MATERIALS AND METHODS
This chapter describes various methods and techniques employed in this research work to evaluate the impact of ongoing National Adolescent Girls Scheme (NAGS). The present study involved the quantitative evaluation and impact of the recently launched (April, 1994) National Adolescent Girls Scheme (NAGS) under ICDS by the Department of Women and child welfare, Ministry of Human Resource Development, Govt. of India and the assessment of the impact of improved module of Nutrition and health education along with supplementation in quantifiable terms by a pre-and post design study, wherein the nutritional status assessment by various methods as well as on the knowledge, attitude and practices (KAP) vis-à-vis nutrition, health, hygiene and childcare (NHHCC) were done at the beginning of the study before the interventions were given and after the interventions were provided for one year to the experimental group. For comparison of the impact of the improved module with the ongoing NAGS, an ongoing group of adolescent girls was also enrolled and assessed.

The methodology used in this research work is presented under following heads:

- National Adolescent Girls Scheme (NAGS)
- Interventions of ongoing National Adolescent Girls Scheme
- Improved module of National Adolescent Girls Scheme
- Selection of sample
- Methodology for assessment of Nutritional Status and Knowledge, Attitudes and Practices (KAP)
- Statistical Analysis
The ‘National Adolescent Girls Scheme’ had been designed to equip the adolescent girls to become conscious participants in the development process. The scheme, therefore, aims at ensuring adolescent girls an equal status, equal opportunities for survival and development to her full potential and better quality of life. The objective was to develop a comprehensive programme for adolescent girls, to equip her with ‘life skills’ and prepare her for her future role in the family and society. Programmes for her embraced a whole range of activities such as nutrition, health, education, recreation, upgradation of home based skills and promotion of her decision making capabilities especially on issues related to her future.

Though the operational objectives of the scheme are multifold but the focus is to create awareness on nutrition, health, hygiene, family welfare, home management and childcare with a view to delay the age of marriage and prepare her for her new role in the family and the society.

However, the specific objectives of National Adolescent Girls Scheme are varied and multifold but in this study only those objectives, which are relevant to nutrition and health will be targeted. These are:

A) To improve the nutritional and health status of adolescent girls and
B) To promote awareness about nutrition, health, hygiene and childcare;

Which will broadly lead to the overall objective i.e. to prepare them for the capable adulthood.
INTERVENTIONS OF ONGOING NATIONAL ADOLESCENT GIRLS SCHEME (NAGS)

For achieving the above listed objectives of ongoing NAGS, two interventions namely dietary supplementation and Nutrition, Health, Hygiene and Child Care Education are given to adolescent girls registered for ongoing scheme.

The operational inputs of the National Adolescent Girls Scheme comprised of the following:

a) Selection of three most eligible adolescent girls (11-15 yrs) from 10 villages by the supervisors of ICDS scheme, who had been trained only non-formally by providing them the educational package prepared for this purpose;

b) Initial orientation of above selected 30 girls for three days in the first month followed by one day continuing education for five months at supervisors circle headquarters as per the educational package, which included topics on food, various deficiency diseases, diarrhoea, growth promotion, immunization, various convergent programmes and services at the health centre. Supervisors could invite resource persons/experts from various fields to deliver talk on various topics for which there was provision of honorarium of Rs.450/- @ Rs.50/- per session under NAGS. In addition, there was a budgetary provision of Rs.7/- per head per day for travelling expenses and Rs.6/- per head per day for refreshment of adolescent girls for each visit to supervisor’s circle headquarters.

c) Attending the activities of Anganwadi centres twice a week by each of these three girls from 10 villages and received supplementary nutrition for 2 days in a week @ Rs.1.15 per head per day for a period of six months. Food supplement comprised of alpahar / biscuits / panjiri available in
ready to eat form at the Anganwadi centers. It aimed to provide 300 – 400 Kcals and 8 – 10 gms of protein but the quantity of supplement varied according to the rate of items supplied.

A review and analysis of National Adolescent Girls Scheme revealed certain limitations in terms of input of dietary supplementation as well as content, duration and mode of delivery of educational package. The food supplement given to adolescent girls was found to be inadequate in terms of its quality and quantity. Moreover, it remained a sporadic input due to frequent interruption in the supply of food supplement by the Department of Women and Child Development, which adversely affected the other intervention of NHHCC. Since the adolescent girls of ONG scheme attended the activities of Anganwadi Centre for only two days in a week, they actually received the food supplement only twice a week, which would not benefit the girls to the extent a daily supplement would do.

The nutrition and health education package of National Adolescent Girls Scheme was characterized by limitations of its short duration of six months only for awareness generation and expecting any change in their nutritional status and the Knowledge, Attitudes and Practices (KAP) of adolescent girls. Other limitations of educational package of NAGS included lack of few important and relevant basic concepts of nutrition, health, hygiene and childcare (NHHCC), improper sequencing of topics, inadequate allocation of time for important topics and utilizing the services of the only supervisor as a resource person, who had not been oriented formally regarding the content, method and delivery of educational package.

Moreover, the objectives set forth were very qualitative in nature and didn't assess the impact of awareness generation programme on nutritional status of adolescent girls in quantitative terms. The effort had been to quantify the impact of the scheme through quantifiable parameters. This study had been planned to
evaluate the ongoing scheme, modify to improve upon the module and its operational aspects. Its impact had been quantified and compared with the ongoing scheme.

**IMPROVED MODULE OF NATIONAL ADOLESCENT GIRLS SCHEME**

Keeping in view the limitations observed during review and analysis of ongoing scheme, the interventions of dietary supplementation and Nutrition, Health, Hygiene And Child Care Education (NHHCC) were improved upon in improved module of NAGS.

Two interventions were provided to the adolescent girls of experimental group namely food and nutrient supplementation and Nutrition, Health, Hygiene And Child Care Education (NHHCC) after their de worming and immunization.

**Deworming**: In view of the unhygienic food habits and insanitary environmental conditions, each girl was dewormed with Mobendazole tablets to accrue full benefits of the food supplementation before it was started.

