Chapter 3

Research Methodology

In this chapter, we discuss the design of sampling, definition and introducing the variables were considered in the questionnaire. And also, explain how and where data were gathered. Elucidating the 24 hours diet recall and food frequency questionnaire, where we are able to estimate the maternal macronutrients and micronutrients intake. Furthermore, statistical test used in this study and also the method was utilized to discovering the relationship between variables and plotting the foetal growth chart, creating the foetal percentiles have been explained as last part of this chapter.

3.1 Sample Design

3.1.1 Steps in sample Design

The following points were used in developing the sample design.

3.1.1.1. Sampling procedure

3.1.1.2. Criteria of sample selection

3.1.1.3. Sample Size

3.1.1.1 Sampling procedure

A cross sectional study was conducted to assess the impact of maternal nutrition on growth of foetus with an anthropological perspective. Sampling was completed according to the criteria of sample selection i.e. those pregnant women who fulfill the
criteria of inclusion and area of sampling. The area of sampling was in two hospitals, Jehangir hospital and Gupte hospital. These two hospitals were selected, in order to the most of sonography were done in the Hospital. And also in terms of reduction of bias among the foetal biometrics data. Accordingly, the respondents were met in last trimester of pregnancy and majority of them were met in last month of pregnancy that was close to delivery time. Therefore, collection of baby’s birth record was accessible. The sample was collected during three months period from June to August 2009, among the affluent pregnant women who were referring for monthly check up to the obstetric department of Gupte and Jehangir hospitals in Pune city, Maharashtara state. It is remarkable to be cited that data was collected among affluent mothers, because this group of pregnant women was from higher social-educational level and paying more attention to their situation during entire course of pregnancy. And also affluent mother covered all of criteria of sample selection. Furthermore, to construct the foetal biometric centil chart, healthy singleton pregnant women is required into study. And also, in the antenatal cards all the information regarding the mother including: anthropometric measurement of mother before pregnancy, maternal medical family history and also important notice regarding foetal location in uterus, foetal growth pattern and situation of pregnant mother during pregnancy as well was made. Therefore, this made it possible to choosing the healthy mother with healthy foetus.

3.1.1.2 Criteria of Sample Selection

Criteria of inclusion sample were as follows:

- At least three sonography reports since second trimester up to delivery.
• Including that sonographies in which, there are four biometric fetus measurements (Head circumference, Biparietal diameter, Abdomen circumference, Femur length).

• Including healthy singleton pregnant women.

Criteria of exclusion sample were as follows:

• Any family history of congenital disease.

• Suffering from chronic disease

• Any complicated position during pregnancy.

3.1.1.3 Sample Size

An optimum sample is one which fulfills the requirements of efficiency, representatives, reliability and flexibility. In the present study a total sample of 156 singleton healthy pregnant women was collected. Initially the 50 sample was collected, therefore from this amount of sample, maternal milk consumption was calculated due to rich in Calcium and Insulin Growth factor I (IGF I) that are the most important factors for the growth. Moreover, the standard deviation (SD) of maternal milk intake was 150 ($\sigma = 150$). Hence, the sample size calculated at level of $\alpha = .05$, precise $d=24$ ml milk consumption. Then the total sample size was calculated based on the given formula, 150 samples (C.R. Kothari 2006):

$$n = Z^2_{1-\alpha/2} \times \frac{\sigma^2}{d^2} \quad \left[ \alpha = .05, \quad d=24 \text{ ml}, \quad \sigma=150 \right] \rightarrow Z_{1-\alpha/2} = 1.96$$

Moreover, on last day of data collection we had six pregnant mothers more, so we added their information. Subsequently, based on the Criteria of sample selection, the total sample 156 pregnant women were qualified into study.
3.2 Interview Method

The method of collecting information through personal interview was carried out in a structured way, which is called as structured interviews. Such interview involved the use of a set of predetermined question.

