

# METHODOLOGY

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The methodology followed in the present study is presented under the following headings

## **3.1 Selection of locale and identification of study families**

3.1.1 Selection of locale of study

3.1.2 Census of the selected anganwadis of South Delhi

3.1.3 Permission to conduct the study

3.1.4 Study design

3.1.5 Sample size

3.1.6 Approval of the Institutional ethics committee

3.1.7 Proforma for data collection

3.1.8 Quality assurance of measures used for anthropometric parameters Weight & Height

## **3.2 Assessment of dietary diversity and household food security in a subsample of the families with under five children**

## **3.3 Assessment of physical activity of school-age children and adults in the subsample of families with under five children**

## **3.4 Assessment of nutritional status of under-five children and their family members**

3.4.1 Determination of age of all age groups between 0-18 years

3.4.2 Body weight of children and adults

3.4.3 Length/Height of children and adults

## **3.5 Data entry, cleaning and analysis**

### 3.1 SELECTION OF LOCALE AND IDENTIFICATION OF STUDY FAMILIES

#### 3.1.1 Selection of locale of study

The areas selected for the study were the anganwadis of Neb Sarai, Lado Sarai and Andheria Mod located in South Delhi. The map shows locale of anganwadis where study was conducted (Figure 3.1).

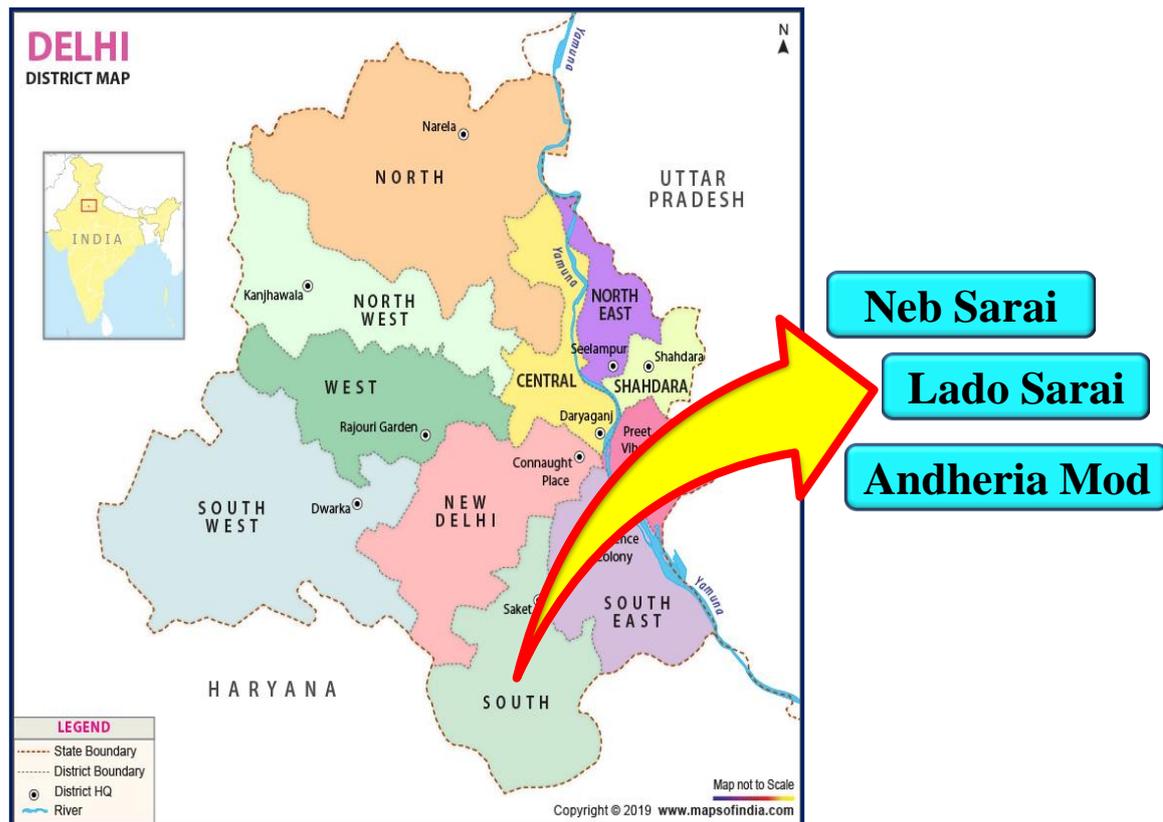


Figure 3.1-Map of Delhi showing locale of study

#### Criteria for selection of locale

The criteria for selection of locale was-

- Nutrition Foundation of India (NFI) has been working in this locale for the past several years and has a good rapport with the people in the area.
- NFI has already obtained permission to undertake studies on health and nutrition status of the population residing in these areas(Plate 3.1),



**Plate 3.1-Survey site**

### **3.1.2 Census of the selected anganwadis of South Delhi**

In 30 anganwadis of 3 areas in South Delhi, namely Neb Sarai, Lado Sarai and Andheria Mod, a door-to-door census was conducted. All the houses in each Anganwadi were numbered during the census. The census began with the Anganwadi Center and ended with the house adjacent to the Anganwadi Center. Numbering was done using small stickers. On the sticker, 'Anganwadi number' was written on the first line and 'House number' was written on the second line with three digits. House number 001(three-digit number) was given to the Anganwadi, and then the numbering was continued on the house to the left side of the anganwadi. (Plate 3.2). Consecutive numbers were given to all households residing in the houses.



**Plate 3.2- Sticker showing house number**

#### **a. Mapping of anganwadi**

Maps of all 30 anganwadi were prepared to enable easy identification of households during follow-up visits. (Plate 3.3).

# Methodology

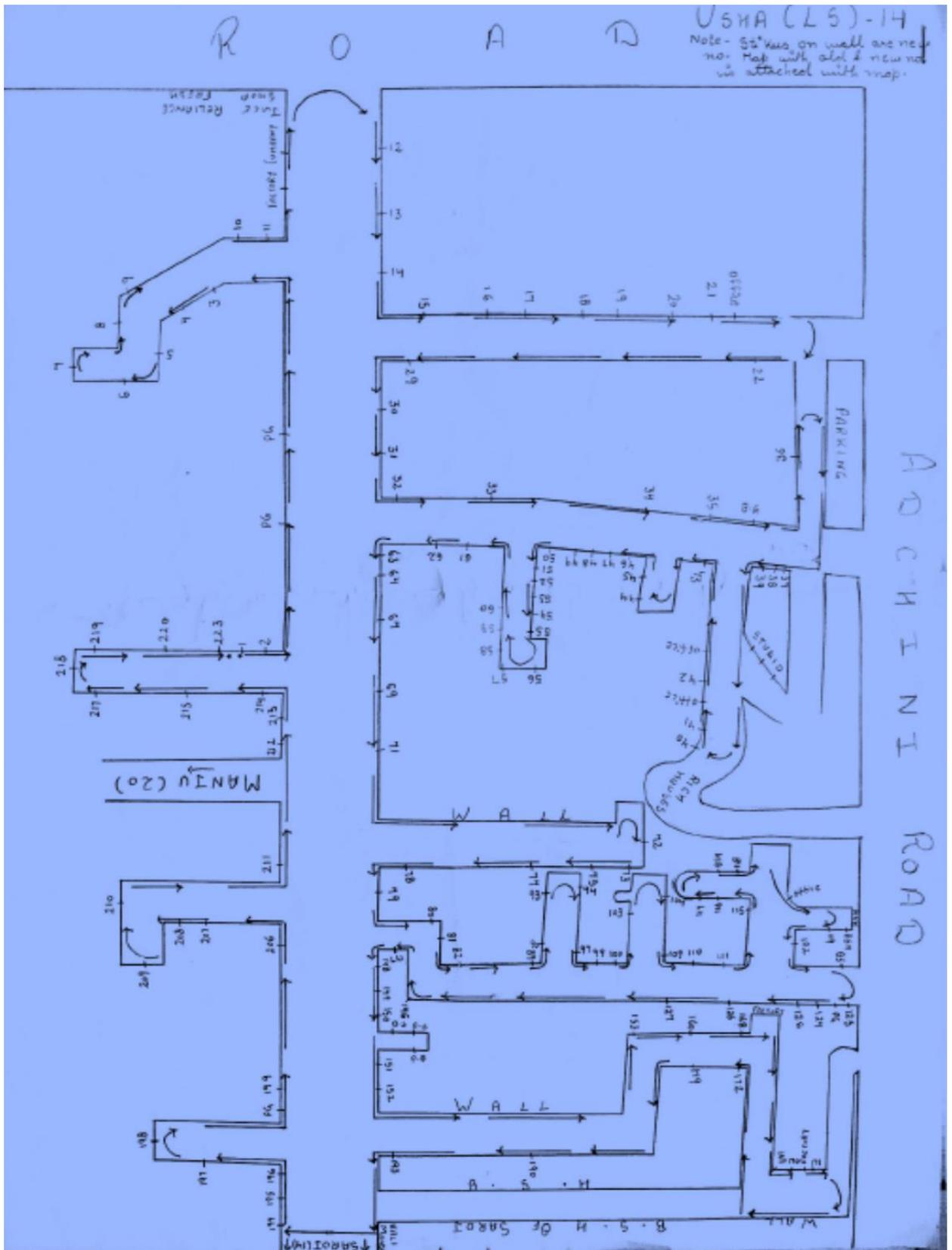


Plate 3.3- Map of anganwadi showing census and numbering of houses

### Household Unique Identity Number (HHUID)

Individual households were given a unique identity number to allow each household to be easily identified. The HHUID consists of the sum of "six digits." The digits show the area, the code of anganwadi, and household number.

