea fowl, grey jungle-fowl, red spur-fowl and quails, white-backed vultures etc. etc. (phythons too).
Climate: The climate of this district is moderate throughout the year. The district enjoys cool and equable temperatures. The climate of the district may be described as essentially tropical monsoon type which is a product of the interplay of the two opposing air-masses of the southwest and northeast monsoons. Over the greater part of the district, summers are languorously warm and winters bracingly cool. By and large, Mysore district is endowed with a delightful or salubrious climate.

Rainfall: The average annual rainfall in the district is 785mm. Periyapatna and H.D. Kote receives more rainfall compared to other taluks.

Soil: The soils of the district are predominantly red loamy and are derived from granites and gneisses and vary from pure sandy soils to typical black cotton soil.

People: Some of the primitive hill tribe people like the Jenu kurubas, Betta kurubas, Sholigas, Yeravas, Bedas, and other tribal people are found near, H.D.Kote, Hunsur and Periyapatna. The life of the people in villages bordering the forest areas differ slightly from that of the other taluks.

Religion: The notable religions in the district are Hinduism, Islam, Christianity, Jainism and Buddhism.

House types: Houses in the rural areas classified into thotti houses, houses with single ridges with \( \frac{1}{2} \) slopes, terraced houses and huts. Most of the houses are single storied with a rectangular ground plan. The plinth of the houses rises to a height of 2/3 feet above the ground level. A thotti house has an open quadrangle inside the house in the middle, generally with four but sometimes with 8-12 pillars. They have a natural air-conditioning effect. These houses contain jagali or raised platforms on both the sides of the main entrance. The roofs will be generally of country tiles or
Mangalore tiles. The second type consists of houses with a single ridge with 2 slopes. There are also houses with a single slope without a ridge, one side of the wall being raised higher than the opposite side. Many manure pits are found in and around the villages. The walls are made of mud, but some with bricks too. The flooring will be of mud, smeared with cowdung periodically but cement flooring with red oxide too is found. Some have pavement of stone slabs.

**Food and Drink:** Paddy is the major crop in the district. Ragi (red millet) is the staple food of the rural folk in the district but jowar (great millet) and rice are also used together with ragi (red millet). Pulses like cluster beans, green gram, horse gram, bengal gram, tur dal etc are commonly used. On the special occasions like feasts, festivals and marriages, even the poor people eat rice at the least as a portion of their diet. There will be two meals a day one in the mid-day and the other at about 8'o clock in the night, with a morning tiffin called ‘tangalu’ which will either be freshly prepared ragi rotti or ragi mudde taken with curds, salt, onion and chillies.

The common dishes for the meals are ragimudde (red millet balls), saru (curry), boiled rice, and butter milk. The common vegetables are brinjal, different kinds of gourds, onion, tomato, cucumber, lady’s finger, beans, radish, pumpkin and greens. The sweet dishes prepared on special occasions are payasa, obbattu, kajjaya, kadabu (these are the sweet dishes) etc. Huliyanna, idli, khichidi, vada (rice and urd dal items). Drinking coffee/tea in the morning has almost become a daily habit and most of the villages have tea and coffee stalls, which are also the places of village gossip.
Those who consume non-vegetarian food, take it occasionally depending upon their economic condition. Non-vegetarian food is not cooked on the particular day of the week considered as God's day which is generally Saturday for Vishnu worshippers and Monday for Shiva worshippers. During lunar months of Shravana and Karthika, people generally abstain from eating non-vegetarian food. Smoking beedies and cigarettes, by men and chewing of tobacco and pan by both men and women are common. A few use snuff. Drinking toddy and arrack is found among the poor.

**Dress:** The upper garment of males irrespective of caste, generally consists of a shirt with full/half sleeves and the lower portion is the lungi/dhoti. While going out, a man puts on a towel on the shoulders. The Muslim dress consists of pyjama/lungi and a shirt. The Muslim women use veils.

The common festivals celebrated are Yugadi, Sri Ramanavami, Basava Jayanti, Gouri Ganesha, Naga Panchami, Ekadashi, Gokulashtami, etc.