**Immunization**: Every girl had been immunized for tetanus toxide at the beginning of the intervention.

**I. Food And Nutrient Supplementation**

**Food Supplement**: Food supplementation of NAGS had to be improved upon keeping in view of its local availability, high acceptability, easy to store, pack and distribute, ready to eat because of inadequate cooking facilities. A number of studies on dietary supplementation have recommended that dietary supplement should contribute at least one-third of the daily calorie and protein intake. However, the gap between recommended dietary intake and the actual food intake of girls was too wide that could not be filled by only one serving of dietary supplement. Though the cost of dietary supplement was increased from Rs. 1.15
per head per day to Rs. 2.00 per head per day due to inflation in rates of food items from the time NAGS was launched in year 1994 till date, only a marginal increase in the cost of dietary supplement was made due to financial constraints. In view of the above considerations, a cereal-pulse combination (2:1) of food supplement comprising of puffed rice, roasted Bengal gram / groundnut and gur was selected which increased the quantity of home diet in such away that total cereal-pulse ratio of 5:1 was well maintained, which is recommended for best utilization of nutrients. The qualitative improvement was brought about through cereal-pulse combination, which provided good quality protein through mutual supplementary effect of their constituent amino acids, lysine and methionine. Addition of gur further improved its caloric value, iron and calcium content to a great extent besides improving its taste and palatability.

The food supplement comprised of following items as given in the Table below:

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty. (gm)</th>
<th>Calorie (Kcal)</th>
<th>Protein (gm)</th>
<th>Iron (mg)</th>
<th>Calcium (mg)</th>
<th>Rate (Rs.)</th>
<th>Amount (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murmura</td>
<td>50</td>
<td>112.5</td>
<td>3.75</td>
<td>3.3</td>
<td>11.5</td>
<td>18/-</td>
<td>0.90</td>
</tr>
<tr>
<td>Roasted Channa / Groundnut</td>
<td>25</td>
<td>92.25</td>
<td>5.62</td>
<td>2.37</td>
<td>14.5</td>
<td>24/-</td>
<td>0.60</td>
</tr>
<tr>
<td>Gur</td>
<td>50</td>
<td>191.5</td>
<td>0.21</td>
<td>5.7</td>
<td>40.0</td>
<td>10/-</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>125</td>
<td><strong>396.25</strong></td>
<td><strong>9.58</strong></td>
<td><strong>11.38</strong></td>
<td><strong>66.0</strong></td>
<td><strong>2.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

Food supplement was provided to all adolescent girls in the experimental group for a period of three months during the first phase of supplementation to assess the impact on physical growth of adolescent girls. This was followed by a gap of 3 months during which no supplement was given so as to compare the growth velocities during supplementation and non-supplementation periods. Further, food and nutrient supplementation was again given to these adolescent girls for a longer period i.e. 4.5 months during the second phase of supplementation to
evaluate the effect of longer duration of supplementation on the growth of adolescent girls.

The purchase of material for supplementary nutrition was made on monthly basis from a wholesale supplier. On supply of material for supplementary nutrition to Anganwadi centers of villages, the Anganwadi workers were made responsible for its proper storage, packaging and distribution, who kept a proper record for it. A multi-level Committee comprising of Village lady Panch, schoolteacher and local ladies was constituted to check the distribution and consumption of material in terms of its quality and quantity. It was ensured that all adolescent girls collect the packets of food supplement and eat it during the recess break of their schools. The schools run by Education Department and Anganwadi Centres under ICDS were located in the same building of their respective villages. Mid morning time was scheduled for food supplement to avoid its sharing by siblings or other members at home and to take care that it remains a supplement and not a substitute to home diet.

**Nutrient Supplement** : Each adolescent girl was given iron and folic acid supplement daily for 120 days during the second phase of dietary supplementation. Each sugarcoated tablet contained 67 mg of dried ferrous sulphate equivalent to 20 mg of elemental iron, along with 0.1 mg of folic acid. Each girl was given the packet containing 30 tablets of iron and folic acid at the beginning of the month and explained its importance, method of storage and consumption. In order to ensure that they consumed it regularly, they were enquired and reminded everyday, when they came to collect the food supplement and marked in the register maintained by the Anganwadi worker for this purpose.
II. Nutrition, Health, Hygiene and Childcare Education (NHHCC)

The educational package of NAGS on Nutrition, Health, Hygiene and Child Care Education was improved upon in terms of its content, duration and mode of delivery. The improved package on nutrition, health, hygiene and childcare education package had been prepared in the regional language Hindi. The content of this improved package included all those topics, which were found to be deficient or inadequate during review of ongoing NAGS. Improvements in content were made in terms of its enlargement by inclusion of some basic concepts of food and nutrition, health, maternal and childcare etc. in a simple language and presented as an improved module. This improved package included important fundamental concepts of food and nutrition and health; applied nutrition for various ages with special emphasis on adolescent health, maternal and child health and also therapeutic nutrition. Growth during adolescence was emphasized which included physical changes during adolescence, nutritional and other requirements of adolescence and food fads and fallacies associated with it. Other important aspects included were food hygiene and sanitation, food and water born diseases and their management through oral rehydration therapy and also other nutritional deficiency diseases.

The content of educational package of Nutrition, Health, Hygiene and Child Care Education was improved upon to be presented to adolescent girls in the form, which was understandable, meaningful and relevant to them in their daily life. It is known that learning is best fostered by capturing learner’s interest in the subject matter which can be achieved by linking learning to life goals and making it relevant to them. It is necessary to guide their expectations on realistic lines so that every expectation turns out to be an achievement, which in turn, would provide motivation for sustaining the onward activity towards the goal. Thus, learning content unrelated to realities of daily life does not sustain interest. Lack of motivation or interest on the part of learners is mainly responsible for widespread illiteracy among our rural women (Pathak and Shah, 1984).
Moreover, proper sequencing of topics was maintained by taking care that new knowledge imparted was linked to previous knowledge possessed by the adolescent girls. It is an established fact that things to be learnt should be linked with their previous learning and be made a base for future learning so as to establish proper connection and association between various aspects of learning.

The duration and the continuity of the improved educational package was also extended to one year so as to increase the scope for more details, more repetition and thus more retention of knowledge. The relationship between practice and learning as explored by Hermann Ebbinghans (1885) states that the amount learnt is a direct function of time devoted to learning. Moreover, the distributed practices are more effective than massed practices. Good deal of evidence suggests that learning is better if it is spread over many days rather than crammed into a few. Also, a break of 2 – 10 minutes after every 30 – 50 minutes of learning period helps to increase the efficiency (Vanka, 1995).