During each interview, information concerning the demographic background of pregnant mothers comprising; of maternal medical history, expectant mothers social and educational circumstances, caste-religions status, maternal work status, house hold activities, maternal spouse anthropometrics measurements, pre-pregnancy anthropometric measurements and also maternal dietary habits were sought. Moreover, the income and educational level were classified from the lower to the upper levels.

Furthermore, birth measurements were recorded from birth record file that was available in obstetric department of the related hospital, including; infant head circumference, neonate height, baby's weight and gender. Dietary assessment was accomplished by 24-hour diet recall and food frequency questionnaire.

3.3 Assessment of dietary adequacy

It enables us to identify both poor and desirable food habits and dietary pattern, and thus is fundamental in determining the risk of inadequate intake of the potential need for supplementation of individual pregnant women. (Block 1982). The dietary data was collected through 24-hour diet recall and food frequency questionnaire.

3.3.1 24-hour Diet recall

This method was used for collecting quantitative data that include 24-hr recall and food record. In the recall method, the individual was asked to recall the types and amount of the foods and beverages consumed during the previous day. A single day's intake can be
used to estimate the nutrient intake of a group of individuals but this is not a usual criteris in clinical practices (Gran 1976). For such nutrients as energy and protein, which are consumed relatively consistently from day to day (Beaton 1979), assessment of average intake over 3 days is sufficient to estimate usual intake by an individual. Thus, in the present study diet recall was collected among those pregnant mothers who referred to the clinic for monthly check up, and then their phone numbers were recorded to organize the next appointment time. Moreover, over 3 days dietary intake was collected and asked about 3 main meals, 3 snacks, beverages and also majority of respondent consumed protein powder daily, that need to be taken into consideration. Many days would have to be sampled to obtain an accurate estimate of the usual intake of nutrient such as vitamin A and C, for which intake is highly variable (Beaten 1983). For these reasons, a pregnant women's risk of dietary inadequacy may be assessed more efficiently and practically by a food frequency or diet history questionnaire.

### 3.3.2 Food frequency questionnaire (FFQ)

The food frequency questionnaire was formulated based on the pattern of Indian food stuffs. The main food items were divided into eight categories (cereal, pulses and legume, milk products, leafy vegetables, other vegetables, fruits, meat products including egg, fish, dry fish, chicken, mutton and oils and additional items were also incorporated according to the maternal consumption. Each category of food stuff attributed to frequency of intake varying from daily, weekly, monthly, rarely, never and also to the different portion size (small, medium, large). In these approaches the women were asked for the usual frequency with which specific foods were consumed over time. The accuracy of the nutrient estimate may improve somewhat if the questionnaire includes portion size (Block & Hartman 1989). But the addition of such
question would increase the time required to complete the form. Hence, it was decided to use the measured bowel, cups, spoon which assist in determining accurate serving size.

3.4 **Food composition Data base**

To estimate nutrient intake from FFQ, there is a need for a food composition table listing the average nutrient content of food stuffs in FFQ and 24 hours diet recall. The food composition data base was used to convert intake of food into nutrients. The macronutrients content of food extracted from nutrient value of Indian food (C.Gopalan 2004).

3.5 **Characteristic of questionnaire variables**

The questionnaire was constructed in three sections comprising; (Appendix III).

3.5.1 **Section I**: Demographic information of respondent.

3.5.2 **Section II**: information related to maternal parity and medical history.

3.5.3 **Section III**: maternal dietary habits.