Dasara is the most extravagant festival of Mysore. This festival has been celebrated in Mysore with great pomp and show since centuries. This tradition is still carried on though the scale of the celebrations has been watered down. The Dasara festival is celebrated in the months of September/October each year. According to Hindu mythology the festival celebrates and commemorates the victory of Goddess Chamundeshwari after slaying the demon Mahishasura and the triumph of good over evil. The Dasara festivities have become an integral part of the culture and life in Mysore. It is considered as one of the National Festivals of India.
PERIYAPATNA TALUK

Periyapatna taluk, one of the seven taluks of Mysore district, is bounded in the north by Hassan district, in the south by Hunsur taluk, in the east by K.R.Nagar taluk and in the west by Kodagu district. Once it was the headquarters of the Changalva Kings. Periya Raja of this line replaced the mud fort with stone in 1578 A.D. and established the town which was named after him. It was known as Singapatna in earlier times (www.karnatakaindustry.gov.in).

The total geographical area of the taluk is 815 Sq.Kms. It is about 75 kms from Mysore. This taluk lies between 72°56' to 76°17' in Longitude and 12°08' to 12°33' in Latitude. Its elevation is 800-1500 mts above Mean Sea Level (MSL). Its annual normal rainfall is 847mm. It is covered with hilly terrain and contains red shallow gravelly soils. The red soils are generally shallow to deep, red to pale brown in colour, well drained and may not contain lime nodules at depth.

The main occupation of the people in the taluk is agriculture. The major crops grown are ragi (red millet), paddy, hybrid maize, pulses, tobacco, cotton, sugarcane. Ragi (red millet), being the staple food, rice and pulses too are commonly used.

Smoking beedies and cigarettes by men chewing of tobacco by both men and women are common in this taluk. Drinking toddy and arrack too is found. Sericulture is an important activity in the entire Mysore district, but not in this taluk, because the climate is not conducive for the growth of mulberry cultivation.
In the present study, data have been randomly collected from 30 villages in the Periyapatna taluk (Table-2). The sample size of the study consisted of boys and girls of 1-5 years age group.

**Table 2: Distribution of sample size of 1-5 years children in different villages of Periyapatna taluk**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Village</th>
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<th>Girls</th>
<th>Total</th>
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<td>41</td>
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<td>Chaudenahalli</td>
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<td>28</td>
<td>Asvalu</td>
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<td>29</td>
<td>R.Hosalli</td>
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<td>30</td>
<td>Kamplapura</td>
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<td><strong>Total</strong></td>
<td><strong>545</strong></td>
<td><strong>555</strong></td>
<td><strong>1100</strong></td>
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merely an assemble of techniques and measurements, but it is a powerful method for description and analysis of body size, shape, form and proportions. Anthropometry encompasses a wide variety of measurement procedures for determining endless number of body dimensions. Each user incorporates a different set of anthropometric measurements to explain the problem under the investigation.

The anthropometric measurements on the human body must be obtained with utmost care and proper precision, to use the data for relevant purpose following certain procedural precautions (Surindemath, 1993). A large array of body measurements may be done, but for practical use, measurements should be limited to those which contribute most to the evaluation of growth, of over-nutrition and of under-nutrition. The choice of anthropometric measurements will also depend on the age of the child, his co-operation in the procedure, the degree of details desired, and the skill and accuracy of the researchers.

Measurements which are especially helpful in the nutritional assessment of children include the following.

**Stature:** Recumbent length from birth to 2 years of age; standing height after 2 years,

**Weight:** Obtained by either Salter (Dial) Scale, weighed in a bag hung till 2 years, on a weighing machine after 2 years,

**Circumference:** Mid upper arm circumference,

**Skin folds:** Triceps, sub scapular thickness using specially designed calipers.
One of the important aspects of the study pertains to the assessment of nutritional status with the help of body measurements. This aspect is more apparently referred to as Nutritional Anthropometry. Nutritional Anthropometry deals with the measurements of physical dimensions and gross composition of the human body, at different age levels during the postnatal period of growth and degree of nutrition. Growth of human body is primarily influenced by certain biological determinants including sex, intra-uterine environment, order of birth, birth weight in single and multiple pregnancies, parental size and genetic constitution and environmental factors like season, climate, socio-economic level and nutrition. The physical dimensions of the body are influenced much more by nutrition than other factors. During the period of rapid growth i.e., early childhood period, certain specified body measurements can provide useful information regarding certain types of malnutrition in which body size and gross body composition are affected. Anthropometric measurements are only one of the numerous techniques that evaluate nutritional status. Anthropometric measurements are considered as one of the initial assessment methods, because they are relatively cheap, easy to understand and yield immediate results. The ultimate choice of the measurements will depend upon the situation in which nutritional surveillance is required.

As in the report of All Coordinated Committee / Sub Committee on Nutrition Workshop 12-14th June 1989, Geneva- The most extensive public health problem among children in developing countries results from the complex of nutritional, biological and social deprivation that is manifested as ill health, growth retardation, functional disadvantages and high
mortality. Height and weight may also be used to mark the department of severe malnutrition in individuals.

