Chapter III

Methodology
3.

METHODOLOGY

The present study entitled, "Assessment of Nutritional Profile of School-Going Children (6-12 years) Among Rural Areas of Aligarh District," was conducted in the villages of Jawan Block, registered with Rural Health Training Centre of the Department of Community Medicine, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh. In 2011, the population of Aligarh District was 3,673,889 of which male and female were 1,951,996 and 1,721,893 respectively. The child sex ratio in census 2011, was 877 girls per 1000 boys compared to figure of 885 girls per 1000 boys in 2001 census data. 66.87% population of Aligarh district lives in rural areas. The total Aligarh district population living in rural areas is 2,456,698 of which males and females are 1,308,923 and 1,147,775 respectively. The child population comprises 16.43% of total rural population (Census, 2011).

3.1 Topography of the Study Area

- **District Aligarh:** It is situated 130 km south east of Delhi, in the middle portions of Doab or the land between Ganga and Yamuna rivers. The latitude is 27°5' north and 78°5' east. It shares its borders with the District Bulandshahar in the north and west, Haryana in West, District Badaun in the east and Districts Hathras and Mathura in the south.

- **Climatic Conditions:** Like other parts of Doab, Aligarh has a hot and dry climate. The maximum temperature reaches up to 47°C in summers and winters can be as cold as 3-5°C. Average rainfall is about 22 inches distributed over second half of July to first half of September.
Figure 3(a): Map of India Indicating the Aligarh District of Uttar Pradesh
• **Administrative Set Up:** The district consists of 5 tehsils (Khair, Atrauli, Kol, Gabhana and Iglas) and 12 development blocks. There are 853 Gram Sabhas, 1184 revenue villages, 9 town areas and 3 municipalities.

• **Rural Health Training Centre:** The Rural Health Training Centre (RHTC) is located at Jawan, which is a block headquarter village on the Anoopshahar Road (NH-93) at a distance of 17km away from the Jawaharlal Nehru Medical College. The language spoken in the area is common to that generally spoken in the western part of Uttar Pradesh, Haryana and Delhi regions i.e. Hindustani with rural accent.

Jawan Block is fortunate in having the facilities of medical and healthcare, for the rural community in the form of Community Health Centre and Rural Health Training Centre. Jawan Block is also being covered under the Integrated Child Development Services (ICDS).

### 3.2 Profile of the Study Area

The present cross-sectional study was undertaken in the rural field practice areas of Department of Community Medicine, Jawaharlal Nehru Medical College, A.M.U. Aligarh under Rural Health Training Centre (RHTC).
Methodology

Figure 3.1: Profile of Study Area
Figure 3(b): Map of Uttar Pradesh Indicating Aligarh Distri...
Ethical Consideration

The following approvals were obtained for conducting the study-

- Permission from the chairman, Department of Community Medicine, Jawaharlal Nehru Medical College, AMU, Aligarh.
- Permission from the Incharge, Rural Health Training Centre, Jawan Block, Aligarh.

Written permissions were sought to conduct the study in the field practice areas of Department of Community Medicine. Objectives as well as the procedure of study was explained to them. The survey was conducted only after getting the permission to do so.

Population of the Study Area

The total population of the registered villages under Rural Health Training Centre is 14082 which comprises about 2422 families. A brief description of the seven villages is given below-

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the Village</th>
<th>Total Population</th>
<th>Families Registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jawan</td>
<td>5601</td>
<td>926</td>
</tr>
<tr>
<td>2.</td>
<td>Jawan Sikanderpur</td>
<td>768</td>
<td>137</td>
</tr>
<tr>
<td>3.</td>
<td>Garhi Bhojpur</td>
<td>894</td>
<td>185</td>
</tr>
<tr>
<td>4.</td>
<td>Chhota Jawan</td>
<td>1518</td>
<td>266</td>
</tr>
<tr>
<td>5.</td>
<td>Sumera Jhal</td>
<td>244</td>
<td>47</td>
</tr>
<tr>
<td>6.</td>
<td>Tejpur</td>
<td>1507</td>
<td>267</td>
</tr>
<tr>
<td>7.</td>
<td>Sumera</td>
<td>3550</td>
<td>594</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>14082</td>
<td>2422</td>
</tr>
</tbody>
</table>
Period of the Study

The present study was carried out for a period of 6 months from April 2010 to September 2010.