3.5.1 **Section I, Demographic information of respondent**

This section was planned to obtain social status, work status of the candidate. In addition number of question were structured regarding the type of family, home town, cast-religion status and maternal age to know at what age the women were entered into pregnancy. It is expected that, age has an impact on nutrition information as a demographic variable within gestation and also number of family members is another interesting variable, as it may likely express the circumstance standing of the people in society.
It is important to know the maternal social status and how it would be related to the maternal dietary intake. Therefore, to find out the social status of the candidate, it was structured a question apropos of maternal and her husband’s educational level. This will be used to provide a direct measure of the woman’s relative socio-economic status. Numerous studies in developing countries have shown that more educated- women have lower perinatal mortality rates. Higher education not only presumes higher economic standing but also suggests a more informed approach to self-care and use of the dietary intake adequately in a regular time. Here education is classified into seven classes including (illiterate, read and write, school, precollege, bachelor, master and Ph.D). Besides, the pregnant women were asked regarding their family income level. This will be useful because, it is likely to reflect the mothers and fathers combined economic position. Income is likely to distinguish most directly to purchase power and selection of sufficient dietary intake. Respondent will be provided with four categories of income in the questionnaire. Accordingly, income levels classification including; (< 5000 Rs, 5000-10000 Rs, 10001-20000 Rs and >20000 Rs). Food consumption is varying clearly in different levels of activity. Thus recommended dietary allowance is assorted, subject to different occupation with various level of activity.

The questions were made to discover the maternal work status i.e. occupation of pregnant woman and her husband. Therewith, household activities of pregnant women were categorized according to general daily house chore including; washing, cleaning utensils, sweeping and cooking.
3.5.2 Section II, Information related to maternal parity and medical history

3.5.2.1 Maternal parity

In the present section various questions were taken into account for the sake of knowing maternal parity, last birth interval, expected date of delivery, last menstrual period date and age of pregnancy in week (trimester stage).

The variable of maternal parity is the present in questionnaire because of its influence on nutritional behavior during pregnancy. It is presumed that pregnant mother in their first pregnancy try more to keep the adequate intake and regularity, as compared to other pregnant mother, means the second and more experience of pregnancy (Szwajcer EM, 2005).

Age of pregnancy in weeks (trimester stage), the whole gestational period of nine months is great importance including including, three trimesters that accompany with physiological and hormonal changes. Such variable in first trimester influence the food intake due to occurrence of pica. Therefore, pregnant women are less interested in consuming the recommended dietary allowance. In third trimester, mother has limitation in consumption of food items. It is due to heartburn, constipation and etc. (L.Kathleen Mahan 2004).

Maternal anthropometric parameters such as weight before pregnancy and height that is essential to acquire the maternal pre-pregnancy body mass index. Hence it is included in the questionnaire. The maternal height and pre-pregnancy weight were collected from maternal antenatal card. In addition anthropometric measurements of their husband were included as well in the questionnaire and it was asked at the time of maternal
interview. In terms of following the growth pattern of foetus, likewise, foetus anthropometric measurements via the maternal sonography report were collected. These parameters comprised of foetus femur length, humerus length, abdomen circumference, head circumference and biparietal diameter.

3.5.2.2 Medical history of pregnant mother

In this part pregnant women were asked apropos of having any pregnancy complication and taking supplement tablets (Iron & Calcium) in pregnancy period.

Besides, the laboratory report regarding their Hb, sugar levels and blood pressure, pulse rate was recorded through the maternal antenatal card. In statistical analysis of maternal hemoglobin (Hb) level was classified into four categories based on ICMR, Hb classification. Finally, the candidates were asked during interview about having any chronic disease and also checked the antenatal card. Cases of chronic illness were obviously excluded from the present study.

3.5.3 Section III, Maternal dietary habits

Generally people were grouped as vegetarian or non-vegetarian. This variable was considered in questionnaire for finding out the importance of regular mealtime in pregnant women in these two groups and also by considering related question in this regard. In this section the maternal dietary habits are investigated. The various numbers of questions were built regarding the expectant mothers dietary habits. These questions were based on the women's appetite, number of daily eating meal, how often taking breakfast, daily taking glass of water, type of milk, quantity of milk intake, daily sugar intake and coffee consumption. In addition, some question were asked to find out the
maternal nutritional adequacy during pregnancy, whether they have the knowledge of nutritional requirements during gestational period.

### 3.6 Fetal Biometry

Fetal biometry is a methodology devoted to the measurement of the several parts of fetal anatomy and their growth. The ultrasound scanning provides the most reliable and important information about the fetal growth and wellbeing.