Various participatory and interactive methods involving active participation of the girls i.e. lecture-cum-discussion, result demonstrations, film / slide show, nutrition and health games, puzzles, rhymes, riddles, role play and songs etc. were used to make the sessions more interesting and effective. Use of various audio visual aids like video films, slides, transparencies, charts, posters, games and puzzles etc. were used because learning is always better when use of more senses is involved to gain information. Researches indicate that 83% of learning takes place through sight. Learners perhaps can not concentrate much on verbal media alone and learn better through visual media, which not only arouse interest but also enrich learning situations by sustaining interest, promoting better understanding and motivating thinking and action (Shah and Gupta, 1986).

This improved educational package was delivered to adolescent girls at their door steps i.e. Anganwadi center of their respective villages which resulted in better learning through lesser distraction of mind towards unfamiliar situations.
Our rural women generally find it difficult to identify themselves with unfamiliar characters, situations and messages presented to them. Thus, an effective method for educating rural women should have the elements of interest, familiarity and indirection (Pathak and Shah, 1984).

The improved module of Nutrition, Health, Hygiene and Child Care Education was imparted to adolescent girls by various experts from Food and Nutrition Board, Department of Women & Child Welfare, Health Department and Family Planning Association of India, who had a lot of exposure of the field situations along with the researcher. This resulted in better learning due to integration of efforts on a common platform. This imparted motivation, feeling of success, increased self-esteem, confidence and competence.

The modified and improved educational package on nutrition, health, hygiene, and childcare is given below and detailed in Annexure (IV).

**Improved Package Of NHHCC**

The improved package was scheduled for one year as indicated below:

**Initial Orientation (For 5 Days) During First Month**

<table>
<thead>
<tr>
<th>Day</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction, Objectives of the programme, ICDS Scheme, Adolescent Girls Scheme and Status of girls in the community</td>
</tr>
<tr>
<td>2.</td>
<td>Knowledge of food and its role in growth, basic food groups and their functions</td>
</tr>
<tr>
<td>3.</td>
<td>Dietary sources of various nutrients</td>
</tr>
<tr>
<td>4.</td>
<td>Balanced diet for all with emphasis on adolescent girls</td>
</tr>
<tr>
<td>5.</td>
<td>Locally available foods and ways of using these for diet enrichment</td>
</tr>
</tbody>
</table>
Continuing Education for 11 Months (For 1 Day a Month)

Month | Topic
--- | ---
2. | Feedback of initial orientation followed by growth promotion and growth spurt of adolescence, physical changes during adolescence
3. | Nutritional and other requirements of adolescence
4. | Awareness of food fads, and fallacies
5. | Locally available low cost food stuffs, use of low cost nutritious recipes especially for adolescent girls
6. | Enhancing nutritive value of food through methods of germination, fermentation and combination
7. | Retention of maximum nutritive value of food
8. | Food hygiene and sanitation
9. | Nutritional deficiency diseases – Protein Energy Malnutrition and Anaemia
10. | Deficiency diseases – Vitamin A and iodine deficiency
11. | Management of water borne diseases like Diarrohea, Dysentry and Cholera using Oral Rehydration Therapy
12. | Preparing adolescent girls for better childcare through child nutrition

The sessions were conducted by the researcher, supervisors of ICDS and guest speakers / experts from various fields. Various teaching methods and teaching aids were used to make the sessions interesting and effective.

**SELECTION OF SAMPLE**

As envisaged in the National Adolescent Girls Scheme (NAGS), all unmarried adolescent girls belonging to the families of low socio-economic background in rural area are eligible and as per the census of 1991. it is estimated that around 18 adolescent girls (Eleven to Fifteen years old) are identified in every 1000 population. National Adolescent Girls Scheme is being implemented in only four blocks of Sirsa District of Haryana namely Sirsa, Rania, Ellnabad and Dabwali.
Selection of sample of 60 adolescent girls was done purposively from two blocks i.e. Sirsa and Rania of Sirsa District for the evaluation of ongoing scheme and was designated as the ongoing group (ONG). Its geographical locale is shown in Fig. (3.1).

For the implementation of improved module of National Adolescent Girls Scheme, selection of 171 non-migrant girls was made from eight villages of Pinjore block of Panchkula District of Haryana, namely Kharag Mangoli, Majri, Devinagar, Maheshpur, Fatehpur, Haripur, Kundi and Rally by applying the criteria used for ongoing group and it was designated as experimental group (EXPT). Geographical locale of this group is shown in Fig. (3.2).

The subjects were selected purposively and due care was taken to include only those girls, who were physically and mentally normal. Girls suffering from any chronic disease, deformity or mental disorder were not involved in the study. Information regarding date of birth and other socio-economic aspects i.e. caste, religion, parents occupation and income was recorded from the school registers or Anganwadi records and verified from the subjects as well as from their teachers. In case of subjects, whose date of birth was not available from the school or Anganwadi record, the date of birth of subjects was ascertained from their parents using local event calendar. Care was taken to ascertain the correct age of the subjects, as this is extremely important in studies pertaining to growth and development of children. Later on in the study, age of the subjects was calculated from date of birth and date of examination. The subjects were then divided into different yearly age groups.
Fig. 3.1

GEOGRAPHICAL LOCALE OF ONG GROUP

To Faridkot
To Bathinda
PUNJAB
To Hisar
(District Headquarter)
To Hisar
(HISAR)

100
Fig. 3.2

GEOGRAPHICAL LOCALE OF EXPT GROUP

HIMACHAL PRADESH

To Solan

To Chandigarh (State Headquarters)

To Ludhiana

YAMUNANAGAR

KAITHAL
METHODOLOGY FOR ASSESSMENT OF NUTRITIONAL STATUS AND KNOWLEDGE, ATTITUDES AND PRACTICES

With a view to generate data for evaluating the National Adolescent Girls Scheme (NAGS) and assessing the impact of the improved module of NAGS on nutritional status of adolescent girls and knowledge, attitude and practices vis-à-vis nutrition, health, hygiene and child care (NHHCC) of the sample under study, the following types of information were recorded:

A) Demographic Details

B) Nutritional status assessment
   I. Dietary and nutrient intake
   II. Anthropometric measurements
   III. Biochemical examination
   IV. Clinical examination

C) Measurement of physical work capacity and energy expenditure

D) Testing knowledge, attitude and practices (KAP) vis-à-vis nutrition, health, hygiene and childcare (NHHCC).