Study Subjects

Children (male and female) between 6-12 years of age.

Pilot Study

All the seven villages were visited with the help of a medico-social worker and medical students. A base line data was collected from the area of study by self-prepared structured interview schedule by door to door visits. The proposed proforma was tried out in the field practice area of the department of community medicine, AMU, and necessary modifications were made. The purpose of this preliminary visit was to understand the layout of the village and observe the living conditions of the people in the village.

This pilot study helped the researcher with the standardized process for the interview schedule to be tested and adapted for use in the main study and gave an indication of how much time it will take to complete. The same interview schedule that will be used for the main study, was piloted and the researcher, herself filled the informations in the interview schedule. On the completion of the pilot study, some of the questions in the interview schedule were re-examined and few questions were re-framed to guarantee that the respondents gave the appropriate information.

3.3 Sample Size Estimation

For the number of children to be included in a research study, the sample size of the study is an important consideration in designing the
Methodology

The results of the pilot study had shown that there was 65% prevalence of undernutrition i.e. stunting and thinness (Low height for age and low BMI age) in the area of study. Following steps were taken by the researcher to calculate the sample size-

Step-1

Based on initial pilot study, there was 65% prevalence of stunting and thinness among school-going (6-12 years) children in the area of study.

Step-2

Sample size was obtained by using the following formula-

\[ n = \frac{4pq}{L^2} \]

Where 
- \( n \) = sample size
- \( p \) = prevalence
- \( q = 100 - p \)
- \( L \) = allowable error in prevalence

Step-3

Now putting the values in the above formula –

\( p = 65\% \)
\( q = 100 - 65 = 35 \)
\( L = \frac{8 \times 65}{100} = 5.2 \) (8% non response error was calculated)
\( L^2 = 5.2 \times 5.2 \)
\( L^2 = 27.04 \)
Step-4

To compensate sample attrition, 4% of sample was added –

\[ n = 336 + (4\% \text{ of } 336) \]
\[ n = 336 + 13 \]
\[ n = 349 \text{ (Rounded off to 350)} \]

Final Sample Size \( n = 350 \)

Proportion of Population Size

Out of total 7 villages, registered under Rural Health Training Centre, only 4 villages (Jawan, Chhota Jawan, Tejpur and Sumera) were selected for the purpose of study. Those four villages had been coded as a, b, c, and d. Proportion of population size was calculated by using the following formula –

\[ PPS = \frac{\text{Population of the particular village}}{\text{Sum of the total population}} \times \text{Sample size} \]

Table 3.2: Population of Selected Villages

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Selected Villages</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Jawan (a)</td>
<td>5601</td>
</tr>
<tr>
<td>2.</td>
<td>Chhota Jawan (b)</td>
<td>1518</td>
</tr>
<tr>
<td>3.</td>
<td>Tejpur (c)</td>
<td>1507</td>
</tr>
<tr>
<td>4.</td>
<td>Sumera (d)</td>
<td>3550</td>
</tr>
<tr>
<td></td>
<td>Sum of total population</td>
<td>12176</td>
</tr>
</tbody>
</table>
Population taken from Jawan (a) = \( \frac{5601}{12176} \times 350 = 161 \)

Population taken from Chhota Jawan (b) = \( \frac{1518}{12176} \times 350 = 43.64 \)

Population taken from Tejpur (c) = \( \frac{1507}{12176} \times 350 = 43 \)

Population taken from Sumera (d) = \( \frac{3550}{12176} \times 350 = 102 \)

Total = a + b + c + d = 161 + 44 + 43 + 102 = 350 (Total Sample)
Figure 3(c): Administrative Blocks of Aligarh District Indicating Jawan Block (Study Area)
3.4 Sampling Frame

The sample frame is defined as the frame of entities from which sampling units are selected for a survey (Singh, 2010). In the present study, households and respondents were selected in the following manner.

Selection of Household

Spin the bottle method was used by the researcher to select the households to collect the sample of 350 respondents. The method has been used when there is no map or list of households in the village (Survey Training Curriculum, 2004). Following steps were taken to select households—

p-1 With the help of a local leader, the researcher reached the center of the particular village (not necessarily the geographic center)

p-2 Now, used flat surface to spin the bottle. The direction it pointed was the direction used by the researcher to select the first household.

p-3 After selecting the first household with the help of spin the bottle method, the researcher went to that household, determine whether an appropriate sampling unit (respondents – mother/child) were in the household and if so then interview was conducted.