**Area:** In three areas of South Delhi, i.e., Nebsarai, Ladosarai and Andheria Mod, the data was collected. Neb Sarai-1, Lado Sarai-2 and Andheria Mod-4 were the codes used.

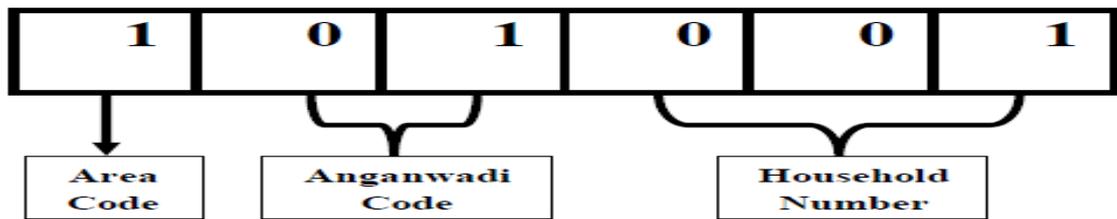
**Anganwadi code:** There are 30 anganwadi areas in these three areas. Neb Sarai has 12 anganwadis, Lado Sarai has 6, and Andheria Mod has 12 anganwadis code are given in Table 3.1.

<b>Area</b>	<b>List of Anganwadis (in Code)</b>
<b>Neb Sarai</b>	1,2,3,4,5,6,7,8,9,10,11&12
<b>Lado Sarai</b>	14,16,17,18,20&21
<b>Andheria Mod</b>	22,23,24,25,26,27,28,29,30,31,32&138

**Household number:** “A household is usually a group of persons who normally live together and take their meals from a common kitchen unless the exigencies of work prevent any of them from doing so. Persons in a household may be related or unrelated or a mix of both. However, if a group of unrelated persons live in a census house but do not take their meals from the common kitchen, then they are not constituents of a common household. Each such person should be treated as a separate household. The important link in finding out whether it is a household or not, is a common kitchen. There may be one member households, two member households or multi-member households.”(Census of India 2001). In this study, household number was taken as for house number 1 household number was “001”. If in the same house the family was cooking separately then the enrolled family of the same house different household number was given.

## Methodology

The HHUID was formulated as:-Area code (1 digit) plus Anganwadi number (2 digits) plus Household number (3 digits). For example:



1 (First digit) - Area code (The child belongs to area Neb Sarai)

01(Second and third digit) - Anganwadi number (two digit number, if the anganwadi number is of one digit “0” is added before the anganwadi number)

001(Fourth, fifth and sixth digit) - Household number (three digit number, if house number is of one digit “00” is added before the anganwadi number)

### b. Inclusion and exclusion criteria

#### Inclusion Criteria

- Low income group households
- Household with under five children
- Willingness of the family to participate in the study

#### Exclusion Criteria

- High income group households
- Households which did not have under five children
- Household who were not willing to participate in the study

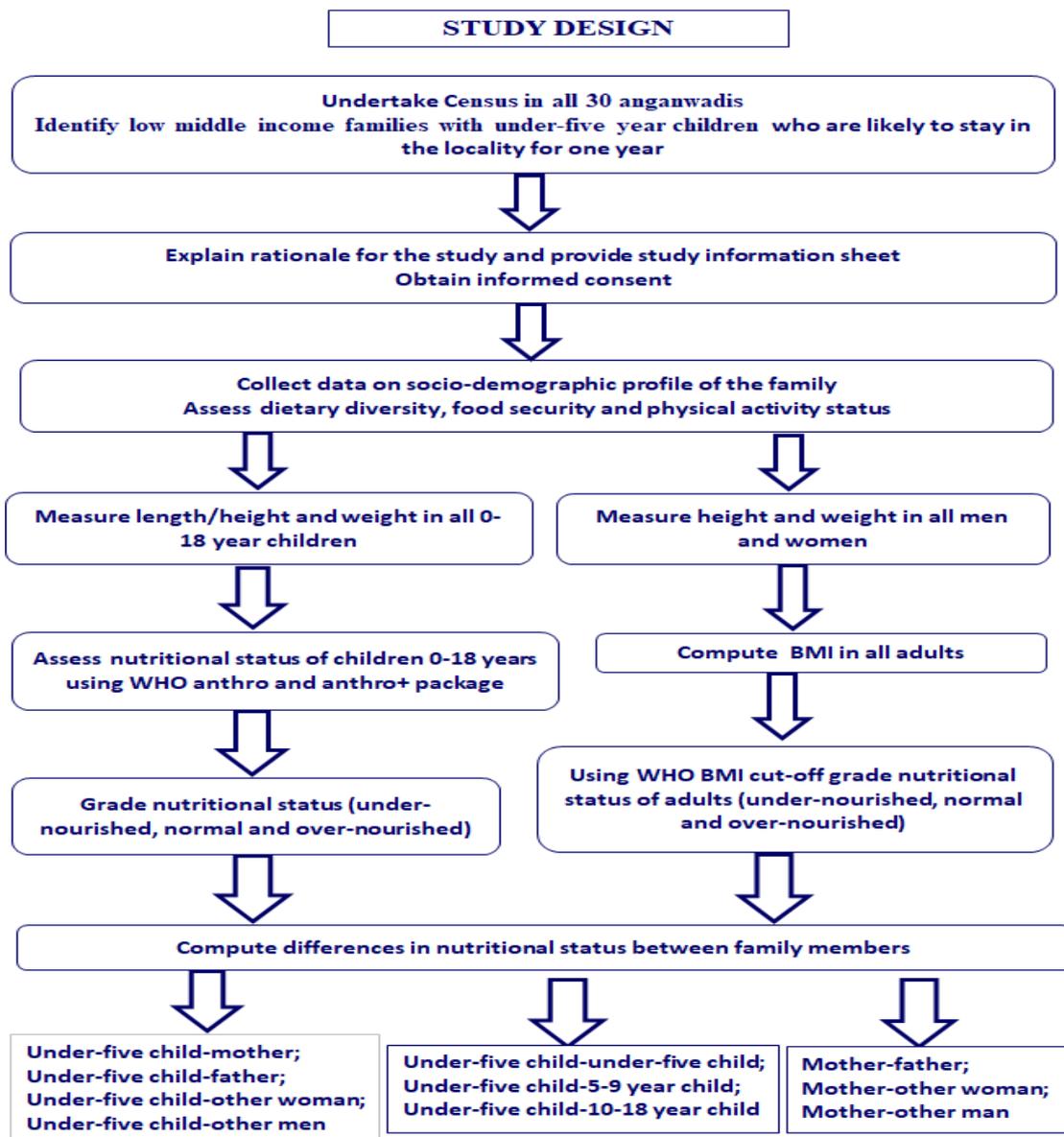
### 3.1.3 Permission to conduct the study

Permission to conduct the study was obtained from the Department of Social Welfare and Women and Child Development (DWCD) NCT, Delhi

### 3.1.4 Study design

The study was designed as cross-sectional observational study. The census was done and families with under-five children who were likely to stay in the area for at least one year were identified. The details about the study were explained to these families and the Hindi version of study information sheet was provided to them. A week later

these families were contacted. In those families who were willing to participate the study consent was obtained from head of the household or the mother of the under-five child. An effort was made to enrol all available members of the family so that intra-family differences in nutritional status between under five child and other available family members as well as intra family differences in nutritional status between all available members of the family could be assessed. Details of the study was explained and informed consent was obtained from the adult members of the family who were willing to participate in the study. Details of the study was explained to the children of the 7-18 year age group and their assent to participate in the study was also obtained. The study design is given in Figure 3.2.