Anthropometric information is non-specific and inadequate for identifying the cause of growth failure; anthropometry's usefulness stems from its close correlation with nutritional outcome and its socio-economic determinants, because adverse economic and environmental factors lead-largely through dietary inadequacy and infection in poor communities to growth failure. It must be appreciated, however that the growth of children is influenced by a variety of factors such as socio economic status of the parents and the sex and birth rank of the child. Climate, seasonal variations, infection, parasites and psychological factors also directly or indirectly affects the child's nutritional status.

According to Seome and Latham (1971), nutritional anthropometry provides the best and simple tool for the assessment of malnutrition.

Physical growth of children is reflected by different anthropometric measurements, especially weight and height. However, because of their inter-correlation, it is important to define indices based on these measurements (possibly independent of age) for more useful classification of physical build and nutrition (Sundaram et.al., 1988).

Growth retardation is not only an important and objective manifestation of malnutrition, but also, perhaps, is the first response to nutritional deprivation. Thus measurement of growth has been considered a valuable tool for the assessment of nutritional status, particularly of children.
In the present study four measurements have been recorded on the sample, viz.,

1) Height vertex or Stature,
2) Body weight,
3) Mid Upper arm circumference, and
4) Skin fold thickness at triceps.

**Height vertex or Stature**

Height after the age of 1 year, standing height, is recorded by anthropometric rod. It measures the vertical distance from vertex to floor, height is a linear measurement made up of the sum of 4 components; legs, pelvis, spine and skull. The extent of height deficit in relation to age, as compared to regional standards may be regarded as a measure of the duration of malnutrition.

In the present study, height was measured with the help of anthropometric rod. While measuring the height, the subject was asked to stand straight with the head positioned such that eye-ear plane was horizontal, feet together, knees straight and heels, buttocks and shoulder blades and heels in contact with the vertical surface of the anthropometer or wall. The moveable head board was gently lowered until it touched the crown of the head. Height was then recorded.

**Weight**

Weight is a measurement of bodymass. Weight deficiency appears to be the best indicator of the prevalence of protein-energy malnutrition in children of all age groups. Comparison of weight-for-age values with
NO. 2- MAP SHOWING THE VILLAGES FROM WHERE DATA WERE COLLECTED

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<td>R.Hosalli</td>
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<td>30</td>
<td>Kamplapura</td>
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The total sample of 1100 subjects (545 boys and 555 girls) of 1+ to 5+ years age group was randomly collected. There was a slight variation in the selection of sample for boys and girls of each village due to cooperation and willingness of the children to participate in the study.

The following parameters are used for the assessment of nutritional status of 1-5 years children of Periyapatna taluk.

1) Anthropometric measurements
2) Biochemical test of Haemoglobin estimation.
3) Dietary intake- 24 hour recall method
4) Examination of clinical signs
5) Socio-economic factors
6) Morbidity
7) Statistical methods for analysis of data

Nutritional status of the children and independent variables included socio-demographic variables such as age, gender, caste/religion, education and occupation of parents. Familial characters such as family income, family type, sibling constellation, family size too are included.

Parameters

Anthropometric Measurements: The term anthropometry, the science of measurement of the human body, is attributed to a German physician, J.S.Elsholtz (1623-88) who is also credited with the design of the first anthropometer for measuring the human body. Anthropometry is not
No. 1. Measuring the stature of the child
No. 2. Measuring the weight of the child by weighing machine

No. 3. Measuring the weight of the child by Salter scale
regional standard corresponding ages will help to determine the degree of underweight in a community. Weight was measured by means of standard weighing machine with fine accuracy. The weighing scale was adjusted to zero before each measurement and was placed on a hard flat surface. The subject was asked to stand unassisted in the centre of the platform and to look straight ahead, standing relaxed.

Those children below 2 years were weighed with the help of Salter (Dial scale). This scale can weigh children upto 25 kgs.

The upper hook of the Salter scale was placed through the hole at the top of the scale. A rope was put through the upper hook of the scale and was hung from a beam. It was made sure that the dial was at eye level so that the weight was recorded correctly. The lower hook was placed on the bottom of the scale. The pant was placed on the lower hook. The needle was adjusted to zero (0) by turning the screw at the top of the scale. The child was placed in the pant and made sure that the straps were in front of the child’s arms and the child’s feet were not touching the ground and also that the child was not in touch with anyone while weighing. The weight was recorded when the needle stopped moving.