(A) Demographic Details: Demographic data about the subjects and their families was collected on a schedule given in Annexure (I). Details of relevant ecological aspects of the family having bearing on the physical health and hence on morbidity of the subjects were also collected and given in Annexure (I).

(B) Nutritional Status assessment: It deals with the methods that can be employed for assessing the nutritional status of a community especially by means of prevalence surveys, and in particular, the clinical, anthropometric, biochemical and dietary procedures that can be employed in the difficult circumstances often found in the developing countries of the World.
The principle aim of nutritional status assessment is to map out the magnitude and geographical distribution of malnutrition as a public health problem, to discover and analyse the ecological factors that are directly or indirectly responsible and where possible, to suggest appropriate corrective measures preferably capable of being applied with continuing community participation. The aim is always to obtain the maximum of useful information using a minimum of staff, inexpensive equipment and uncomplicated techniques that can be analysed easily.

For the assessment of the nutritional status of the subjects, the following assessments were made at the beginning of the study i.e. at T1. Improved module of NAGS comprising of dietary supplementation and NHHCC education was imparted to adolescent girls of EXPT group for one year and nutritional status assessment was done at that time i.e. T4. The adolescent girls of ONG group were given both interventions of ongoing NAGS for six months and their nutritional status was assessed at that time i.e. T3

I) Dietary and nutrient Intake: twenty-four hour recall method had been used to assess the dietary and nutrient intake of the subjects for 3 consecutive days. The reliability of this method has been established and validated by DOP et al (1994).

An interview schedule was used to make a quantitative record of all the food items consumed by a subject on a day preceding interview by weighing and measuring them in raw state, and also if the methods of cooking are fairly standard, by weighing cooked food portions. At the same time, details of family composition were collected to calculate food consumption per capita per day. The household measures like bowls and glasses were then converted into raw ingredients in the laboratory of Govt. Home Science College. From the amounts of food consumed, the mean of three days intake of all the raw ingredients was worked out.
For the assessment of nutrient intake, the ‘MSU NUTRIGUIDE PROGRAMME for Asian Indian foods’ – a nutritional analysis computer programme developed by Department of Food Science and Human Nutrition, Michigan State University, USA was used (Song et al, 1992). This programme was designed to assess individual Indians daily nutrient intake by analyzing various nutrients. This version, however, provided nutrient composition data for only calories and 16 nutrients, that is protein, carbohydrates, fat, Vitamin A, β-carotene, vitamin B1, B2, B3, vitamin C, iron, calcium, phosphorous, sodium, potassium, magnesium and zinc by entering food names/ raw ingredients in English, Hindi, Punjabi or Marathi. Recommended daily allowances (RDA) values for the above listed nutrients reflect those for Indians (ICMR, 1989). The calculated values of above listed nutrients were compared to RDA (1989) for their adequacy. Further, the sources of calories from proximate principles and the food groups contributing to different nutrients were also analysed using data on food and nutrient intake of adolescent girls.

II) Anthropometric Measurements: Anthropometry- the technique of taking measurements on man-provides a useful tool to scientifically investigate the variations and changes in human body dimensions as a result of growth and development.

A large number of anthropometric measurements are available for studies pertaining to growth and development but for the present study, a set of anthropometric measurements having bearing on the growth and nutritional status of adolescent girls were selected. Standard anthropometric instruments were used to take the measurements. The accuracy of instruments was checked periodically by taking measurements of researcher. Attention was paid to the posture of every subject, while taking measurements. Measurements were taken on the subjects with minimum possible clothing. All measurements were recorded in centimeters, except, for weight and skinfold measurements which were recorded in kilograms and millimeters respectively. All the measurements,
except height and weight, were taken twice i.e. at the beginning of the interventions (T1) and after the interventions were over i.e. at T4. Height and weight of the subjects were taken four times i.e. at the beginning of intervention i.e. at T1 and after giving them dietary supplementation for three months during the first phase i.e. at T2. No supplement was given for three months and height and weight of adolescent girls were measured at T3. Then, dietary and nutrient supplementation was given again for a longer period i.e. 4.5 months during the second phase and both measurements were taken at the end i.e. T4.

The following measurements were taken on each subject according to the procedures described by Weiner and Lourie (1969).

a) Weight: Weight is the anthropometric measurement most in use. The body weight was taken to the nearest of 0.5 kg using a platform balance. The subjects were not wearing any heavy garments and were asked to remove their shoes before weighing. The weighing scale was recalibrated frequently by taking weight of the researcher and also the zero error of the scale was recalibrated after every use.

b) Height: For taking height of the subjects in field situations, the measuring scale was drawn on the wall of Anganwadi centre. The subjects were asked to stand erect on the floor without shoes, with feet side by side. The heels, buttocks, shoulders and back of head touched the wall at the back. The arms were hanging at the sides in a natural manner. A steel scale was used, which was lowered gently, crushing the hair and making contact with the top of the head. The reading was recorded to the nearest of 0.5 cm.

c) Chest Circumference: A narrow, flexible non-stretchable steel tape was used and the measurement was made at the nipple line to the nearest of 0.1 cm.
d) **Mid upper arm circumference:** The arm circumference was measured to the nearest of 0.1cm. with a flexible non-stretchable, steel tape, which was placed gently, but firmly round the left limb to avoid compression of the soft tissues. The left arm was measured while hanging freely, at its mid point, halfway down the arm, between the tip of the acromion process of the scapula and the olecranon process of the ulna.

e) **Calf Circumference:** The same flexible non-stretchable steel tape was used to measure the calf circumference to the nearest 0.1cm. by making the subject stand erect and taking the measurement of the lower limb at the point of maximum circumference.

f) **Bicondylar Breadth of Humerus:** The subjects elbow was bent to a right angle and the width across the outermost part of the lower end of the humerus was measured with a sliding caliper. Pressure was exerted to compress the tissues.

g) **Bicondylar Breadth of Femur:** The subject sat on a table with knees bent to a right angle and the width across the outermost part of the lower end of the femur was measured with a sliding caliper. Pressure was exerted to compress the tissues.

h) **Pelvic girth:** The subjects were asked to stand erect and the circumferential measurement was taken at the level of pelvic bone to the nearest 0.1cm. using the flexible non-stretchable, steel tape.

i) **Skinfold measurements:** Body composition concerning the amount and distribution of human subcutaneous fat and hence the calorie reserve can be carried out by physical anthropometry using skinfold calipers.
The instrument used for taking skinfold measurements were Harpenden caliper, having standard contact surface or pinch area (20-40 mm²), should read to 0.1mm accuracy and exert a constant pressure on (10 gm/mm²) through a whole range of skinfold thickness at all distances of separation of the jaws.