Step-4 When first household was selected, the next household was the household whose front door was closest to the front door of the house which was previously selected.

Step-5 When the researcher reached the boundary of the village then turned to the right or left and continue within the boundary until the required sample from each village was collected.
Step-6  The household not having the children of 6-12 years, was skipped.

Selection of Respondents

In the present study, mothers as well as their children were interviewed to get the information related to child and his socio-demographic profile. If any household having more than one child of the age group 6-12 years, then only the eldest one was selected.

- **Inclusion Criteria:**
  (a) Children who had completed 6 years of age on the date of interview and were not more than 12 years of age.
  (b) Male as well as female (both) were included in the study.
  (c) Children who were attending as well as not attending the school (both) were included in the study.

- **Exclusion Criteria:**
  (a) Children less than 6 years of age and more than 12 years of age.
  (b) Children having physical deformities of the limbs and spine.
  (c) Children who were suffering from diseases and having mental defects were excluded from the study.
  (d) Children not cooperating for anthropometric measurements.
Research Design

3.5 Variables in the Study

A variable is a characteristic that may take on different values. The variable that is systematically manipulated by the investigator is called the independent variable. The variable that is measured is called the dependent variable (Minium et al, 1993).

For the purpose of present study, the researcher had selected the following dependent and independent variables:
Table 3.3: Independent and Dependent Variable

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Socio-Demographic Factors –</td>
<td>➢ Nutritional Status of the Child</td>
</tr>
<tr>
<td>• Age of the Child</td>
<td>• Height for age z-score (HAZ)</td>
</tr>
<tr>
<td>• Gender of the Child</td>
<td>• BMI for age z-score (BAZ)</td>
</tr>
<tr>
<td>• Parent’s Literacy Level</td>
<td>➢ Dietary Pattern</td>
</tr>
<tr>
<td>• Parent’s Occupation</td>
<td>• Adequate Intake of Nutrients</td>
</tr>
<tr>
<td>• Type of Family</td>
<td>• Inadequate Intake of Nutrients</td>
</tr>
<tr>
<td>• Social Class</td>
<td>• Clinical Signs of Nutritional Deficiencies</td>
</tr>
<tr>
<td>• Number of Siblings</td>
<td></td>
</tr>
</tbody>
</table>

3.6 Tools for Data Collection

A self-prepared structured interview schedule was used by the researcher as a tool for data collection.

Interview Schedule

For the purpose of present study, the pretested structured interview schedule was grouped into following categories –

➢ Socio-demographic Profile of the Child (Respondent – Mother)
➢ Nutritional Assessment of the Child
  • Anthropometric Measurements
  • 24-hr Dietary Recall Method
  • Clinical Examination of the Child
➢ Socio-demographic Profile of the Child

This part of the interview schedule consisted information about the personal and family profile of the child like his age, gender, parents’ education, fathers’ occupation, working status of mothers, type of family, no. of siblings and social class.
Operational Definitions

(a) Date of Birth of the Child (Age Estimation):

According to the Oxford English Dictionary (2006), age may be defined as the length of time that a person has existed, a particular stage in someone's life. For the purpose of present study, children of age group between 6-12 years (school-age) were selected. Knowledge of exact date of birth of the child for proper interpretation of anthropometric data is crucial but not always easy to obtain especially in rural areas. For this purpose, an indigenous calendar was prepared consisting of festivals and local events for the estimation of age of the child. For the statistical purpose, children were grouped in the following categories:

(a) 6-7 years  (d) 9-10 years
(b) 7-8 years  (c) 10-11 years
(c) 8-9 years  (f) 11-12 years

(b) Gender of the Child:

The words gender and sex both have the sense 'the state of being male or female,' they are typically used in different ways: sex tends to refer to biological differences, while gender tends to refer to cultural or social ones (Soanes and Stevenson, 2006). For the purpose of present study, children of age group between 6-12 years were grouped as male and female.

(c) Parents' Education:

Education measures the inculcation of values, knowledge and achievements of the individual. The world map of illiteracy closely coincides with the maps of poverty, malnutrition, ill health, high infant and child mortality rates (Park, 2011). For the purpose of present study,
both the parents (father and mother) were grouped into following categories -

(i) illiterate
(ii) just literate
(iii) primary school certificate
(iv) high school
(v) intermediate
(vi) graduation or postgraduation

For the statistical analysis, parents were classified as illiterate, just literate and primary education. Illiterate were those who can not read or write. The parents who can read and write were under the category of just literate and parents who were passed upto 8th standard, were categorized as primary educated. Other categories of education like high school, intermediate and graduation/postgraduation were not found among the parents.