Body Mass Index

It is defined as weight divided by square of height (kg/m²). BMI has been often advocated and used in developed countries as the diagnostic tool for obesity. Assessing obesity in children is more difficult than in adults. Application of the Body Mass Index (BMI) to children is generally considered to be inappropriate (Mukhopadhyay, et.al., 2005). Recently interest has expanded in using BMI for assessing the Chronic
Energy Deficiency (CED) and morbidity patterns. James, Ferro-Luzzi and Waterlow (1988) suggested various ranges of BMI in 1988 to distinguish different states of nutrition. A BMI <18.5 was shown to influence the illness significantly are considered underweight. Decreasing values of BMI are associated with progressive functional impairments either in terms of morbidity or rating of physical performance or Socio-Economic Success. BMI is a good parameter to grade Chronic Energy Deficiency (CED) (Singh and Sachdeva, 1999).

The BMI of each individuals was calculated and they were divided into different nutritional status (Table-3) based on the cut off values of BMI proposed by James et.al., (1988).

**Table 3: BMI classification (James et.al., 1988)**

<table>
<thead>
<tr>
<th>BMI</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 16.0</td>
<td>CED III (Severe)</td>
</tr>
<tr>
<td>17.0 - 16.0</td>
<td>CED II (Moderate)</td>
</tr>
<tr>
<td>18.5 - 17.0</td>
<td>CED I (Mild)</td>
</tr>
<tr>
<td>18.5 - 20.0</td>
<td>Low Weight Normal</td>
</tr>
<tr>
<td>20.0 - 25.0</td>
<td>Normal</td>
</tr>
<tr>
<td>25.0 - 30.0</td>
<td>Obesity I</td>
</tr>
<tr>
<td>&gt; 30.0</td>
<td>Obesity II</td>
</tr>
</tbody>
</table>


\[
\text{BMI} = \frac{\text{Wt (in kg)}}{\text{Ht / Stature (in m²)}} \text{ i.e. kg/m}^2
\]
Body mass index is the ratio of weight (in kg) / recumbent length or standing height (in m²). Epidemiological aspects of the standards: As expected, there are notable differences with the NCHS/WHO reference that vary by age, sex, anthropometric measure and specific percentile or Z-score curve. Differences are particularly important in infancy. Stunting will be greater throughout childhood when assessed using the new WHO standards compared to the NCHS/WHO reference. The growth pattern of breastfed infants will result in a substantial increase in rates of underweight during the first half of infancy and a decrease thereafter. For wasting, the main difference is during infancy. With respect to overweight, use of the new WHO standards will result in a greater prevalence that will vary by age, sex and nutritional status of the index population.

Mid Upper Arm Circumference (MUAC)

During the first year of life, the circumference of the upper arm of healthy children increases rapidly as muscle and fat are laid down. It then remains fairly constant at about 16cms until the age of 5 years. This can be used as a screening test for Protein Energy Malnutrition (PEM).

If the child becomes malnourished, the muscles are wasted, fat disappears and the circumference is reduced. Therefore measuring the Mid Upper Arm Circumference (MUAC) can be a useful and quick screening method for finding malnourished children in the 1-5 years age group. If the arm circumference is in between 12.5-13.5 cms, the child can be considered moderately malnourished (Figure-3). Below 12.5cms indicates severe malnutrition.
No.4. Measuring the Mid Upper Arm Circumference of the child
Figure 3: MUAC (Mid Upper Arm Circumference) from 0 - 5 years

- Arm circumference increases rapidly during 1st year
- Arm circumference stays almost the same between 1st to 5th Birthdays

Colors:
- Green: Normal
- Yellow: Moderately malnourished
- Red: Severely malnourished
Mid Upper Arm Circumference (MUAC) measures the maximum circumference of the upper arm taken horizontally i.e., where the biceps muscles are most developed. The arm circumference is considered as a useful and practical means of assessing the protein energy deficiency in early childhood. The instrument used to record this measurement is flexible fiber glass tape. In the present study, the left upper arm of the subject was measured, while hanging freely, at its mid point. The tape was placed gently but firmly round the midpoint avoiding compression of the soft tissues. There were no clothes on the arm while taking the measurement.

Weight and MUAC are affected within a short duration of inadequate nutrient intake and ill health, while height does not change so rapidly.

**Skin Fold Thickness**

Measurement of skin fold thickness (or fat fold) at triceps is one of the methods for the assessment of the amount of subcutaneous fat, which gives an indication of the calorie reserves in the body. Harpenden calipers is used to record this measurement.