**Figure 3.2- Study Design Flow Chart**

Socioeconomic profile of the enrolled families were collected. In all enrolled families, anthropometric measurements were carried out in under-five children, their mothers and other family members who were available at time of visit. All members of the family were weighed using a digital balance (with accuracy of 100 gm. In infants and children who could not stand erect length was measured using an infantometer. Wall mounted staturemeter was used to measure height in children who stand erect and all adults. From the weight and height/length, BMI (body mass index) was computed.

In sub-sample of selected households, information on dietary diversity was assessed by using food frequency questionnaire, Information on household food security was obtained by two methods: based on the information on food stuffs purchased and consumed by the family and food cooked for the family on the previous day. Based on the data energy intake /consumption unit /day was computed in sub-sample of selected households, information on physical activity in school age children and adults was obtained using 24 hours physical activity recall In. Information on physical activity of under five children was not collected because of the difficulties in assessing physical activity in these children.

Nutritional status of the under-five children was assessed using WHO MGRS standards for weight-for-age (underweight, normal or overweight), length/height-for-age (stunted, normal or tall), and BMI-for-age (wasted normal or overweight). Nutritional status of school age children (5-18 years) was assessed using WHO child growth standards. Nutritional status of adults was assessed using WHO cut-off points for BMI. Adult women and men who had  $BMI < 18.5 \text{ kg/m}^2$ , were classified as undernourished those with  $BMI 18.5 \text{ to } 24.9 \text{ kg/m}^2$  were classified as normally nourished and those with  $BMI \geq 25 \text{ kg/m}^2$  were classified as over-nourished.

### **Computation of the intra-family differences in nutritional status**

Intra-family differences between under five children and their siblings and parents were computed in nuclear families (Figure 3.3). In joint families intrafamily differences between under five children and their siblings and parents and other family members were assessed (Figure 3.4)

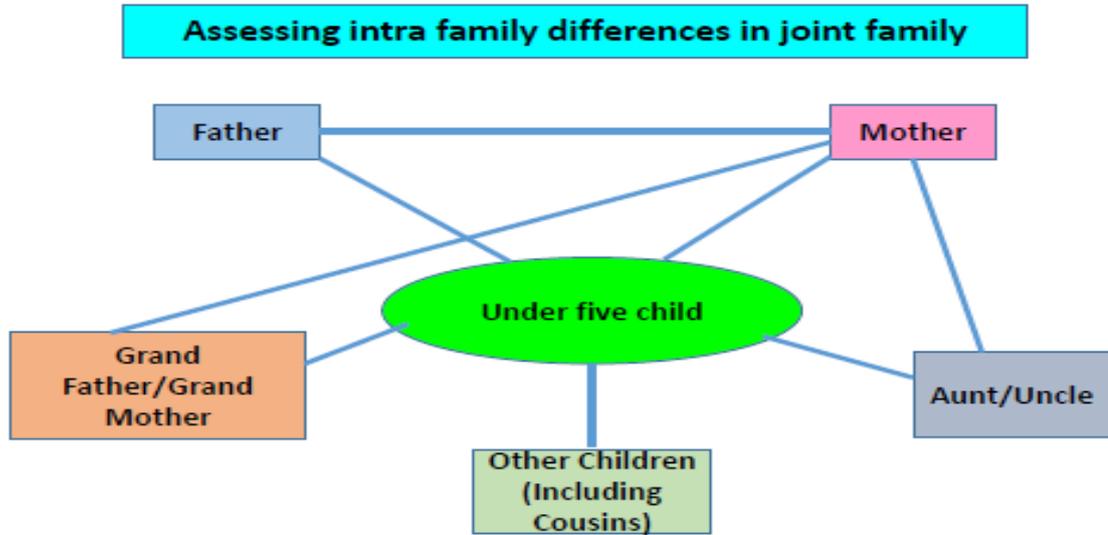


Figure 3.3 Assessing Intra family difference in joint family

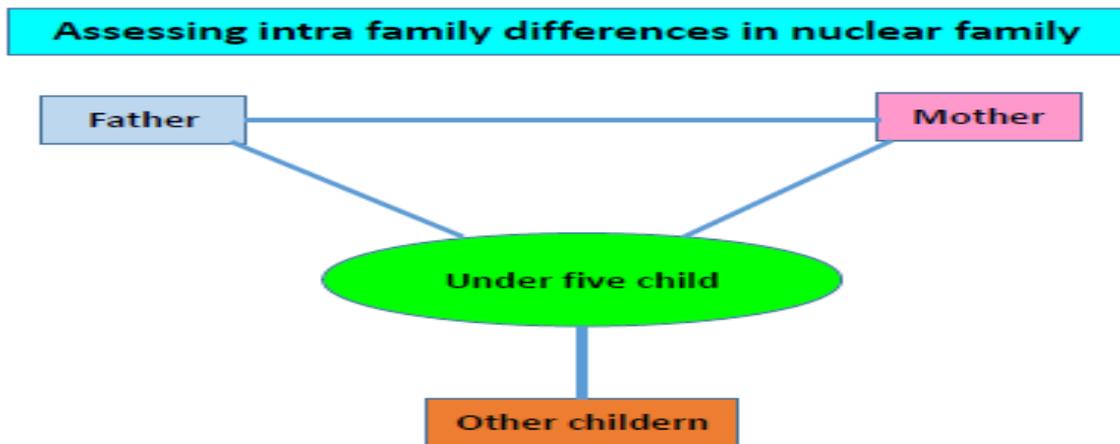


Figure 3.4 Assessing Intra family difference in nuclear family

Majority of families enrolled were nuclear families. In these households nutritional status of under five children was compared with the nutritional status of the mother; in addition nutritional status of the under five child was compared to the nutritional status of the father and other siblings in whom anthropometric measurements were available. In joint families in addition to the parents and their children, there were grandparents, aunts and cousins. In these households nutritional status of the under five children were compared with the nutritional status of the mother and all other family members whose anthropometric measurements were available. In addition nutritional status of parents and other members were compared.

Intra-family differences were assessed between under five children and other family members. Comparisons of the nutritional status were made between the following pairs of individuals from the family

- Under five child and mother
- Under five child and father
- Under five child and other woman
- Under five child and other man
- Elder and younger siblings if there are two under-five children in the family
- Under five child and 5-9 years child
- Under five child and 10-18 years child

In addition intra family differences in the nutritional status between the adults were also computed

- Mother and father of under five child
- Mother and other woman
- Mother and other man

### 3.1.5 Sample size

There are no published data on intra-family differences in nutritional status in urban low-income group families in Delhi. Data from some of the earlier studies carried out by Nutrition Foundation of India in this study population showed that the intra-family differences between two under-five children in the same family was the least in wasting and was about 10%. Using a 10% difference in wasting in under five children, a margin of error of 5%, a confidence level of 95%, and a design effect of 2, the sample size was computed to be 1000 under five children.

### 3.1.6 Approval of the institutional ethics committee

**The study was approved by the Institutional ethics committee of Nutrition Foundation of India. (Annexure I)**

#### a. Study information sheet

The study information sheet in Hindi was provided/read out to the head of household/mother (Annexure II); the rationale of the study and the benefits that the family could get by participating in the study were explained to the adult family members available at home. Contact details of the person to be

contacted at NFI for any information the study and any assistance needed was provided in study information sheet.

### c. **Informed Consent to participate in the study**

A week later families were contacted and families who were willing to participate in the study were identified. Informed consent (Annexure III) to participate in the study was obtained from head of household/ mother for under five child. Individual consent for taking anthropometric measurements was obtained from all available and willing adults of the family; consent from the parent and assent from the 7-18 aged child were obtained to take anthropometric measurements in 7-18 year children

### 3.1.7 **Proforma for data collection**

#### a. **Socio-demographic profile**

The proforma for collection of socio-demographic details about the family is given in Annexure IV. The form had the identification details about the family, list of persons in households (name, relation to head of household, sex, age, marital status, age at marriage, education, occupation). Information household type, size, caste, economical status, literacy and working status of head of household and the mother of under-five child, dietary habits, monthly income of family, type of house, ownership of house, no. of rooms in house, availability of toilet, means of transport used, cooking fuel used, source of drinking water, means of entertainment and kitchenware used were collected in this form.