The skinfold measurements were taken at four sites namely bicep, tricep, subscapular, and suprailliac; all measurements being taken on the left side of the body of all subjects. At all sites, a lengthwise skinfold was firmly grasped and slightly lifted up between finger and thumb of left hand, care being taken not to include the underlying muscle. The calipers were applied 1cm. below the operator's finger at the depth about equal to skinfold, while the skinfold was just gently held throughout the measurement. These measurements were made and the results averaged. Due care was taken to select the site of the measurement carefully because the thickness of fat is not same in all regions.

- **Bicep Skinfold**: Bicep skinfold was measured at the same level as of the tricep but on the anterior side of the left arm, hanging relaxed at the side. The skinfold parallel to the long axis was picked up in the same way and measured at that point nearest to 0.1m.m.

- **Tricep Skinfold**: The measurement was made with arm hanging relaxed at the side, at halfway down the arm, between the tip of the acromion process of the scapula and the olecranon process of the ulna. The skinfold parallel to the long axis was picked up between the thumb and the forefinger of the left hand, clean away from the underlying muscle and measured at the point to nearest of 0.1 mm.

- **Subscapular Skinfold**: Subscapular skinfold was measured just below and laterally to the angle of left scapula, in a line running at approximately 45° to the spine, in the natural line of skin cleavage.

- **Suprailliac skinfold**: Superalliac skinfold was measured at the level of pelvic bone in a manner perpendicular to the long axis of the body.
Indices

From the above anthropometric measurements on each subject, the following indices were derived for the interpretation of measurements.

**Height-for-age** : Low height-for-age signifies a slowing of skeletal growth and is a principal indicator of long term nutritional experience or growth impairment caused by malnutrition in the past. It was categorized into various grades of stunting, besides normal.

**Weight-for-age** : The prevalence of low weight-for-age signified under weight and categorized into various grades of underweight, besides normal.

**Body Mass Index (BMI)** : The body mass index was calculated using the formula –

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

The BMI classification given by Garrow (1981), is as follows:

<table>
<thead>
<tr>
<th>BMI Class</th>
<th>Assumptive Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 16.0</td>
<td>Chronic Energy Deficit Grade III (Severe)</td>
</tr>
<tr>
<td>17.0</td>
<td>Chronic Energy Deficit Grade II (Moderate)</td>
</tr>
<tr>
<td>17.0-18.5</td>
<td>Chronic Energy Deficit Grade 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>Obese Grade I</td>
</tr>
<tr>
<td>&gt; 30.0</td>
<td>Obese Grade II</td>
</tr>
</tbody>
</table>
III) Biochemical Examination: A large number of biochemical parameters on blood and urine are used to assess under-nutrition and anaemia. Out of these, the biochemical parameters used in the present study to assess under-nutrition and anaemia were haemoglobin level, packed cell volume, red blood cell count, serum protein, albumin, serum iron and total iron binding capacity. Except for haemoglobin estimation, all other parameters were assessed twice i.e. at the beginning of the intervention and after the intervention was over and were designated as T1 and T4 respectively. Haemoglobin was measured four times i.e. at the beginning of intervention (T1) and after giving them dietary supplementation for three months during the first phase i.e. at T2. No supplement was given for three months and haemoglobin of adolescent girls was measured at that point and termed as T3. Then, dietary and nutrient supplementation given for a longer period i.e. 4.5 months during the second phase and haemoglobin was measured at the end of supplementation and termed as T4.

Collection of Blood Samples

Decontamination of Equipment: Glass and Plastic equipment was washed with soap solution and rinsed thoroughly with water. These were dipped overnight in 10% laboratory grade hydrochloric acid (HCl). Then, these were rinsed with distilled water. Glass equipment was then dried in an autoclave.

Collection of Blood Sample: For the collection of blood samples, help was taken from a technician. Venous blood sample (5ml) was drawn from the inner side of the arm of each subject with the help of disposable syringe. Out of this 5ml blood, 2 ml was transferred to vial containing Ethylene diamine Tetra-acetic acid (EDTA) powder at the rate of 1 mg/ml for haemoglobin, packed cell volume and red blood cell count. The rest of the blood (3ml) was put in another decontaminated vial and carried to the laboratory carefully to avoid haemolysis of blood. This was then centrifuged for 15 minutes at 3000 rpm to separate out the
serum. The separated serum was transferred to decontaminated vials and kept in refrigerator till analysed for protein, albumin, iron and total iron binding capacity.

**Biochemical Estimation**

**Determination of Haemoglobin by Sahli’s method**: This is based on conversion of haemoglobin to acid haematin, which has a brown colour.

**Haemoglobinometer**: It is provided with a glass tube with a square cross-section. This is graduated in percent haemoglobin on one side and gram haemoglobin on the other side. In this, the colour of unknown solution is compared with the standard, which consists of a non-fading tinted glass. The instrument is calibrated for taking reading of haemoglobin value after 5 minutes action of acid on blood.

**Apparatus and Reagents**
- a) Haemoglobinometer
- b) 0.02 ml pipette
- c) N/10 HCl
- d) Distilled Water

**Procedure**:

1) Filled the graduated tube of haemoglobinometer to the 20 mark with N/10 HCl.

2) Added 0.02 ml of blood, mixed well and left for 5 minutes.

3) Added distilled water drop-by-drop, mixing between each addition until the colour matched the standard of haemoglobinometer.
4) Read the calibration on the graduated tube, which tells the amount of haemoglobin in percentage as well as grams/100ml.

**Packed Cell Volume (PCV)**

For estimation of PCV, Wintrobe’s method, also known as Macro-method was followed. The estimation of packed cell volume is often a valuable guide in diagnosing certain blood disorders.

Wintrobe tubes, 2.5-3 mm in internal diameter and about 110 mm in length calibrated at 1 mm interval to 100 mm, are used in this estimation. 1 ml of anticoagulated blood is spun at high speed. The light of the column of red cells is taken as the packed cell volume.

**Procedure:**

1) Added venous blood to a vial containing EDTA (0.1 mg/ml of blood)

2) With a capillary pipette filled the wintrobe tube to 100 mm.

3) Centrifuged the tube at 3000 rpm for 30 minutes.