The site, midway down the length of the left arm, the skinfold parallel to the long axis was picked up between the thumb and the forefinger, and the skinfold was measured by means of Harpenden calipers.

The MUAC and skin fold thickness at triceps are used to calculate the mid-arm muscle circumference, which correlate well with the general manifestation of protein-calorie malnutrition.
No.5. Measuring the Fat Fold Thickness of the child
**Height-for-Age**: This parameter is used for assessing "chronic undernutrition" in children. Impaired height gain is called "stunting".

**Weight-for-Age**: This parameter is most difficult to interpret because it can be affected by either acute or chronic under-nutrition.

**Biochemical Indicators**

These represent the most objective assessment of the nutritional status of an individual, frequently providing pre or sub-clinical information, specific for different nutritional deficiencies. In most instances, nutrient intakes are reflected in their levels present in blood/serum or urine. These levels can at least in part be defined or related to inadequate, low adequate or high dietary intakes of the nutrient. Though biochemical tests are time consuming and cannot be applied on a large scale, they are useful aids in the diagnosis of specific diseases.

In the present study, only biochemical test of Haemoglobin estimation i.e., (haemoglobin level) is carried out by Sahli method (Acid haematin method). The investigation was done with the help of Auxiliary Nursing Mother, Miss. Sabeena and lab technician, Mr. Velu who assisted in carrying out the test. The test was done on the spot itself, according to the methodology suggested by Bharucha et.al., (1982).

**Sahli Method or Acid Haematin Method**: Haemoglobin is converted to acid haematin by the addition of N/10 or 0.1 N hydrochloric acid and the resulting brown color is compared with standard brown glass reference blocks. The intensity of brown color depends on the amount of acid haematin, which in turn, depends on the amount of haemoglobin in the blood sample.
No.6. Haemoglobin estimation of the child
The Sahli haemoglobinometer consists of a standard brown glass mounted on a comparator and a graduated tube. A special pipette to measure out 20 cu.mm. of blood is supplied with the instrument. The graduation on the tube varies with the different modification. The original one shows 17.3 gms as equal to 100 percent. The Adam's Co., tube shows 17gms as 100 percent. The recent Hellige's tubes gives 14.5gms as 100 percent. The tubes commonly used now are square with graduations is percent on one side and grams per 100ml on the other.

Equipment used for Haemoglobin Estimation –

1) Haemoglobinometer
2) Haemoglobin tube with percentage and gram grading
3) 0.01 N HCl (100 ml) i.e., N/10 HCl
4) 100ml distilled water
5) Glass rod for stirring
6) Disposable needle, cotton, spirit
7) Tube stand

Collection of blood samples: The tip of the middle finger of left hand of the subject was thoroughly cleaned with spirit and the skin was dried with a piece of cotton. Then a fine prick was induced with a disposable needle. A good drop of blood was allowed to form on the finger tip (do not squeeze the finger tip because squeezing leads to haemoconcentration and ultimately wrong results). Once a good drop of blood is formed, the blood was drawn with the pipette upto the circular mark, which is 0.02ml. Then a cotton ball was placed and pressed on the site of the puncture.

Method: N/10 Hydrochloric acid was placed in the tube upto the lowest rank. The blow drawn through the pipette was transferred to the acid in
the tube. Pipette was rinsed well by drawing up some of the acid and blood by shaking the tube well and allowed the tube to stand for at least 10 minutes to allow the brown color to develop. Then the solution was diluted with distilled water, a few drops at a time, till the color matches with the glass plates in the comparator. The solution should be mixed well after each addition of water with the glass rod provided. The level of the fluid was noted at its lower-meniscus and the reading corresponding to this level on the scale was read in grams per 100ml. Approximately N/10 HCl may be prepared by mixing 1ml of concentrated HCl and 99ml of distilled water. This is based on the fact that the normal concentrated HCl we buy is 10N.

**Indirect Parameters**

**Diet Survey**

Diet survey is an essential part of any complete study of nutritional status of individuals or groups. The first stage of nutritional deficiency is identified by diet surveys. The dietary intake of one or more nutrients is inadequate either because of lower intake or due to effect of certain drugs, dietary components or diseases interfering with the ingestion, adsorption, transport, utilization or excretion of nutrients.

There are a number of different dietary survey methods for the assessment of nutritional status. The methods can be rapid or systemic in nature.