(d) Fathers’ Occupation:

Fathers’ Occupation refers to the job or profession of the father i.e. the means of earning money (State of being employed in productive work). Occupation of father determines the socio-economic status of the household. For the purpose of present study fathers were classified into two categories – as skilled worker and unskilled workers -

(i) Skilled Workers: refers to any worker who has some special skill, knowledge (usually acquired) or ability in their work.

(ii) Unskilled Workers: refers to any person who does unskilled manual work, as opposed to skilled labor.
Working Status of Mothers:

Working status of mothers refers as working mothers and non-working mothers –

(i) **Working mothers**: were those who were involved in self employed work at home or outside the home for raising the family income.

(ii) **Non working mothers**: were those who stayed at home and were not involved in any type of income raising activity.
(f) Family Type:

The family is a primary unit in all societies. It is a group of biologically related individuals living together and eating from a common kitchen (Park, 2011). For the purpose of present study, families of children were grouped into two categories —

(i) **Nuclear Family:** refers as the family which consisted of the married couple and their children.

(ii) **Joint or Extended Family:** refers as the family which consisted of a number of married couples and their children who live together in the same household.
(g) **Number of Siblings:**

Siblings refers as the brother or sister of the child. For the purpose of present study, no. of siblings were grouped into following categories –

(i) one (ii) two (iii) three (iv) four (v) five or more.

For the statistical analysis, children were classified on the basis of number of siblings as - more than 3 and less than 3.

(h) **Socio-Economic Status:**

The socio-economic status of the child’s family was determined using the modified BG Prasad’s Classification (2004). There have been several attempts to develop different scales to measure socio-economic status but Prasad’s classification based on the per-capita monthly income has been extensively used in the Indian scenario.

**Table 3.4: Proposed Social Classification for the Month of December 2004**

<table>
<thead>
<tr>
<th>Social Class</th>
<th>Per Capita Monthly Income Limits (Rs.)</th>
<th>Prasad’s Classification (1961)</th>
<th>Modified Proposed Classification for the Month of December 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Upper High</td>
<td>100 and above</td>
<td>10.000 and above</td>
<td>10,000 and above</td>
</tr>
<tr>
<td>II High</td>
<td>50-99</td>
<td>5000-9999</td>
<td></td>
</tr>
<tr>
<td>III Upper Middle</td>
<td>30-49</td>
<td>3000-4999</td>
<td></td>
</tr>
<tr>
<td>IV Lower Middle</td>
<td>15-29</td>
<td>1500-2999</td>
<td></td>
</tr>
<tr>
<td>V Poor</td>
<td>Below 15</td>
<td>500-1499</td>
<td>Below 500</td>
</tr>
<tr>
<td>VI Very Poor or Below</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poverty Line (BPL)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methodology

Multiplication Factor

\[ \text{MF} = \text{Value of All India Whole Price Index (AIWPI)} \times 0.53 \]

There \( \text{MF} = 189.2 \times 0.53 = 100.276 \) (Rounded it off) =100

So multiplication factor for December 2004 was 100. The value of All India Whole Price Index (AIWPI) was 189.2 for December 2004. (Hindu Business Line 2005; 15th Jan). The hypothetical value i.e. 0.53, was developed by Economic Advisor, Department of Industrial Policy and Promotion, Govt. of India, 2001.

**Nutritional Status Assessment of the Children**

The assessment of the nutritional status involves various techniques. The nutritional status of an individual is often the result of many interrelated factors. It is influenced by the adequacy of food intake in terms of quantity and quality, its utilization in the body and also by the physical health of the individual. Nutritional status can be determined with the help of clinical examination of symptoms of nutritional deficiencies, dietary intake and anthropometry. When these methods are used in combination like anthropometry and clinical examination, provide better picture of assessment of nutritional status of children (Park K, 2007). For the purpose of present study, the nutritional assessment of school-age (6-12 yrs) children was done through following methods —

1. Anthropometric Measurements
2. 24 hr Dietary Recall Method
3. Clinical Examination of the Child

1. **Anthropometric Measurements:**

   Assessment of nutritional status by anthropometry is the simplest and most useful tool for assessing the nutritional status of children (Ghai, 2005). It is widely recognized as one of the useful technique in the
Methodology

assessment of nutritional status because it is highly sensitive to detect undernutrition (workshop on epidemiological tools in assessment of nutritional status, NIN, 2005).