#### 3.6.1 Fetal biometric parameters:

**3.6.1.1 Biparietal diameter (BPD):**

This parameter is used in the second trimester, from 12th week onward. It measures the maximum distance between the two parietal bones taken from the leading edge of the skull to the leading edge i.e. outer to inner (Hadlock FP 1982).

![Foetus Biparietal diameter](image)

*Figure 3.1 Foetus Biparietal diameter.*
3.6.1.2 Head circumference (HC):

This parameter is used in the third trimester along with other parameters such as femur length (Ott WJ 1994, Exacoustos C 1991).

It is measured at the same level at which the BPD is taken by using the ellipsoid mode of the machine and adjusting the elliptical calipers to the outer margin of the skull table (Khalid Shehzad & et al. 2006).

Figure 3.2 Foetus Head circumference.

3.6.1.3 Abdominal circumference (AC):

This ultrasonic fetal biometric parameter is less used for the assessment of gestational age. It is however, more used for monitoring fetal growth, especially in the third trimester and for estimation of fetal weight (Campbell S 1975). The abdominal circumference is taken at the level where the umbilical vein enters the left branch of the portal vein alternatively, a scan at a slightly lower level showing a short segment of the
umbilical vein may be taken. The outline of the abdomen should be as circular as possible (Khalid Shehzad & etal. 2006).

**Figure 3.3** Foetus Abdomen circumference.

### 3.6.1.4 Femur length (FL):

Femur length is a very useful biometric parameter used in the second and third trimester of pregnancy. It grows linear throughout and is best measured after 14 weeks of gestation (Deter RL 1987, Yarkoni S 1985).
3.7 Gestational age

Gestational age at birth for each newborn was derived from the expected due date (EDC) calculated on the basis of both early ultrasound and the date of the last menstrual period (LMP).

3.8 Morphometry

Measurement of growth parameter was completed within 48 hours of birth. Length was measured using a stadiometer, a hard plastic platform with a vertical head band against which the crown of the baby's head was placed. The measurement from the crown to the soles of the feet was taken using the centimeter scale on the stadiometer. The head circumference was measured using a firm plastic tape. All measurements were made in
hospital by an experienced nurse. The birth weight was documented in the birth record immediately after birth before breast feeding.

### 3.9 Statistical Analysis

Data processing and statistical analysis were performed by using SPSS 11.5. Statistical analysis comparison, **descriptive** and **inference statistic** were carried out. At the commencement, descriptive analysis was accomplished to express mean, standard deviation, standard error of mean and minimum, maximum of continuous variables that consisted of; maternal macronutrients and micronutrients intakes, percentage of energy derived from macronutrients intake, expectant mother’s age, maternal pre-pregnancy BMI, gestational weight gain, maternal hemoglobin level during pregnancy, maternal anthropometrics measurements, foetal growth parameters, offspring birth measurements and graphical exhibition, constituents of pie chart, were depicted to describe the data easily. Accordingly, **Mean** that is known as arithmetic average, is the most common measure of central tendency. Its chief use consists in summarizing the essential feature of a series and in enabling data to be compared (C.R. Kothari 2006).

**Standard deviation** is most widely used measure of dispersion of a series and is defined as the square-root of the average of squares of deviations for the value of individual items in a series that are obtained from the arithmetic average. In the present study mean and standard deviation for all of the continuous variables that mentioned above were calculated (C.R. Kothari 2006).

**Coefficient of variation (CV)**, it is used in statistics for judging the variability and is calculated by dividing the standard deviation by the arithmetic average of the series and the resulting quantity is known as coefficient of standard deviation which happens to be a relative measure and is often used for comparing similar measure of other series.
When this coefficient of standard deviation is multiplied by 100, the result is known as coefficient of variation (C.R. Kothari 2006).

In this study **Coefficient of variation** for baby’s birth parameters among two genders, including; Birth weight, Head circumference and Length at the time of birth were calculated and compared with the birth measurements variability between baby girls and boy.