4) Read the height of red cells and expressed results as a percentage.

**Red Blood Cell Count (RBC)**

For RBC count, Neubauer counting chamber method was followed.
Neubauer Counting Chamber Method

Apparatus and Reagents:

a) Improved Neubauer Counting Chamber
b) Red Blood Cell Pipette (Bulb type)
c) Red Blood Cell diluting fluid.

Procedure:

1) Blood was drawn from the chosen site of the subject or from a sample of EDTA into red cell pipette until it was leveled to the 0.5 mark. If blood is drawn above the chosen mark, the end of the pippete should be touched against the hand to withdraw the excess blood.

2) Wiped the outside of the pipette with a piece of clean gauge and the diluting fluid was drawn up to the 101 mark rotating the pipette during the process.

3) The pipette was withdrawn from the diluting fluid and the outside was wiped with a clean gauge. The tip of the pipette was closed with the thumb. Removed the sucker, placed the middle finger over the top and mixed well by shaking.

4) The counting chamber was thoroughly cleaned and the cover glass was placed on a flat horizontal surface and using a firm pressure, slided the coverglass into position on the counting chamber obtaining a rainbow effect on the both sides.

5) The suspension was mixed well by shaking the pipette for 3-4 minutes and about quarter of mixture was discarded.
6) The chamber was filled by holding the pipette at an angle of 45° and lightly touching the tip against the edge of the coverslip. It is important that the fluid is not allowed to overflow into the channels. Should this occur the chamber should be cleaned and refilled. Too much fluid in the chamber may raise the cover glass causing a variation in the depth resulting in gross errors.

7) The chamber was placed on the Microscope stage and cells were allowed to settle. Using a 4mm objective and X10 eyepiece, focussed the objective onto the central square of the millimetre of the counting chamber and counted all the cells contained with 80 of the 400 small squares (Five groups of 16 small squares). Cells touching the centre line bordering the top and right hand side of each large square should be included in the count. Those touching the other two sides should be discarded.

For the final result to be expressed as the number of cells per cubic millimetre, the following calculations were used:

**Calculations:**

Let \( N \) = No. of Cells counted in 80 small squares.

The area of each small square is \( 1/400 \) mm\(^2\) and the depth of the chamber is \( 1/10 \) mm. The volume of the fluid over the small square is therefore:

\[
\frac{1}{400} \times \frac{1}{10} = \frac{1}{4000} \text{ mm}^3
\]

If \( N \) cells are counted in \( 80/4000 \) mm\(^3\) of diluted blood

\( 1 \) mm\(^3\) of diluted blood contains \( N \times 4000 / 80 \) cells
Since blood is diluted 1 in 200, 1 mm$^3$ of blood contains $N \times \frac{4000}{80} \times 200$ cells = $N \times 10,000$ cells = /cmm.

Iron Status Indices: From the analysed values of haemoglobin, RBC count (million/mm$^3$) and PCV, the following indices were calculated:

**Mean Cell Volume (MCV):** This is average volume of single red cell expressed in cubic millimeter.

\[
MCV = \frac{PCV \times 10}{RBC \text{ count (million / cubic mm)}} = \mu m^3
\]

**Mean Cell Haemoglobin (MCH):** This expresses the average haemoglobin content of a single red cell in picograms (pg)

\[
MCH = \text{haemoglobin gm } \% \times \frac{10}{RBC \text{ Count (millions/ cubic mm)}} = pg
\]

**Mean Cell Haemoglobin Concentration (MCHC):** This refers to the percentage of haemoglobin in 100 ml of red blood cells, as opposed to the percentage of haemoglobin in 100 ml of whole blood, given concentration of haemoglobin in the cells.

\[
MCHC = \frac{\text{haemoglobin } X \times 100}{RBC \text{ Count (millions/ cubic mm)}} = \%
\]

**Estimation of Total Protein:** Total protein is useful for monitoring gross changes in protein levels caused by various nutritional status conditions. It is usually performed in conjunction with other tests such as serum albumin or protein electrophoresis. An albumin/globulin ratio is calculated to obtain additional information.
**Principle**: The peptide bonds of protein react with copper II ions in alkaline solution to form a blue-violet complex (the so called biuret reaction). To each copper ion complexing with 5 or 6 peptide bonds, Tartarate is added as a stabiliser whilst iodide is used to prevent auto-reaction of the alkaline copper complex. The colour formed is proportional to the protein concentration and is measured at 546 nm (520-560 nm). For bichromatic analyser, the black wavelength should be set to (600-700 nm).

**Reagent Composition**:

- a) Copper II Sulphate - 19 mmol/l
- b) Potassium Sodium Tartarate - 43 mmol/l
- c) Potassium Iodide - 30 mmol/l
- d) Sodium Hydroxide - 600 mmol/l
- e) Total Protein Standard - 6.0 gm/dl

**Sample**: Serum or Plasma, Hemolysed specimens are unsuitable.

**Assay Procedures**:
- **Temperature**: 30-37°C
- **Wavelength**: 546 nm (520-560 nm)
- **Optical Path**: 1.0 cm.

Zero the spectrophotometer against distilled water.

<table>
<thead>
<tr>
<th></th>
<th>Blank</th>
<th>Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Reagent</td>
<td>1000μl</td>
<td>1000 μl</td>
<td>1000 μl</td>
</tr>
<tr>
<td>Distilled water</td>
<td>20μl</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Standard</td>
<td>-</td>
<td>20μl</td>
<td>-</td>
</tr>
<tr>
<td>Sample</td>
<td>-</td>
<td>-</td>
<td>20 μl</td>
</tr>
</tbody>
</table>
Incubate for 10 minutes at 37°C. Read the absorbance of the standard and each sample at 546 nm (520-560 nm) against reagent black.

**Calculation**: Calculate the results as follows:

\[
\text{Total Protein} = \frac{\text{Absorbance of Sample} \times \text{Concentration of Standard (g/dl)}}{(\text{gm/dl}) \times \text{Absorbance of standard}}
\]

**Normal Values**: 6.0-8.3 gm/dl

**Total Albumin estimation**: Albumin, a major plasma protein is synthesised in the liver from amino acids, which are absorbed from the ileum. The functions include regulation of distribution of extracellular fluid, transport agent for various hormones, vitamins and trace metals.

**Principle**: Albumin binds with Bromocresol green (BCG) at pH 4.2 causing a shift in absorbance of the Yellow BCG dye. The blue green colour formed is proportional to the concentration of albumin present, when measured photometrically between 580-630 nm with maximum absorbance at 625 nm.