**Rapid Method**: Rural Appraisal Participatory or Participatory Rapid Appraisal method (RAP/PRA).

**Systemic Methods**: Food balance sheet

- Questionnaire method
No.7. Information being collected regarding dietary intake of the child
In the present study, the 24 hour recall method is used to analyze the dietary pattern of 1-5 years children of Periyapatna taluk.

**24 Hour Recall Method:** A single 24 hour recall method is most appropriate for assessing average intake of food and nutrients for large group. The housewife is interviewed and she gives the information about:

1) Food cooked for all the three different meals. Sometimes it is also seen that they skip one meal (lunch).
2) Raw food ingredients used for the preparation of each stuff.
3) Total cooked amount of each preparation in forms of standardized cup(s) katories.
4) The intake of each food item by the child in terms of cups.

**Precision of 24 Hour Recall Method**

In general, result based on paired t-tests and or correlation analysis have suggested that this method can provide a relatively precise estimate of the mean intake of group.

**Diet History:** This method gives qualitative information about details of diet and food pattern at each household level. It is used to study the dietary habits, meal patterns, likes and dislikes of food, infant feeding practices and associated cultural constraints. At the same time,
approximate quantity of foods consumed by child in household and at Anganwadi Centres is obtained in terms of gross weights/volume.

**Calculation of Nutritive Value of Foods and Comparison with Recommended Caloric Requirements**

It is a known fact that an individual needs a wide range of nutrients to keep himself healthy and safe. Thus, it is very urgent to know the physiological requirements of various nutrients at different age levels and sex groups. Expert committees have arrived at Recommended Dietary Allowances (RDA) or Intakes (RDI). Recommended Dietary Allowances (RDA) is thus defined as the intake of nutrient derived from diet which keeps nearly all people in good health. RDA is given at different age levels. RDA varies in nutrient needs, availability of nutrients and also from diet to diet.

The dietary information collected through 24 hour recall method and diet history was used to calculate their nutritive value, especially for caloric content, using appropriate food consumption tables containing references to local food. The food consumption tables used to calculate the nutritive value, especially the caloric value, was taken from “Nutritive Value of Indian Foods” (ICMR,1989). The energy of Kcal/day of all the subjects were calculated from the information collected through 24 hour Recall method and Diet history.

In the present study, the mean intake of Kcal/day of the children according to the age groups compared to the energy requirements recommended by Indian Council of Medical Research (ICMR, 1989).
Supplementation of Food to Pre-school Children in Anganwadi Centres

The supplementary food provided to the pre-school children at Anganwadi Centres has been narrated below.

Procedure: Materials used for the preparation of supplementary food is given in table-4. The cleaned cereals and bengal gram, edible groundnut cake were roasted in an electric revolving roaster for a period of 20 minutes at 80-90°C till a pleasant flavor was developed. The roasted materials were powdered (40 mesh) in a disc type grinding mill and blended in required quantities with other ingredients like powdered jaggery (crude sugar), melted hydrogenated fat, calcium salts and vitamin premix.

Table 4: Composition of Food (gm/100gm of the food)

<table>
<thead>
<tr>
<th>Raw materials</th>
<th>Blend I</th>
<th>Blend II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ragi (red millet)</td>
<td>25</td>
<td>11</td>
</tr>
<tr>
<td>Jowar (sorghum)</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Wheat</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Bengalgram flour</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Jaggery (crude sugar)</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Hydrogenated fat</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Calcium salts</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Vitamin premix</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Examination of Clinical Signs

Clinical examination is an important practical method for assessing the nutritional status. This method is based on examination of changes related to inadequate nutrition which can be seen or felt in superficial epithelial tissues especially the skin, eyes, hair and buccal mucosa, or in
organs near the surface of the body such as the Parotids and Thyroid glands (Verma and Jain, 1999).

Clinical assessment of a community can give valuable objective information to the public health worker especially in regions of the world where malnutrition is widespread.

**Advantages of Clinical Examination:** This method is relatively inexpensive and no elaborate equipment or laboratory facilities are required.

**Limitations:** Although this method seems to be simple, yet it has its own limitations. Many of the critical physical signs are non-specific, therefore, has to be supplemented with anthropometry and dietary surveys.

Laboratory assessment may also prove helpful in interpreting the results. In fact, most signs of malnutrition are not specific to lack of one nutrient and can often be produced by various non-nutritional factors. A few signs may be "two-directional" in that they can occur both in deficiency or during recovery (Verma and Jain, 1999).

Most of the times the signs recorded during the clinical nutritional surveys are vague and are not related to malnutrition at all. World Health Organization Expert Committee on Medical Assessment of Nutritional Status (1963) suggested the classification of signs recorded into 3 categories.