The data analysis was performed into two parts. The first part of analysis was conducted to uncover the relationship between independent and dependent variables. This analysis was coincided to the type of data means, **Chi-square test**, for qualitative variable.

**Independent sample T- test, multiple linear regression model and one-way ANOVA** for quantitative.

In the present study we assigned the variables into categorical data (qualitative or descriptive) and continuous variable (quantitative). **Quantitative** is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. **Qualitative**, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind.

Hence, **categorical variables** consists of education levels, economical levels, occupations, maternal household activities, pregnancy gravida, maternal pregnancy complication, consumption of type of milk, expectant women appetite, number of meal per day, dietary habits of taking breakfast during week, daily glass of water, daily milk intake, daily sugar using, pregnant women information sources, maternal Hb levels (hemoglobin level) categories and maternal BMI categories.

**Quantitative variables** including, anthropometric measurements of expectant mother, anthropometric measurements of their husband, maternal Hb levels, maternal pre-
pregnancy BMI, foetus growth parameters, new born growth measurements and dietary data with regard to 24 hours diet recall and food frequency questionnaire (FFQ), in which basically we made all of the subgroup food items in every group such as cereal, pulses, dairy product vegetables, leafy vegetables, meat, fruits, saturated oil and unsaturated oil as one food item in every group, as example; cereal group will be compacted into only cereals and convert them into daily amount. Moreover, because of too much variety of subgroup food items in each group, it was decided to summarize them. Furthermore, the approach that we used will be completely explained in data processing for quantitative variables.

Regression is of a statistical relationship between two or more variables. In regression, we have only two variables, one variable (defined as independent) is the cause of the behavior of another one (defined as dependent variable). Regression can only interpret what exist physically i.e. there must be a physical way in which independent variable can affect dependent variable.

Thus, the regression analysis is a statistical method to deal with the formulation of mathematical model depicting relationship amongst variables which can be used for the purpose of prediction of the value of dependent variable, given the value of the independent variable (C.R. Kothari 2006). Therefore, the linear regression model was used to find out the predictor variables for maternal foetal growth pattern and also after birth. The test was carried out among pregnant mother dietary intake and maternal confounders with foetal growth parameters and offspring birth measurements. So that, birth characteristics of the new born including; birth weight, birth head circumference and birth length were considered as dependent variable and maternal dietary intake, maternal confounders were taken into account as independent variables during
regression analysis. Likewise, the regression test was applied for foetal growth parameters as dependent variables and maternal dietary intake as independent variables. It is needed to verify the contribution between one foetus growth parameter with other foetus parameters. Therefore, foetal abdomen circumference, head circumference and femur length are treated as dependent variables and other foetal growth parameters considered as independent variables. The regression analysis result regarding foetal growth measurements is available in foetal analysis part. Finally, the non parametric Kruskall-wallis test was carried out to illustrate the effect of milk intake on newborn’s growth parameters and foetus as well. Applying this a test was based on the related histograms to baby’s growth measurements that has been given in appendix I and indicate that there is no normal distribution for each variables including; birth parameters (birth weight, length and head circumference) and foetus parameters (Average AC, Average BPD, Average FL and Average HC). Accordingly, the maternal milk intake was categorized based on average milk intake and standard deviation (SD) as follow:

Group 1) $\leq$ Mean – SD  [$\leq 155.65$ ml /day]
Group 2) Mean – SD to Mean + SD  [155.65 to 465.17 ml / day]
Group 3) $\geq$ Mean + SD  [$\geq 465.17$ ml / day]

The second part is about the foetal growth chart monitoring, chart plotting of foetal growth percentiles and configuration of foetus percentiles graph that was carried out by Grostat II software , is a statistical package for construction of growth centile models (Rasbash j et al 1988).