**Reagent Composition**:

- a) Bromocresol Green - 0.08 mmol/l
- b) Succinate Buffer (pH 4.2 ± 0.1 at 25°C) - 50 mmol/l
- c) Sodium Azide - 1.50 mmol/l
- d) Surfactant Albumin Standard - 3.6 g/dl

**Sample**: Serum or Plasma
Assay Procedure:

Temperature: 25°C to 37°C  
Wavelength: 630 nm (580-630 nm)  
Optical Path: 1 cm.

Zero the spectrophotometer with Distilled water.

<table>
<thead>
<tr>
<th></th>
<th>Blank</th>
<th>Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin Reagent</td>
<td>1000μl</td>
<td>1000μl</td>
<td>1000μl</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>10 μl</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Standard</td>
<td>-</td>
<td>10 μl</td>
<td>-</td>
</tr>
<tr>
<td>Sample</td>
<td>-</td>
<td>-</td>
<td>10 μl</td>
</tr>
</tbody>
</table>

Mix well, read immediately the absorbance of standard and each sample at 630 nm (580-630 nm) against reagent blank.

Calculations:

\[
\text{Absorbance of Sample} = \text{Absorbance of standard} \times \text{Concentration of Standard (gm/dl)}
\]

**Calculation of Globulin Content:** Total Globulin content was calculated by subtracting the estimated value of total albumin from total protein value present in the serum.

**Calculation of Albumin/Globulin Ratio (A:G Ratio):** The proportion of Albumin value to Globulin value gives Albumin/Globulin Ratio.
Estimation of Serum Iron:

**Principle:** Ferric iron is dissociated from its carrier protein transferrin, in an acid medium and simultaneously reduced to the ferrous form. The ferrous iron is then complexed with chromogen, a sensitive iron indicator, to produce a blue chromophore, which absorbs maximally at 595 nm.

**Reagents:**

<table>
<thead>
<tr>
<th>Content</th>
<th>Initial Concentration of Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chromogen</td>
<td>9.7 mmol/l</td>
</tr>
<tr>
<td>2. Reductant- Ascorbic Acid</td>
<td>1.3 mol/l</td>
</tr>
<tr>
<td>3. Buffer</td>
<td></td>
</tr>
<tr>
<td>Acetate Buffer</td>
<td></td>
</tr>
<tr>
<td>Diethyl Sulphoxide</td>
<td>0.2 mol/l, pH 4.5</td>
</tr>
<tr>
<td>Surfactant</td>
<td></td>
</tr>
<tr>
<td>4. Standard</td>
<td>35.8 μmol/l (0.2 mg/dl)</td>
</tr>
</tbody>
</table>

Dissolve the contents of one vial of Reductant 2 with 15 ml of iron-free deionized water stable for 4 weeks at +4 to +8 °C.

**Procedure:**

- **Wavelength:** 595 nm (590-610 nm)
- **Cuvette:** 1 cm light path
- **Temperature:** 20-25°C
- **Measurement:** against reagent blank.
Mix, read initial absorbance of the sample and of the standard against the reagent blank.

<table>
<thead>
<tr>
<th></th>
<th>Reagent Blank</th>
<th>Sample</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buffer</strong></td>
<td>1.00 ml</td>
<td>1.00 ml</td>
<td>1.00 ml</td>
</tr>
<tr>
<td><strong>Reductant</strong></td>
<td>0.05 ml</td>
<td>0.05 ml</td>
<td>0.05 ml</td>
</tr>
<tr>
<td><strong>Iron-Free Water</strong></td>
<td>0.25 ml</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Standard</strong></td>
<td>--</td>
<td>0.25 ml</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td>-</td>
<td>0.25 ml</td>
<td>-</td>
</tr>
</tbody>
</table>

Mix, incubate for 5 min at 20-25°C. Read final absorbance against the reagent blank. Subtract initial absorbance from the final absorbance to give ΔA for sample and standard.

**Calculation:**

\[
\Delta A_{\text{Sample}} = \Delta A_{\text{Standard}} \times \text{Concentration of standard}
\]

Normal Values in Serum: 7.34-23.6 µmol/l (60 – 200 µgm / 100 ml).

**Total Iron Binding Capacity:** In the plasma, iron is bound to a B-globulin (transferrin) and the total iron binding capacity depends on the concentration of the globulin. The transferrin to which iron is not actually bound is known as the ‘unsaturated iron binding capacity’. The serum iron concentration plus the unsaturated iron binding capacity together gives the total iron binding capacity.

**Principle:** An excess of iron is added to the serum to saturate the protein, transferrin. The unbound iron is precipitated with basic magnesium carbonate. After centrifugation, the iron in the supernatant is determined.
Reagents:

<table>
<thead>
<tr>
<th>Contents</th>
<th>Initial Concentration of Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Solution (Iron)</td>
<td>500 µg/100ml (89.5 µmol/L)</td>
</tr>
<tr>
<td>Basic magnesium Carbonate</td>
<td>15gm</td>
</tr>
</tbody>
</table>

Sample: Serum

Procedure:

- Pipette into 10ml Centrifuge tube:
  - Serum 0.5ml
  - Solution 1.0ml

Mix, let it stand for 5-30 min at +20 to +25°C. Add one spatula-full (180mg) of basic magnesium carbonate from bottle 6.

Let stand for 30-60 min at ± 20°C to ± 25°C, mixing frequently during this period, then centrifuge for 10 min at 3000 rpm. The supernatant can be stored for upto one hour.

Use 0.5 ml of supernatant or an assay with serum iron kit.

Calculation of Total Iron Binding Capacity (TIBC):

\[
\text{TIBC (µmol/L)} = \text{A sample} \times 107.4
\]
\[
\text{TIBC (mg/dl)} = \text{A sample} \times 0.6
\]

Calculation of Unsaturated Iron Binding Capacity (UIBC): For the calculation of UIBC, subtract the serum iron concentration from the TIBC.

\[
\text{UIBC} = \text{TIBC} - \text{serum iron concentration.}
\]
Normal Values (TIBC):

Serum = 0.259-0.388 mg/dl (46.4-69.5 μmol/l) (250 – 416 μgm / ml)

Calculation of Transferrin Saturation Percentage: The degree of saturation of transferrin in the serum can be calculated by

\[
\text{Transferrin Saturation %} = \frac{\text{Serum Iron (μg/dl)}}{\text{Total Iron Binding Capacity (μg/dl)}} \times 100
\]

IV) Clinical Examination: The clinical signs and symptoms of nutritional deficiencies were recorded according to the schedule prescribed by Jelliffe (1966) and given in annexure (II). To identify the signs and symptoms of nutritional deficiencies, help of a Pediatrician from the local primary health centre was taken, who visited the Anganwadi centres of each village to conduct the clinical examination. Clinical examination was conducted twice i.e. at the beginning of the intervention (T1) as well as after one year of the interventions in EXPT group and the observations were designated as T4 and six months of interventions in ONG group, the observations being designated as T3.