#### b. **Household Dietary diversity & food security form**

The household data provided the information on age, sex and physiological status of the members of the in the household. From this data, the number of consumption units in each family was computed. Information pertaining to food security status of the family was collected using the Household food security form (Annexure V). Household food security was assessed by two methods:

- NSSO assesses the amount of food purchased (staples such as cereals, pulses, legumes, oil, sugar, jaggery and salt and perishables such as fruits vegetables

milk and milk products, animal food) energy consumption per consumption unit was calculated.

- NNMB collects information on the food cooked and consumed on the previous day by using 24 hour dietary recall method; from the type and quantity of food stuffs used for cooking household meals for the previous day energy consumption per consumption unit was calculated.

### c. **Physical activity Questionnaire**

Physical activity in the persons was assessed using a modified WHO physical activity questionnaire (WHO 2003) (Annexure VI). Time spent and intensity (sedentary, moderate, and vigorous) of activity in household, occupational, transport, personal/ grooming, entertainment and discretionary activity domain was ascertained in detail. Time spent sleeping was also recorded. Based on this 24-hour physical activity recall hours spent in sleep, sedentary, moderate and vigorous activity was computed.

### d. **Perfoma Assessment of nutrition Status of family members.**

#### i) **Child card**

Child anthropometry card for under five children (Annexure VII) had identification details about the family, sex, date of birth, birth weight, date of visit and anthropometry measurements (weight, height/length).

#### ii) **Mother Card**

Mother anthropometry card (Annexure VIII) provided information on age, physiological status, date of visit and anthropometry measurements (weight and height) of the mother

#### iii) **Card for $\geq 5$ -19 years children and adults**

This card is used for recording information about all members of the family except under five children and their mothers (Annexure IX) It has information on unique household identifiers, individuals person details- name of person, relationship to head of the household sex, age, date of birth (for 5-18 children), date of visit and anthropometry measurements (weight and height)

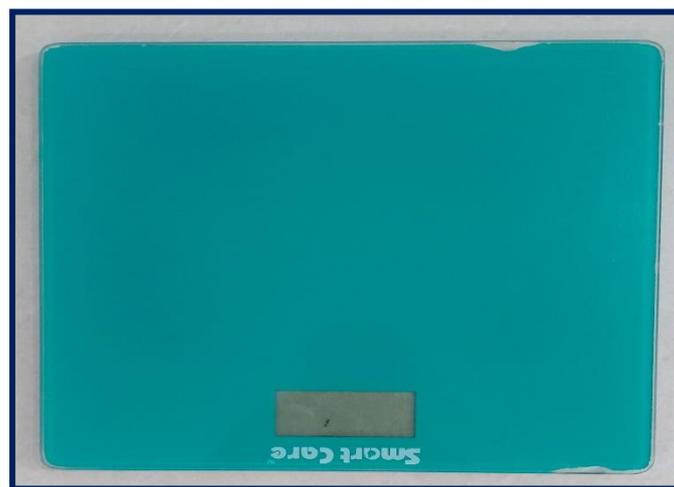
### 3.1.8 Quality assurance of measures used for anthropometric parameters weight & height

All the team members were trained in undertaking height and weight measurements before they undertook the measurements in the community. The main focus of training was on teaching the team members on

- how to correctly weigh the individual
- how to correctly take height/length of the individual
- how to minimize the inter individual and intra-individual variation in anthropometric measurements especially in children and so on.

#### A. Weight measurement

Weight is measured using the Lithium battery operated digital weighing machine. Weighing is the most commonly used measurement for assessment of nutritional status. With the availability of the electronic balances which are light weight, accurate and sensitive, it has become possible to easily undertake measurement of weight in all age and physiological groups. With single electronic balance with 100g accuracy it is possible to measure the weight of all persons in the family ranging from new born and elderly person. Weighing balance used in the study can weigh persons in the weight range of 5 kg to 150 kg with accuracy of 100g (Plate 3.4).



**Plate 3.4 – Digital weighing balance**

### a. Testing accuracy of digital balances

For accurate measurement of weight, accuracy of balances is an essential prerequisite. Accuracy of balances was tested by

- Weighing the of standard weights certified by the Department of Weights and Measures and checking the weight displayed in the balance.
- By weighing five persons of varying weights at least five times in the test balances and comparing it with the weight of the same person weighed using the standard balance.

### b. Testing accuracy of balance using standard weights

- The standard weights of 5, 2, 1, 0.5, 0.2 and 0.1 were used for testing accuracy of weighing balance.
- The standard weights used for accuracy checking was certified by Department of Weights and Measures
- For testing accuracy of balance first 5 kg weight was kept on balance and then 2, 1, 0.5, and 0.1 kg.
- This was done to check the consistently accuracy of balance across weights.
- The balance should have accuracy of  $\pm 0.1$  kg (e.g. if 5+2 kg weights were put on balance, the balance which shows reading as 6.9/7/7.1 was consider as accurate). (Plate 3.5)(NFI)

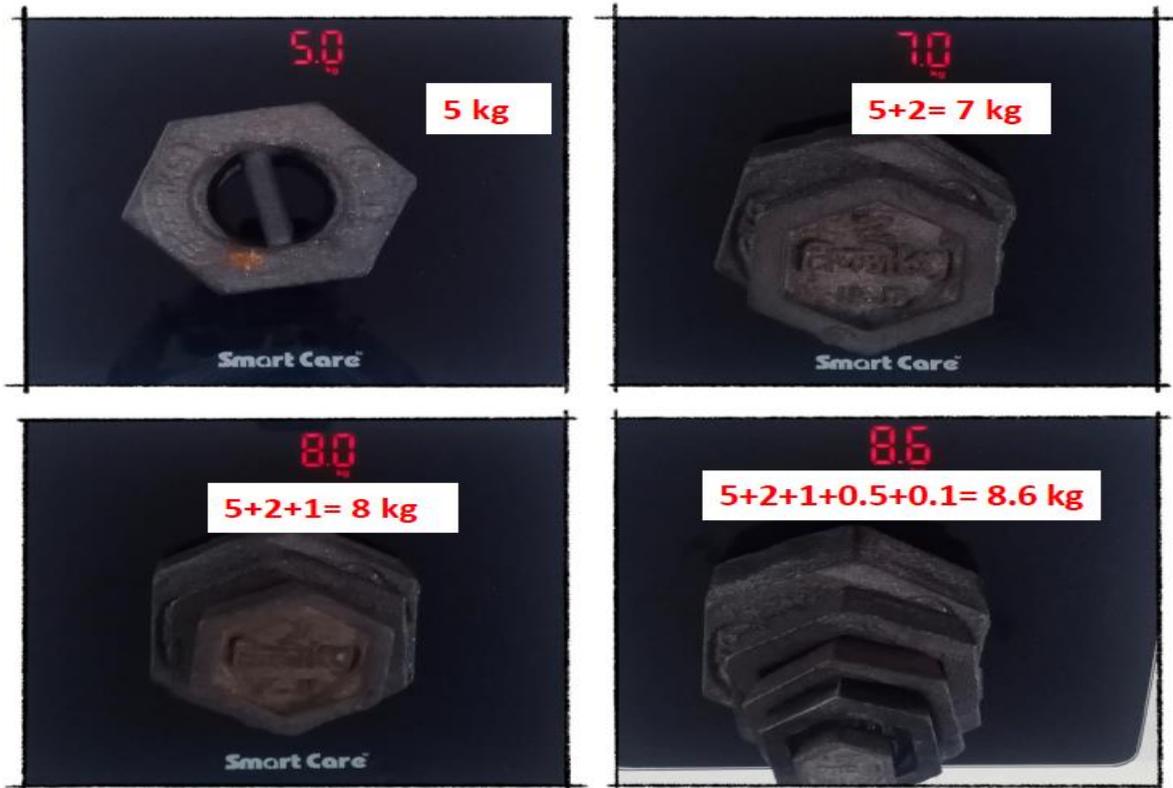


Plate 3.5-Accuracy Testing of Weighing Balances using standard Weights

**Weighing five persons five times in the balance**

- Weigh five adults five times in each balance.
- The difference between weight measured should not be >0.1 kg.
- Data presented in the table 3.2 indicates that the balance was accurate and could be used for weight measurements in the study.