For the purpose of present study, body weight and height of the school age (6-12 years) children were measured for the assessment of their nutritional status.

**Measurement of Body Weight:** Body weight is the most widely used and the simplest reproductive anthropometric measurement. Weight of the subjects was measured in the upright position to the nearest 0.1kg using calibrated salter weighing balance with standard minimum clothing possible and without shoes.

**Measurement of Height:** Height was measured to the nearest 0.1cm using calibrated stadiometer. The individual was made to stand on a horizontal plat form with heels together, stretching upwards to the fullest extend with arms hanging by sides and heels and buttocks touching against the rod. The head shall be aligned so that the lower rim of orbit and the auditory canal were in a horizontal plane. The right angle device of rod was held against the top of head and the reading was obtained.

**Anthropometric Indices:** As suggested by Gibson (2005), measurements by themselves are incomplete unless they are associated with other measurements. Thus, anthropometric indices are derived from combination of raw measurements. Examples of anthropometric indices are weight for age, height for age, weight for height and BMI for age etc. For the purpose of present study, height for age z-score (HAZ) and BMI for age z-score (BAZ) of the subjects (school-age children) were calculated. Because weight for age is inadequate for monitoring growth beyond childhood due to its inability to distinguish between relative height and body mass in an age period where many children are
experiencing the pubertal growth spurt and may appear as having excess weight (by weight for age) when in fact they are just tall. So, BMI for age complements with height for age in the assessment of thinness, overweight and obesity and stunting among school-aged children is recommended by the WHO (Onis et al 2007).

*z-score (SD)* is widely recognized as the best system for analysis and presentation of anthropometric data. The z-score system expresses the anthropometric value as a number of standard deviations (SD) (WHO, Tech. Rep. Series 854).

Following are the reasons to select z-score (SD) system for calculating the anthropometric indices (height for age and BMI for age) –

- The SD system can provide useful summary statistics.
- SD cut-offs point intervals of similar magnitude always imply a fixed difference for height, weight or any other anthropometric measurements.
- All anthropometric indices show similarity in respect of percentage of children who remain below or above a particular SD cut-off point of an age among the reference/standard population.

(WHO Global Database on Child Growth and Malnutrition, 1997)

So the researcher adopted z-score system for calculating the height for age and BMI for age by using the World Health Organisations' (WHO) Anthro Plus version 1.0.2 statistical software.
Table 3.5: Z-Score Classification System Recommended by WHO (2007)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Classification</th>
<th>Z-scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height for Age</td>
<td>Normal</td>
<td>-2SD to +2SD</td>
</tr>
<tr>
<td></td>
<td>Stunted</td>
<td>&lt;-2SD</td>
</tr>
<tr>
<td></td>
<td>Severely Stunted</td>
<td>&lt;-3SD</td>
</tr>
<tr>
<td>BMI for Age</td>
<td>Normal</td>
<td>-2SD to +1SD</td>
</tr>
<tr>
<td></td>
<td>Thin</td>
<td>&lt;-2SD</td>
</tr>
<tr>
<td></td>
<td>Severely Thin</td>
<td>&lt;-3SD</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>&gt;+1SD</td>
</tr>
<tr>
<td></td>
<td>Obesity</td>
<td>&gt;+2SD</td>
</tr>
</tbody>
</table>

**Height for Age:** Low height for age i.e. stunting is an indicator of past growth failure that have resulted from previous long term or repeated short term nutrient deficiencies and/or illness, and/or might be related to low birth weight and poor economic conditions (Gorstein et al, 1994).

For the purpose of present study, school-aged children (6-12 years) with z-score values of <-2SD for height for age were classified as stunted and those who were <-3SD were termed as severely stunted. Children with z-score between -2SD to +2SD were considered as normal. This was done as per the WHO criteria and classification standard.

**BMI for Age:** Low BMI for age i.e. thinness indicates recent weight loss or failure to gain weight because of inadequate food intake and/or illness, and is linked to child mortality and requires immediate intervention (Cogill, 2003).