Details of menarcheal status were obtained from the subjects by the researcher using recall method at the beginning of the study as well as retrospectively during the study. The median age of menarche was calculated through Probit analysis (Finney, 1971).
Harvard Step Test (Weiner and Lourie, 1969) was used to assess the physical work capacity of the subjects at the beginning of the intervention and after the intervention was over and designated as T1 and T4 respectively.

The subjects performed the test by stepping on and off a 17-inch high bench 30 times a minute for 5 minutes or till exhaustion. The Harvard Step Test was not performed after heavy meals. Subjects wore light costume. Stepping was done in tune to a metronome beating at half second interval, stepping up with one leg at first beat, up with other leg on second beat, down with first leg on third beat and down with other leg on fourth beat of the cycle. It was permissible to change step from time to time. Subject must stand erect at each step on the bench, if she crouches or fails to keep up with metronome, she must be encouraged to do better. If faulty posture is maintained for 15 seconds, exercise was stopped and duration of exercise was recorded.

Physical fitness index was derived from duration of exercise (upto 5 minutes) at a single post exercise recovery pulse count using the following formula:

\[
PFI = \frac{\text{Duration of exercise (in seconds) \times 100}}{5.5 \times \text{pulse count (1 to 1.5 minutes after exercise)}}
\]

Energy expenditure of the subjects was calculated from MSU NUTRI GUIDE Programme for Asian Indian foods' – a nutritional analysis computer programme developed by Department of Food Science and Human Nutrition, Michigan State University, USA (Song et al, 1992). By recording the number of hours spent in sleeping and various activities, basal metabolic rate as well as total energy expenditure was calculated.
A specifically designed composite questionnaire to test the knowledge, attitude and practices (KAP) vis-à-vis nutrition, health, hygiene and childcare (NHHCC) had been prepared, pre-tested on 8 adolescent girls, who were not part of the study, for its validity and reliability. This questionnaire was used for pre-testing as well as post-testing knowledge, attitudes and practices of adolescent girls before giving them the educational intervention on Nutrition, Health, Hygiene and Child Care Education i.e. at T1 and after giving them Nutrition, Health, Hygiene and Child Care Education through improved module of one year i.e. at T4. The educational package of ongoing NAGS was of six months duration and KAP of adolescent girls of ONG group vis-à-vis NHHCC was pre-tested before giving them the educational intervention i.e.T1 and post tested after six months of educational intervention i.e. T3.

The questionnaire given in Annexure (III) comprised of 100 questions prepared in Hindi on various aspects of nutrition, health, hygiene and childcare. It included questions on:

a) Basic Knowledge
b) Applied Knowledge
c) Maternal and Child Health
d) Adolescent Health
e) Growth Monitoring, Oral Rehydration, Breast Feeding and Immunization (GOBI)
f) Therapeutic Nutrition.

Before administrating the questionnaire to the subjects, the questions and options were thoroughly explained and clarified to remove any ambiguity and misinterpretation. Then, the subjects were asked to answer them in a classroom situation.
The questionnaire comprised of 50 knowledge based questions of multiple choice, fill in the blanks and pair matching; 25 attitude based questions using two point scale (Agree/Disagree) and 25 practices based questions of multiple choice.

### a) Knowledge based questions

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICDS / NAGS</td>
<td>2</td>
</tr>
<tr>
<td>Basic Knowledge</td>
<td>15</td>
</tr>
<tr>
<td>Therapeutic knowledge</td>
<td>4</td>
</tr>
<tr>
<td>Adolescent health</td>
<td>11</td>
</tr>
<tr>
<td>Maternal and child health</td>
<td>6</td>
</tr>
<tr>
<td>GOBI</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>51</strong></td>
</tr>
</tbody>
</table>

### b) Attitude based questions

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of girls</td>
<td>6</td>
</tr>
<tr>
<td>Adolescent health</td>
<td>6</td>
</tr>
<tr>
<td>Maternal and child health</td>
<td>8</td>
</tr>
<tr>
<td>Therapeutic nutrition</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

### c) Practices based questions

<table>
<thead>
<tr>
<th>Category</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent health</td>
<td>5</td>
</tr>
<tr>
<td>Maternal and child health</td>
<td>6</td>
</tr>
<tr>
<td>Cooking practices</td>
<td>6</td>
</tr>
<tr>
<td>Feeding practices</td>
<td>6</td>
</tr>
<tr>
<td>Therapeutic nutrition</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

**Total number of questions : 101**
The responses in the questionnaire were coded on coding sheets, which were evaluated on computer with the help of answer-key. For each correct response to knowledge and attitudes based question, one mark was given. The questions based on practices comprised of two parts i.e. practices followed by them and reason for the same. Half mark was assigned for each correct response and full mark was given if both the responses were correct. However, wrong responses were not negatively marked. The total score of knowledge, attitudes and practices as well as on various aspects of KAP were converted to percentage score for further analysis.

STATISTICAL ANALYSIS

Different data base were used simultaneously for data editing purposes and different variables from different data basis were joined together into a new database for analysis purpose.

Keeping in mind the objectives of the study the data was analyzed as follows:

- Computation of some descriptive statistical measures such as mean, standard deviation and range for all variables.

- Probit analysis was done for estimating median age of menarche.

- Student t-test was used for various parameters for comparing EXPT group for ONG group.

- Paired t-test to study the significance of difference at various stages of intervention.
• Chi-square test was applied to test the statistical significance of difference between distribution of girls into different grades for various parameters.

• Proportionality test was used to test the significance of difference between two proportions.

• Various correlation coefficients so as to find out the relationship between various variables.

• Multiple regression analysis was done to observe the relationship between nutritional status and KAP on one hand and many other variables on the other.