**Table 3.2- Checking accuracy of balance by weighing five adults five times**

Round no.	A	B	C	D	E
1	50.3	70.0	83.7	38.3	49.9
2	50.3	69.9	83.7	38.3	49.8
3	50.3	70.0	83.6	38.3	49.9
4	50.3	70.0	83.7	38.3	49.9
5	50.4	70.0	83.7	38.3	49.9

Every morning before going to the community digital balances were checked for accuracy, using the standard weights and by weighing two adults five times.

### B. Length/height measurement

#### a. Length measurement

Infantometer was used to measure length in infants and young children who cannot stand straight (Plate 3.6). The accuracy of the instrument used was  $\pm 0.1$  cm and the children with length from 45 to 90 cm can be measured. (NFI). Infantometer used was made of plastic so that there is no risk of warping during monsoon season.

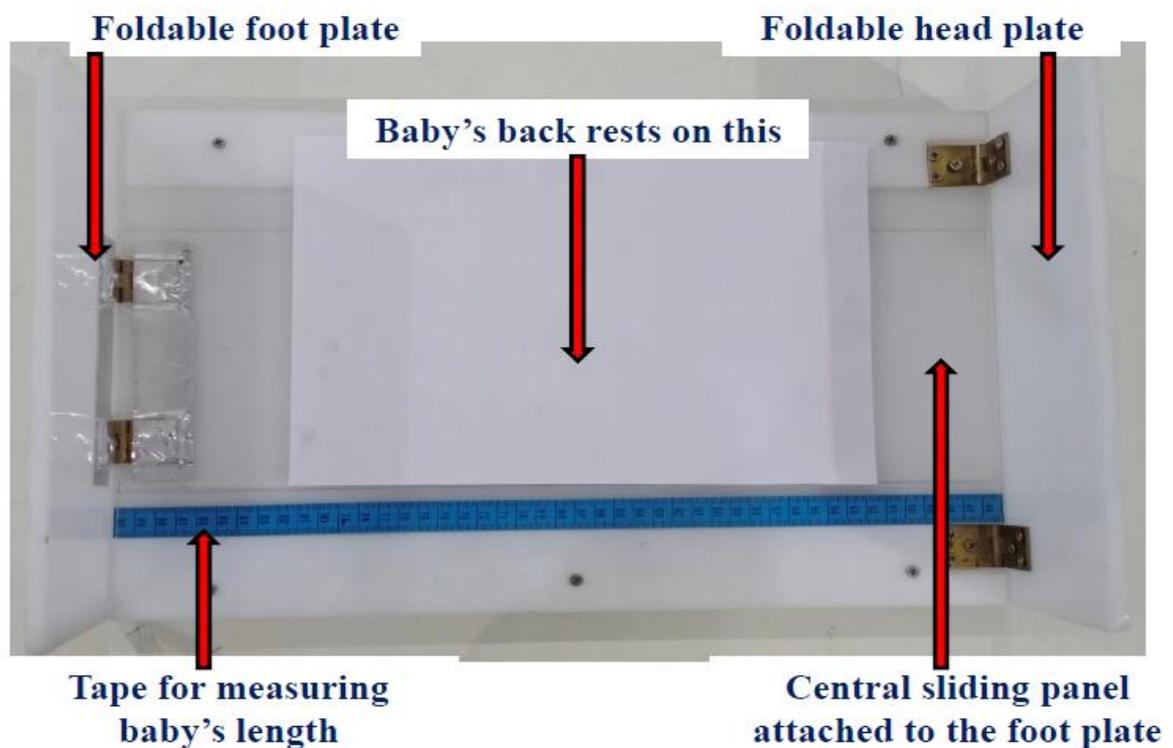
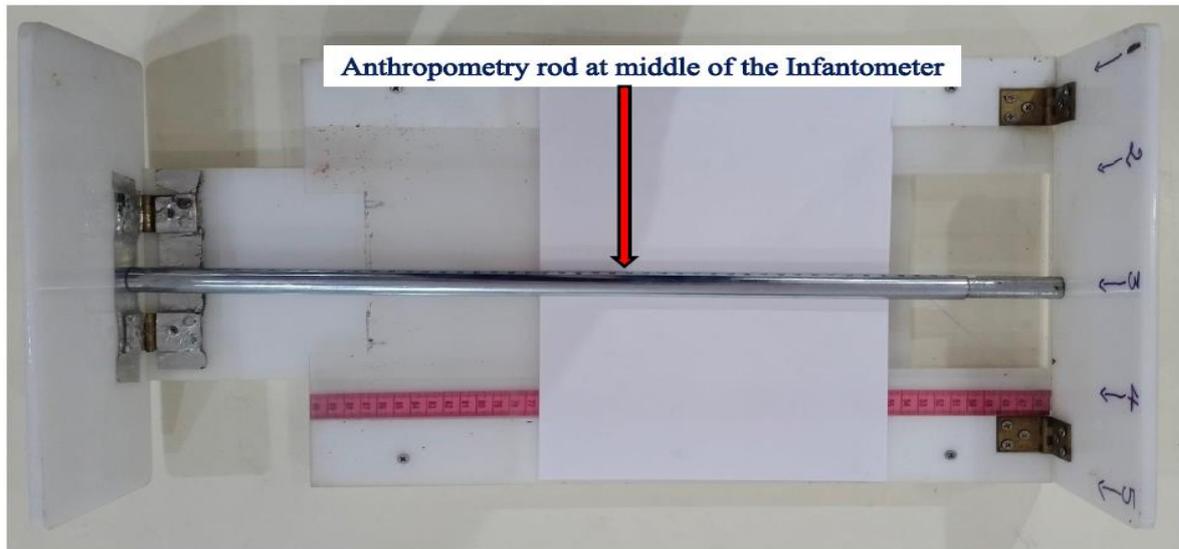


Plate 3.6-Infantometer used for measurement of length of infants

#### b. Accuracy testing of Infantometer

The accuracy of infantometer was tested by using anthropometry rod. The anthropometry rod used had length of 55cm and it was used to measure five segments of infantometer i.e., centre, left and right edges of infantometer and midpoint of centre and edge of infantometer from both the ends (NFI) (Plate 3.7).



**Plate 3.7-Accuracy testing of Infantometer**

### **c. Height measurement**

Height is one of the most widely used indicators for assessment of nutritional status and provides an index of linear skeletal growth. Until a few decades ago many of the surveys were carried out in places without level ground or vertical wall. Under these circumstances height was measured using either a stadiometer or anthropometry rod. Stadiometer is a bulky instrument, occupies space and is heavy. Anthropometry rod is relatively compact but intensive training is required to keep the rod perpendicular and accurately measure the height. In our study area all families live in pucca houses with flat floors and vertical walls. Therefore the small readily portable wall-mounted stature meter is used for measurement of height. Wall-mounted staturemeter can measure height up to 200 cm and the accuracy of the instrument used was  $\pm 0.1$  cm (Plate 3.8).



**Plate 3.8- Staturimeter**

### **d. Accuracy testing of staturimeter**

Accuracy of the tape in the staturimeter to be assessed by comparing it with the standard steel tapes certified by the Department of Weights and Measures. When fully wound the zero mark of the stature meter should be against the red line in the reading window. Next, the tape is fully unwound; now the reading 200 should be against the red line in the reading window.