For the purpose of present study, school aged children (6-12 years) with z-score values of <-2SD for BMI for age were classified as thin and...
those who were <-3SD were termed as severely thin. On the other hand, children with z-score values of >+1SD and >+2SD for BMI for age is the criteria for overweight and obesity respectively. But in the present study, no children were found under the category of overweight and obesity. Children with z-score between −2SD to +1SD were considered as normal. This was done as per the WHO criteria and classification system.

**WHO Anthroplus Version 1.0.2 Statistical Software:**

WHO Anthroplus software consists of three modules -

- Anthropometric Calculator (AC)
- Individual Assessment (IA)
- Nutritional Survey (NS)

For the purpose of present study, the researcher used the anthropometric calculator to calculate the HAZ and BAZ.

**Anthropometric Calculator Module:** The Anthropometric Calculator module enabled the researcher to derive nutritional status information for individual child, based on the WHO growth reference 2007. The software calculated z-scores (SD) for the indicators – height for age and BMI for age. Based on the z-score (SD) values, children were graded as normal (-2SD to +2SD), stunted (z< −2SD) and severely stunted (z< −3SD) for height for age and similarly, normal (-2SD to +1SD), thin (z<-2SD) and severely thin (z< −3SD) for BMI for age. The calculated values were recorded for each child and noted down in each interview schedule.

This software derived the child’s age based on his/her date of birth and date of visit. When the exact birth day of the child was unknown, then the researcher tick the box next to “Approximate date,” the software then automatically inserted a randomized day within the given month.

**24 hr Dietary Recall Method**
A number of diet and nutrition surveys have revealed that majority of school children consume inadequate food stuffs. The immediate, physiologic cause of malnutrition is a food intake that is inadequate in quantity or quality to meet the requirements for normal growth and development (Philips et al 1984), while much of the global childhood stunting and wasting are the result of deficiencies in energy and protein intake (WHO technical report series 854), mainly assessed by dietary intake in individual or household level (Patterson et al, 2005). Twenty four hours dietary recall method was used to assess dietary intake (Mitra et al, 2007). This method is generally used by dietitian to obtain a general picture of person’s food intake. It was used to elicit an accurate picture of the diet history (Mehrotra et al, 2011). For the purpose of present study, the total cooked food volume of each of the preparations was recorded in terms of standard cups. The quantity of each preparation consumed by each individual child was assessed in terms of cups and also recorded the quantity of left-over food (workshop on epidemiological tools in assessment of nutritional status, NIN, 2005). At the end of the interview, the researcher summarized the items that were consumed by the child and got it checked by the mothers so that nothing had been omitted. This method of dietary assessment was adopted by the researcher on the basis of review of literature, particularly on national studies (Sati et al, 2012, Mehrotra et al, 2011, Mitra et al, 2007). The energy and protein content of diet was calculated for individual child using food composition table (Gopalan et al, 2004). After calculating the energy and protein consumption of each child, it was compared with recommended dietary allowances (RDA) by ICMR (2010) according to age and gender.
Children were categorized into two grades i.e. adequate and inadequate according to the dietary consumption pattern of energy and protein.

**Adequate Pattern:** Children whose dietary pattern of energy and protein consumption was as per the recommended dietary allowances given by ICMR, were categorized as adequate.

**Inadequate Pattern:** Children whose dietary pattern was less than the recommended allowances, were grouped as inadequate.

The nutritional status (HAZ and BAZ) of each subject was compared with the dietary consumption pattern of energy and protein. The association of dietary consumption pattern (adequate / inadequate) of energy and protein with age, gender, social class, mother’s education, mothers’ working status and family type of the children was also established.

**Clinical Examination of Children**

Clinical examination is an essential feature of all nutritional surveys since their ultimate objective is to assess levels of health of individuals or of population groups in relation to the food they consume (Park, 2005). For the purpose of present study, clinical examination manual was used to assess the nutritional deficiency disorders among school-age children. Since it is relatively simple method and do not call for sophisticated equipment and it reveals the anatomical changes due to malnutrition that can be diagnosed by the naked eyes (Mehrotra et al, 2011). The researcher developed the schedule to detect the signs of deficiency disorder with the help of ICNNDs (1985) Manual for Nutrition Surveys, to identify the prevalence of clinical signs of nutritional deficiency disorders among school age children. Clinical examination
was done under the supervision of medical personnel. The gender-wise association of micro-nutrient deficiency disorders was established.