**Category I**-Signs that are considered to be of value in nutritional assessment as they indicate with considerable probability of deficiency of one or more nutrients in the tissues.
No. 8. Examination of the clinical signs of the child
Category II- Signs that need further investigation where chronic malnutrition may play some part, found usually in populations with low standard of living.

Category III- Signs not related to nutrition.

Description of Selected Clinical Signs

1) Hair
   a) Sparse: Hair falling, scanty hairs and not bountiful, easily pluckable and discolored. Reddish hair and grey hair is common.
   b) Discolored: It is common in children suffering from Protein-Calorie Malnutrition, wherein the hair becomes light. Protein rich foods lead to normal color of the hair.
   c) Easily pluckable: Here a small clump or tuft of hair can be easily pulled out with moderate force or without pain. It is accompanied with other hair changes such as dyspigmentation, sparseness and occurs in Kwashiorkar and other forms of Protein-Calorie Malnutrition in early childhood.

2) Moon face
   Face becomes round, cheeks develop with a sort of oedema, muscle mass becomes glosular and face looks round. This is common in preschool child with Kwashiorkar.

3) Oedema
   Collection of fluid in subcutaneous tissue under the skin, water collection is seen.
4) **Emaciation**

Lean looking, wasting, considerable loss of weight and nutritional loss of weight is called emaciation.

5) **Marasmus**

Extensive tissue and muscle wasting. Wasting away of the body.

6) **Eyes**

a) **Night Blindness**: Is common in poor people living in under developed countries and it can occur in the mal absorption syndrome in affluent countries. In case of children, parents may notice that the child stumbles in dimlight.

b) **Conjunctival Xerosis**: This condition includes dryness, thickening, pigmentation and lack of lustre of the conjunctiva of the exposed part of the eyeball.

c) **Bitot Spots**: These are triangular, foamy, rough and raised patches seen in bulbar conjunctiva not interfering the vision. These are generally bilateral. If more than 2 percent of children of ages 0-5 years show bitot spots with conjunctival xerosis it should be regarded as a criterion for community diagnosis of Xerophthalmia and Vitamin A deficiency.

d) **Corneal Xerosis**: Cornea becomes dry and hazy like ground glass, usually accompanied with conjunctival xerosis.

e) **Keratomalacia**: It consists of softening of the entire thickness of a part or cornea. If not treated then it is serious medical emergency. The process is a rapid one and may lead to neurosis and ulceration.
f) **Corneal scar:** It is a scar/wound at the cornea.

g) **Photophobia:** Threat to light. Some children due to Vitamin A deficiency are afraid of light. They close their eyes when exposed to light.

7) **Lips**

a) **Angular Stomatitis:** Fissuring is seen at both the angles of the mouth, may be shallow or deep confined to a small area of the angles of the mouth.

b) **Glositis:** Development of pigmentation of the angle of the mouth.

c) **Cheilosis:** Copper poisoning is known as cheilosis. High amount of collection of metal in the body causes cheilosis (not so discovered at this place). Fissures at the corners of the mouth is seen.

8) **Skin**

**Phrynoderma:** It occurs due to Vitamin A and niacin deficiency, easily detected over buttocks, thighs, elbows and knees, i.e. Toad skin.

9) **Nails**

**Koilonychia:** Due to iron deficiency that we see spooning of nails, concavity and flatness of nails.

10) **Gums**

**Spongy bleeding gums:** Purplish red spongy swelling at the interdental papillae and or the gums margins which usually bleed easily on slight pressure.
11) **Knock knees/Bow legs**

Vitamin D deficiency leads to bow legs in children. Vitamin D is obtained through sunlight.

12) **Teeth**

a) **Dental caries:** It is the caries seen in dental, may be due to excessive chocolate chewing or flurosis. It leads to death of the teeth, may be by birth or later on.

b) **Dental flurosis:** The teeth lose their shiny appearance and chalky yellow patches develop on them. This gives the appearance of mottled enamel. These yellow patches later may become brown/black. Later on pitting may be seen especially in upper incisor.

Srikantia (1989) reported that fluorosis is not a deficiency disease but a water-related disorder.

13) **Glands**

a) **Thyroid gland palpable:** The thyroid is probably enlarged more than 4-5 times, although not visible with the head in normal position. Most cases will be readily visible with the head thrown back and the neck fully extended. Palpation is examined by sitting or standing, facing the subject and placing his thumbs gently on either side at the Thyroid area.

b) **Thyroid gland visible:** Wherein the thyroid gland is visibly seen enlarged i.e., visible goitre observed.