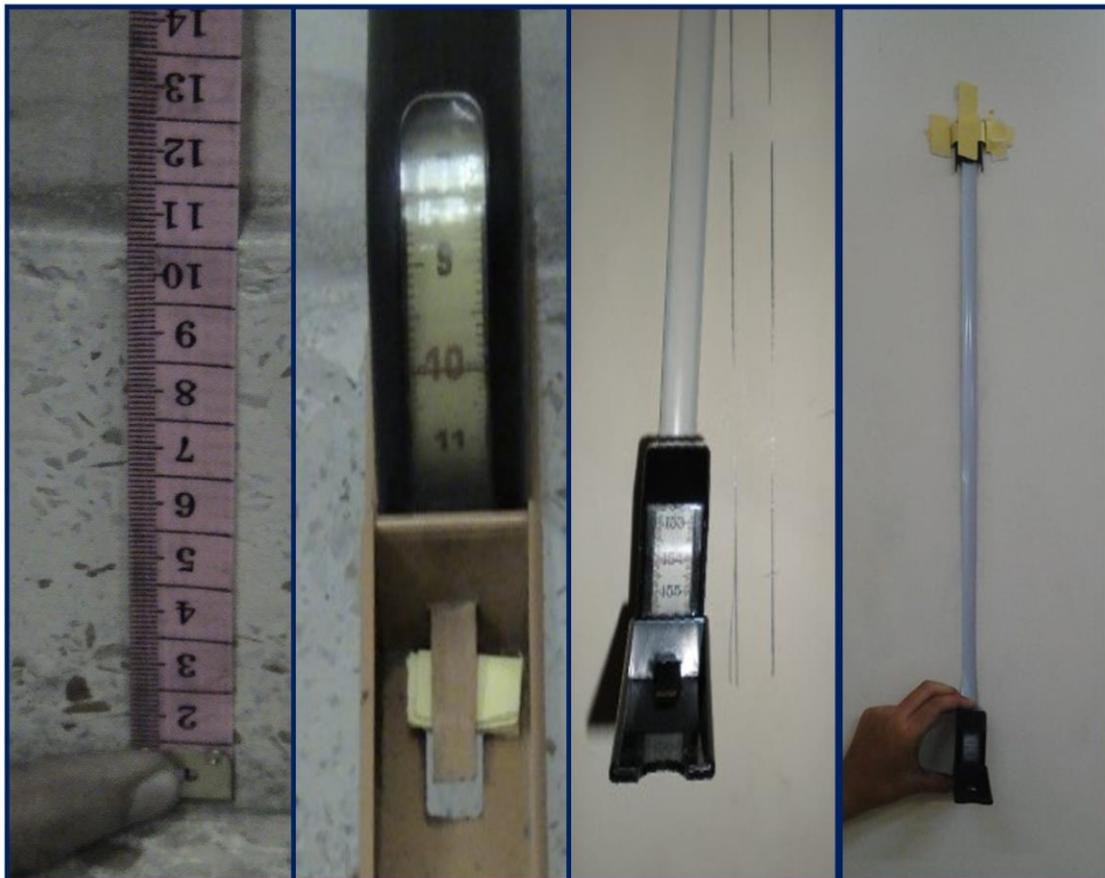
Accuracy of staturimeter is tested by comparing the height of two individuals measured by the staturimeter with the height of the same person measured using the standard stature meter (NFI)

### **e. Fixing of Stature meter to the wall**

In most Indian houses there is a skirting in all the walls. Because of this if the horizontal limb of the stature meter is placed on the ground and the tape is wound up there is a gap between the tape and the wall at the skirting; as the tape crosses the skirting obliquely there will be an error in the measurements. In order to prevent this error, first measure the height of skirting using ordinary tape. If the skirting is 10 cm

## Methodology

height pull out the tape in the stature meter and fix it so that the reading in the red mark in the window is 10 cm. Keep the horizontal limb of the stature meter on the top of the skirting and pull the vertical limb up fully so that the reading is 200 cm. Fix the vertical limb to the wall using screws if it is to be fixed permanently – in the anganwadi. If the staturer is to be fixed in houses for measuring the persons of the household, fix the staturer to the wall using a two sided adhesive tape. While undertaking measurement of height, especially for children it is essential that the tape of the staturer winds down vertically because if the tape slants while being wound down, there will error in the reading. In order to ensure that the tape is wound down vertically, place a small weight e.g.200 or 500gram and allow the tape to wind down under gravity. Mark with pencil the vertically sides of the tape; when measuring any person, the tape should be wound down only between these two lines. This will ensure that the tape winds down vertically and any error due to slanting of the tape is eliminated the tape being (Plate 3.9) (NFI).



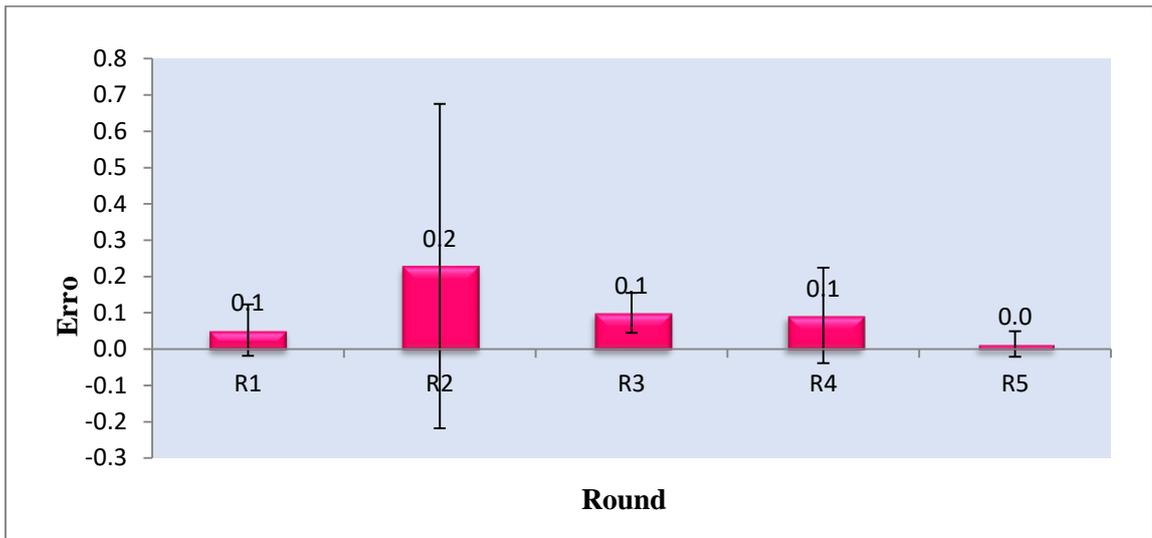
**Plate 3.9- Fixing of stature meter on the wall**

(Source- NFI)

**f. Quality control of height measurement**

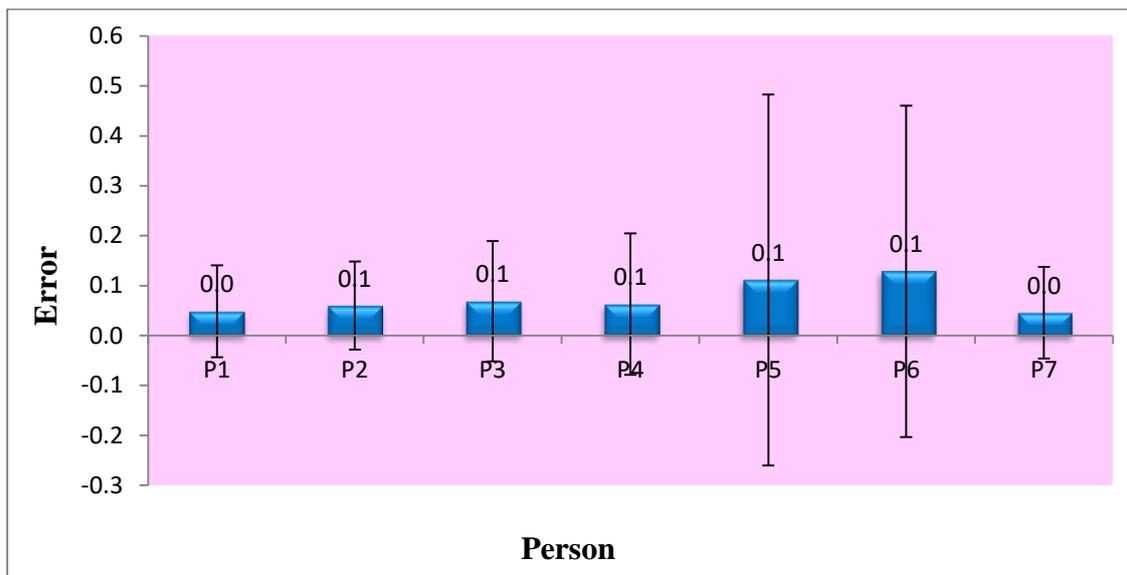
Variability in the measurement can be of two types – Intra-individual variability and inter-individual variability. Intra-individual variability refers to the variation in the measurement, when the same measurement is taken by an investigator repeatedly in the same person at the given time. Inter-individual variability refers to the variation in the measurement, when the same measurement is taken by different investigators in the same person at a given time. Variability in measurement can be reduced by standardizing the tools and techniques used and by appropriate training of the persons undertaking data collection. After getting initial training in accurately measuring height, and weight, I along with the NFI staff all undertook an exercise to assess the errors in measurement as compared to the faculty. The results of exercise of five rounds of height measurement in seven individuals taken by us were compared with to the measurement of the seven individuals taken by the faculty are shown in Table 3.3 and Figures (3.6 & 3.7) given in the below.