**Assessment of Night Blindness**

WHO criteria was used by the researcher for the assessment of night blindness among school-age children. It was based on the most recent guidelines from 1996 in a publication titled “Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes.” On pages 24 and 25 of that document, there was guidance about the assessment of night blindness of particular note, in which, it was mentioned that “a reliable assessment of night blindness by interview requires that there should be a specific local word descriptive of the symptoms characteristics of this condition and that it must be specific to vitamin A deficiency.

Four questions were suggested for the classification of night blindness —

1. Does your child have any problem seeing in the day time?
2. Does your child have any problem seeing at night time?
3. If 2 is yes, is this problem different from other children in your community? (Note that this question is particularly appropriate where vitamin A deficiency is not very prevalent).
4. Does your child have night blindness? (Use local term that describes the symptoms)

The researcher used the local term “RATAUNDHI” to describe night blindness among rural women of the area of study. As researcher did not find any specific recommendations on the interpretation about night blindness for above mentioned questions, so in general, the interpretation was done in the following manner —
If the answer to question no. 1 was no, but the answer to the remaining three questions was “yes”, then the child was classified as having night blindness.

This interpretation was based on the suggestion given by Lisa M. Rogers who is a “Technical Officer, Evidence and Programme Guidance, Department of Nutrition for Health and Development, World Health Organization, Geneva.”

**Assessment of Goitre**

Goitre implies non-neoplastic, non-inflammatory and non-toxic enlargement of the thyroid gland. In the present study, goiter was screened by palpation method and was graded as per definition provided by WHO/UNICEF/ICCIDD (2001). The grading was described as-

Grade 0 - no palpable or visible goiter

Grade 1 - goiter that is palpable but not visible when the neck is in the normal position.

Grade 2 - visible when the neck is in the normal position.

**Technique Used for the Examination of Goitre:**

The subject stands in front of the examiner and the examiner looks carefully for any signs of thyroid enlargement. The subject was then asked to fully extend the neck, this pushes the gland forwards and if any enlargement was present, then it becomes obvious. Then, the examiner palpates the gland by gently sliding his thumb along the side of trachea. The size and consistency of thyroid were also looked for. If necessary the subject was asked to swallow when being examined, the thyroid moves up on swallowing (WHO/UNICEF/ICCIDD, 2001). Goitre was not present in any of the child during the course of study.
Validity and Reliability of Interview Schedule

Validity and reliability are essential to the effectiveness of any data-gathering procedure. Validity and reliability measure the extent to which there may be an error in measurements (Leedy and Ormrod, 2005). Before starting the collection of data for the main study, the interview schedule was pretested for validity and reliability during the pilot study. The interview schedule was framed according to the suggestions and comments from the experts of Department of Community Medicine and Rural Health Training Centre, Aligarh Muslim University, Aligarh.

Test for the Reliability: Reliability is ensured when findings generated are the same when the study is repeated under the same conditions (Bailey 1997, Leedy and Ormrod 2005). To test the reliability of the interview schedule, 10% of the same respondents (those who were interviewed before) were contacted again and the interview schedule was re-administered. When the answer to the questions differed from the answer which was given earlier then the question was considered unreliable and it was erased from the interview schedule. The researcher was the only person that coded the interview schedule, this also ensured the reliability.

Test for the Validity: The interview schedule was based on the published information related to the factors affecting the nutritional status of children, anthropometry, 24 hr dietary recall method and clinical examination for micronutrient deficiency disorders among school-going children, as discussed in the literature review. All the questions in the interview schedule were designed according to the objectives framed for conducting the study.

Statistical Analysis
Initially for the purpose of analysis, all the data obtained was converted into coded form and transferred it to computer software (Microsoft Excel). Statistical analysis of the data was performed using the statistical package for social sciences for windows SPSS (Version 16.0).

Anthropometric indices i.e. height for age (stunting and severe stunting) and BMI for age (thinness and severe thinness) were calculated using the new World Health Organisation Child Growth Standards, WHO, 2007 Anthro Plus Software. This software is for the global application of the WHO reference for 5-19 years to monitor the growth of school-age children and adolescents. To test the significance of association between independent and dependent variables, chi-square ($\chi^2$) test was used. The calculation was made using the following formula

$$ \chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} $$

Where

- $O$ = Observed frequency
- $E$ = Expected frequency
- $\Sigma$ = Sum of observations