For making examination of clinical signs, doctors were consulted and accordingly different signs were observed.
Socio-Economic Factors

In the present study evaluation of socio-economic condition has been made through the following characters:

1) Caste
2) Parental occupation
3) Income of the family
4) Family size
5) Type of family.

Gopalan et al. (2002) showed that the socio-economic status ordinal position, family size played an important role in the variation of growth and nutrition status of children.

Rao (1971) revealed in his study that the larger the family size the poorer will be the nutritional status. Pooled socio-economic status is, perhaps, the most important determinant of the nutritional status of communities.

Socio-economic factors have long been known to influence health status, wherein for the majority of the world’s people, health status is determined primarily by their level of Socioeconomic Development, Per-capita, Gross National Product, Education, Nutrition and Employment. A harmonious adjustment to the social environment enables man to enjoy happy and perfect health whereas maladjustment lead to illness and deprivation (Pattanaik and Mahakud, 1998).

Recall that Socio-Economic Status (SES) is an index that combines years of education, prestige and skill required by one’s job and income. As
Socio-Economic Status (SES) rises and falls, parents and children face changing circumstances that profoundly affect family functioning.

**Morbidity**

Recent advances in the field of medical and public health issues have led to a decline in mortality rates in most countries, including India. Consequently, it has become essential to know the magnitude and pattern of morbidity in order to plan and evaluate medical and health services (World Health Organization Report, 1959). In most of the developing countries, the health status of children is very disappointing because of high morbidity resulting in physical, emotional, economic drain on the community (Sharma et al., 1978).

Strong scientific evidence exists on synergism between undernutrition and child mortality due to common childhood morbidities including diarrhea, acute respiratory infections, malaria and measles. The risk of death is 20-60 times higher when severely malnourished children suffer from any of these morbidities.

One who doesn’t have the sufficient knowledge about the pattern of morbidity, it will be difficult for him to formulate appropriate strategies both in managing and preventing.

Diarrhea is a common illness and a leading cause of malnutrition and death in under five children of developing countries (Ghai and Gupta., 1999). Child care practices including personal and domestic hygiene play an important role in diarrhea prevention.

The health status of the children was assessed by interviewing the subject’s mother and by asking them about the ailments and diseases suffered by each child during the last 2-3 months to know the health
status. Further, the number of diseases suffered by each child was totaled and the percentage prevalence was calculated.

**Statistical Methods Used for the Analysis of Data**

Statistics analysis helps in presenting the facts in a precised and a definite form, simplifying unwieldy masses of facts. It helps in classification of data, comparison, studying relationship, and association between different phenomenon and testing hypothesis.

The statistics calculated for every variable normally include the mean with its standard error, the standard deviation with its standard error. In the present study, Mean, Standard Deviation and Standard Error were calculated by using the following formulae.

The most popular and widely used measure for representing the entire data by one value is what most laymen call an average and what the statisticians call the arithematic mean.

\[ M = \frac{\sum fx}{N} \]

Where, \( M \) = Arithematic Mean Value  
\( fx \) = Total of all values  
\( N \) = Number of values

The standard deviation measures the absolute dispersion or variability of a distribution; and is extremely useful in judging the representation of the mean.

\[ S.D = \sigma = \sqrt{\frac{\sum f dx^2}{N}} \]

Where, \( f \) = Frequency  
\( D = (x-m) \) available from frequency table  
\( N = Number of observations (sample size) \)
The standard error is the error in drawing the sample from the population. That is, it is an estimate of the standard deviation of the means of many samples which might be taken from the same population. The Socio Economic Status (SES) gives an indication of the visual magnitude of the sampling error. It depends on the size of the sample.

\[ S.E. = \frac{\sigma}{\sqrt{n}} \]

Where, \( \sigma = S.D \)

\( N = \) Number of observations (sample size)

The test of significance of difference viz., "t" test is used in the present study using the following formula.

\[ t = \frac{M_1 - M_2}{\sqrt{(SE_1)^2 - (SE_2)^2}} \]

Where, \( M_1 \) and \( M_2 \) are the mean and \( SE_1 \) and \( SE_2 \) are the Standard Errors of the two groups.

Body Mass Index (BMI) is calculated with the following formula.

\[ BMI = \frac{\text{Weight (kg)}}{\text{Height (meter)}^2} \]

Percentile: The 3rd, 50th, 97th percentiles of the subjects are computed and are compared with the National and International reference values as well as with the results of other similar nutritional studies.