<b>Table 3.3 Checking accuracy in measuring of height in adults</b>							
<b>DATE- 02.02.2015</b>		<b>Time- 2:00PM-2:30PM</b>					<b>Round-1</b>
<b>Person taking the measurement</b>	<b>Person being measured</b>						
	1	2	3	4	5	6	7
<b>1</b>	-	145.6	150.2	147.8	151.6	154.1	159.4
<b>2</b>	154.6	-	150.2	147.9	151.5	154.1	159.4
<b>3</b>	154.7	145.7	-	147.8	151.6	154.2	159.5
<b>4</b>	154.6	145.6	150.3	-	151.9	154.1	159.3
<b>5</b>	154.8	145.6	150.3	145.5	-	154.3	159.2
<b>6</b>	54.7	145.7	150.3	145.8	151.5	-	159.3
<b>7</b>	154.7	145.6	150.3	147.9	151.5	154.2	-
<b>FACULTY</b>	154.7	145.6	150.2	147.7	151.1	154.2	159.4



**Figure 3.5- Round variation in height measurements**

Figure 3.5 depicts the mean difference in the height measurement between the faculty and the persons participating in the quality control exercise. In the first round the persons were slow and very careful and the difference between the faculty and the interns was not very high. However, in the next round, the differences went up perhaps because they were tired. In the third and the fourth rounds, the mean difference between the faculty height and staff was only 0.1-0.2cm; in the fifth round, the SD was lower, indicating that all of them had improved their skills in accurately measuring height.



**Figure 3.6- Individual's variation**

Figure 3.6 shows the extent of inter-individual variations in the measurements of height in 5 rounds. The inter-individual difference as compared to the faculty is the

lowest for P1 and P7 and highest for P6. However all of them showed improvement with training and after the 5<sup>th</sup> round were able to measure height within 0.1 cm difference as compared to the faculty.

### 3.2 ASSESSMENT OF DIETARY DIVERSITY AND FOOD SECURITY

The computed energy consumption per consumption unit by both methods were compared with EAR for energy per consumption unit (ICMR-NIN, 2020) to assess whether household was food secure.

Families who were willing to provide information on different foodstuffs purchased and consumed by the family over a defined period and the amount of foodstuffs used in cooking the family meals on the previous day were taken up for the study. Questionnaire had information on area, anganwadis name with code, house number and household number to provide household identity.

It also has information on the age, sex and physiological status of the members of the household so that consumption units per household could be calculated

Food consumption/CU/day of the family was computed using the values for CU for the members of the family as given in Table 3.4.

<b>Man</b>		1
<b>Women</b>	NPNL	0.8
	Pregnant	0.9
	Lactating	1.3
<b>Boys</b>	16-17 years	1.2
	13-15 years	1.1
	10-12 years	1
<b>Girls</b>	16-17 years	0.9
	13-15 years	1
	10-12 years	0.9
<b>Children</b>	7-9 years	0.9
	4-6 years	0.7
	1-3 years	0.5
<b>Source-NNMB surveys</b>		

Food consumption (per consumption unit/day) of major foodstuffs by the family was computed using two methods: NSSO method: the amount of foodstuff purchased by the family (daily eg milk), alternate days, or weekly (eg fruits, vegetables), once a

fortnight, or once a month (cereals, pulses oil, sugar, etc.) for each of the major categories of foodstuffs were tabulated. Many households purchased pulses, sugar and oil once a month; in some households, cereals were purchased or brought from the family farm once in six months. Actual amounts purchased and the period over which they were used were ascertained and consumption for each of the major foodstuffs/CU/Day were computed.

NNMB method: NNMB surveys collect data on foodstuffs used in cooking the family meals on the previous day using 24-hour dietary recall. In the present study data on food cooked on the previous day was collected by personal interviews of the person who cooked the meals on the previous day (previous day should not be any festival or any special day). Actual amounts of foodstuffs used in cooking the meals for the family was ascertained and consumption for each of the major foodstuffs/CU/Day were computed.

The data on consumption of food stuffs/CU/day calculated by NSSO and NNMB methods were compared with each other and also compared with the food stuffs in sample balanced diet (for sedentary men) provided in Nutrient requirements for Indians (ICMR-NIN, 2020). Indian food composition tables were used to compute the carbohydrate, protein, fat and energy/CU/day from food group consumption/CU/day (by NSSO and NNMB methods). The macronutrient and energy consumption/CU/day computed by NSSO and NNMB methods were compared with each other and with the EAR for energy recommended by the ICMR Expert Group on Nutrient Requirements for sedentary reference man weighing 65Kg (CU1). The ICMR Expert Group on nutrient requirements took the mean +2 SD of the height from NNMB surveys both for men and women and BMI of 21 for both men and women to compute the weight of reference man and women (ICMR-NIN, 2020).

The ICMR expert group suggested that in the dual nutrition burden era, the EAR for the actual average optimal weight of the population may be computed for energy requirements. The average height of men in India (based on CAB-AHS and DLHS4 surveys) is 162 cm; optimal BMI for Indians recommended was 21kg/m<sup>2</sup>; computed optimal weight for average Indian man is 55 kg. The EAR for energy for 55 kg sedentary man was computed and compared with the energy consumption of the families/CU/day.

### 3.3 ASSESSMENT OF PHYSICAL ACTIVITY OF SCHOOL-AGE CHILDREN AND ADULTS

WHO Global physical activity questionnaire is mainly used in surveys for assessing the risk of NCDs and are usually not administered by trained nutritionists. It does not document detailed information of the type of physical activity throughout the 24 hours of the day. The 24 hour questionnaire administered by the research scholar to the individuals in the family provides more detailed and accurate information on the activity pattern as compared to the WHO Global physical activity questionnaire.

#### 3.4 Data collection: Assessment of nutritional status of under-five children and their family members

Anthropometric measurements were taken of all available members of household with under-five children from 2015 to 2019. For this study, the first single full anthropometry data of individuals from was used.

##### 3.4.1 Determination of age of all age groups between 0-18 years

Accurate ascertainment of age of all 0-18 year children is very important because assessment of nutritional status of children is computing weight-for-age, height-for-age and BMI-for-age. Ascertainment of age is not very difficult in the population because majority of women delivered in the hospital and hospital discharge card gave information on time and date of birth. In under-five children 1.4% did not have discharge card indicating date of birth. In 5-18 year children 2.9% of children did not have discharge card.

If a discharge card was not available, date of birth was ascertained from the parents by using a calendar of local events such as festivals.

##### 3.4.2 Body weight of children and adults

###### a. Procedure for measuring body weight

Body weight is an important parameter used for assessing the nutritional status of an individual. Weighing children as well as adults using a digital balance is very easy. Keep the digital balance on the flat floor. Step on it to switch on the battery; after that tell the subject (adults/children) clearly that he/she should stand straight on the digital balance. Check for compliance; correct problems if any. Plate 3.10 shows child and adult standing straight on the digital balance in his home.



**Plate 3.10- Weighing adults and children using a digital balance**

(Source- NFI)

**b. Measurement of infant's weight**

The weight of the mother is recorded while carrying the infant. Their combined weight is 47.8 kg. Weight of mother alone; her weight is 40.6 kg. Therefore infant's weight is  $47.8 - 40.6 = 7.2$ kg. Picture is showing how infant weight is measured (Plate 3.11).



**Plate 3.11- Measurement of infant weight**

### **3.4.3 Length/Height of children and adults**

#### **a. Procedure for measuring length of infants**

The infant was laid on the infantometer with the head placed firmly against the fixed headboard and eyes looking up vertically (Plate-3.12). Infant's head is pressed against head plate so that lower orbital margin and tragus lie on same plane. Mother of the

infant was asked to keep the head in position. Throughout the process of taking measurement, the mother was requested to stay next to infant and keep playing with the infant to make the infant comfortable and cooperate in taking the length. Firm pressure was given on the knees to keep the leg flat on the infantometer; the feet were placed at right angle to the lower legs by the investigator and flat on the moveable foot plate of the infantometer and the length was measured to the nearest 0.1 cm. A white sheet was placed on Infantometer at level of the top of central sliding panel (to prevent parallax errors in taking the reading) and the measurement was read on the tape (NFI).

### Points to be kept in mind while taking length of infant

- i. The head of the baby should be correctly positioned and held by mother (Plate 3.12).



**Plate 3.12- Positioning of head of infant on infantometer**

- ii. The legs of the infant should be lying flat on the infantometer; the feet should be flat and be correctly resting on the footplate (Plate 3.13).



**Error: Foot not resting on footplate**

**Plate 3.13: Correctly resting of foot on the footplate**

(Source- NFI)

### **b. Height Measurement**

Height is widely used as an indicator for assessment of nutritional status. It provides a linear index for skeletal growth.

- The person whose height is being measured should be standing barefoot and his/her hair should be flat
- Feet should be aligned with heels, buttocks, and shoulder each touching the wall. Tragus of the ear and the lower orbital margin should be in the same horizontal plane. This is called Frankfurt Plane.
- The horizontal limb of the stature meter should be firmly placed on the top of the head but should not be pressed.
- The eyes of the investigator should level with the window showing the reading. The height should be taken/noted to the nearest 0.1 cm.
- If the height of the subject is more than that of the investigator, then the investigator should stand on a stool and bring her eyes to the level of the window in the stature meter.

- If the height of the subject is less than that of investigator, then investigator should stoop down bring her eyes to the level of the widow in the stature meter and then take the measurement. (Plate 3.14) (NFI).



**Plate 3.14-Positioning the person for height measurement**

### 3.5 DATA ENTRY, CLEANING AND ANALYSIS

Data was collected from selected study population from year 2015 to 2019.

#### Data Analysis

Analysis of data involved following steps:

- Data entry
- Data cleaning
- Running data through WHO Anthro and WHO Anthro Plus software
- Data Pairing
- Analyzing data through MS excel and SPSS version 26 software

#### a. Data entry

Data entered and cleaning was done in MS excel. Overall data divided in four excel format. All excel sheets contained area code, anganwadi name with code and household number and could be linked to each other for analysis.

## Methodology

- i. Under five children entry format- In this format only under five children data entry was done. It contains area code, anganwadi name and number, household number, sex of child, child's name, child's mother name, child's father name, date of birth of child, date of visit, weight (kg) and height(cm).
  - ii. 5-19 year children and adult's data entry format. In this format all members of household (except under five children) data entry done. It contains area code, anganwadi name and number, household number, name of the person, relationship to HOH, sex of person, age, date of birth (if age below 19 years), date of visit, physiological status (L/NPNL), weight(kg) and height(cm).
  - iii. Household dietary diversity and food security entry format-various food stuffs purchased by the family (daily, twice a week, weekly fortnightly or monthly) was obtained from the family (NSSO survey method). The type and amount of ingredients used for cooking meals for the family on the previous day was collected (NNMB survey method)  
  
The age and physiological status of all the members of the family were recorded so that the number of consumption units /household could be calculated
- b. 24-hours Physical Activity questionnaire - This format indicates physical activity pattern of the persons, based on their 24-hour physical activity recall; hours spent in sleep, sedentary, moderate and vigorous activity was computed.

### Data cleaning

- i. Under five children's data
  - Check area code, anganwadi name and household number, sex of child, child name, mother name, father name, date of birth of child, date of visit, weight(kg) and height(cm) If any row and column were blank or error then check from hard copy and fill the blank or correct if data wrong entry respectively.
  - Date of birth and date of visit should be entered in the same format (DD/MM/YYYY) "days360" excel Formula used for calculation of age in months.
  - The count of each columns should be same.

- Age calculation formula filter was applied to age to check that there were any errors and negative values in age column. (Error or negative value was mainly due to error in date of birth or visit.), then the data was checked from hard copy and correction was done.
  - After cleaning the data entry serial number was given to each row for re-arrangement according to our data analysis requirement.
- ii. 5-18 year children and adults data checking included area code, anganwadi name and number, person UID, name of the person, relationship to HOH, sex of person, age, date of birth (if age below 18 yrs), date of visit, physiological status (L, NPNL), weight(kg) and height(cm). If any row and column were blank or error were found data was checked against the hard copy and blank were filled and wrong entries corrected.
- After that data of 5 to 18 aged and  $\geq 19$  aged members were separate Data cleaning for 5-18 year children was similar to that done for 0-5 year children. Data pertaining to the adults both men and women were also checked for completeness.
- iii. In household food security and 24 hours Physical Activity questionnaire if any row and column were blank or a data entry error was detected, hard copy form was taken out and blanks in data entry were filled and wrong entry corrected.

### c. Running data through WHO Anthro and Anthro Plus software

The WHO Anthro Survey Analyzer is an analytical tool developed by the Department of Nutrition for Health and Development of the World Health Organization (WHO). The software helps to perform comprehensive analysis of anthropometric survey data for children under five years of age based on weight and height. The analyses were based on the WHO Child Growth Standards.

The cleaned data from excel was pasted in notepad and then imported to WHO Anthro and run through software. The data was pasted on a notepad because WHO Anthro takes data with notepad only.

The Outputs include a set of z-scores of the anthropometric indexes: height-for-age, weight-for-age, and body mass-index-for-age. Data was checked whether all data have z score. Outliers were marked and removed

- range for weight for age and height for age  $<-7SD$  to  $>+3SD$ .
- range for BMI for age  $-5SD$  to  $+5SD$

All outliers were removed because WHO recommends for removal of outliers. The cut-off given by WHO is  $-5SD$  and  $+5SD$  for WAZ and HAZ. Indian children are small statured and underweight therefore, we removed as outliers only those with value for height and weight beyond  $+3 SD$  and less than  $-7SD$ . For BAZ outliers value  $<-5SD$  and  $>+5SD$ , because median BAZ of Indian children was near the median of the WHO standards. All the values lying between the cut-off were taken for analysis of data.

**Data pairing-** The following intra family differences in nutritional status was assessed. Differences in nutritional status between under five children and other members of the family and differences in nutritional status between adult members of the family. Pairs were

- Under five child and their mother
- Under five child and father
- Under five child and other women
- Under five child and other men
- Elder and younger siblings if there are two under-five children in the family
- Under five child and 5-9 age children
- Under five child and 10-18 age children
- Mother and father of under five child
- Mother and other women
- Mother and other men

### Analyzing data through MS excel and SPSS version 26

- i. **Analysis of socio-economical demographic profile-**The data on socioeconomic-demographic profile was collected at the time of enrollment of all under five children. Frequency distribution and percentages were calculated for each of the socioeconomic-demographic parameters (education details of parents, occupational details, household type, household size, caste, economic status, literacy, dietary habit, monthly income of family,

- type of house, ownership of house, availability of toilet, means of transport used, cooking fuel used, source of drinking water, means of entertainment).
- ii. **Analysis of food security of the selected households**-Household food security status information on various food stuffs purchased by the family (daily, twice a week, weekly fortnightly or monthly) was obtained from the family (NSSO survey method). The type and amount of ingredients used for cooking meals for the family on the previous day was collected (NNMB survey method). No of consumption units in each family was calculated on the basis of age, sex and physiological status of all the members of the family. Based on these data, the intake of carbohydrates, protein fats and total energy/consumption unit were computed. The computed energy intake/CU /day was compared with the EAR for reference sedentary man as one consumption unit, and EAR of average weight sedentary man as one consumption unit (ICMR-NIN, 2020).
  - iii. **Analysis of physical activity**-Physical activity data was collected from adults and school-aged children of households with under-five children. Based on this 24-hour physical activity recall hours spent in sleep, sedentary, moderate and vigorous activity were computed.
  - iv. **Analysis of anthropometric assessment of nutritional status of 0-18 year children**- Nutritional status of the 0-18 year children was assessed using WHO MGRS or WHO anthro plus packages z scores for length/height-for-age (stunted, normal or tall), weight-for-age (underweight, normal or overweight) and BMI-for-age (wasted, normal or over-nourished). Means and standard deviations were calculated for continuous variables; for categorical variables percent prevalence was computed. Prevalence of under-nutrition (stunting, underweight and wasting) was computed.
  - v. **Analysis of anthropometric assessment of nutritional status of adult members**- Means and standard deviations of height weight and BMI were calculated was compared. Nutritional status of women and men were assessed using the WHO norms for BMI (<18.5 kg/m<sup>2</sup> undernourished; 18.5 to 24.9 kg/m<sup>2</sup> normal and ≥25 kg/m<sup>2</sup> over-nourished).
  - vi. **Analysis of Intra family differences in nutritional status of the families**-intra-family differences for all pairs made from the same family were

## **Methodology**

assessed. Student t-test was used to assess the statistical significance of the observed inter-group differences in the continuous variables; Chi square test was used to assess the statistical significance of observed inter-group variations in categorical variables.