The multiple linear regression models were adopted to find out the contribution among foetal growth parameters and expectant mother dietary intake and other confounders.
3.10 Growth chart Monitoring

Monitoring of foetal growth measurements were carried out through centile growth chart. Growth charts comprised of; each foetal measurement for age were abdomen circumference, femur length, biparietal diameter, head circumference and age contain 15 th week till 36 th week of gestational period. Centile curves were obtained by Grostat II software. The below quadratic polynomial fitted as a suitable model for our data are given below.

\[ y_t = (a_{00} + a_{01} z + a_{02} z^2) + (a_{10} + a_{11} z + a_{12} z^2) t + (a_{20} + a_{21} z + a_{22} z^2) t^2. \]

Corresponding degree of above model is \(2 \ 2 \ 2\ 2\). In this model \(t\) represents time or age of foetus in week and \(z\) is the corresponding centile, for instance \(z=.5\) or \(.25\). \(y_t\) represents fetus measure at age \(t\).

In above model the degree \((2 \ 2 \ 2 \ 2)\), means, the first 2 is the degree of \(t\), the second 2 is degree of \(z\) for intercept, the third 2 is degree of \(z\) for \(t\), and the last 2 is the degree of \(z\) for \(t^2\). To illuminate our purpose the polynomial model for \((2 \ 1 \ 0 \ 1)\) is:

\[ y_t = (a_{00} + a_{01} z) + (a_{10} + a_{11} z) t + (a_{20} + a_{21} z) t^2. \]

Also the polynomial model for \((2 \ 0 \ 1 \ 0)\) is as below:

\[ y_t = (a_{00} + a_{01} z) + (a_{10} + a_{11} z) t + (a_{20}) t^2. \]

This centile curves charts are also called smooth growth centile chart. To obtain centile growth charts presented in next chapter (Result) we adopted different models for different fetus measurements. The degrees of polynomials were selected such that the minimum error or highest precision was met. Grostat II has command for this purpose and Statistical program code has given in Appendix II (Healy MJR et al 1988, Ayatolahi SMT et al 2001).
3.11 Data processing for qualitative variables

3.11.1 Age

The maternal age variable was asked directly in the face to face interview and also was recorded through their maternal antenatal card that was available in the respective obstetric department of the hospitals. The maternal average age and variance were 28.48 years old and 14.23 respectively. The maternal age minimum and maximum were 19, 38 years old respectively.

3.11.2 Education levels

The maternal education level was categorized into seven classes (illiterate, read and write, school, precollege, bachelor, master and Ph.D). After analysis, it was found out there was no frequency in the first three classes and the last one. Hence, the categories were decreased to three levels comprising (precollege and more- bachelor- master).

3.11.3 Family income levels

The family income levels were classified into the four levels such as (<5000 Rs. 5000-10000 Rs. 10001-20000 Rs.>20000 Rs.). The finding showed that, no frequency in the first class of category. Accordingly, family income classification reduced into three levels including (5000-10000 Rs., 10001-20000 Rs.,>20000 Rs.)

3.11.4 Maternal anthropometric measurements

3.11.4.1 Maternal height

Maternal height is one of the maternal anthropometric measurements which were recorded through their antenatal card that was available in the respective obstetrics
department of the hospitals. This variable is a continuous variable. For the sake of some analysis, it was categorized into three levels (<150 Cm, 150-155Cm., >155 Cm.).

3.11.4.2 Maternal pre-pregnancy weight

Another maternal anthropometric parameter is maternal pre-pregnancy weight, by which, it is essential for maternal pre-pregnancy BMI calculation. Similarly, maternal weight is an continuous variable. Owing to making the association between variables the chi-square test was needed to grouping the variable into three levels including (<45 kg, 45-60 kg, >60 kg).

3.11.4.3 Maternal pre-pregnancy body mass index (BMI):

Body Mass Index (BMI) is a tool for representing weight status by measuring weight for height. BMI is not valid while pregnancy and it should be measured pre- and post-pregnancy. (Online 3)

It can be calculated using the following formula for BMI:

\[
\text{BMI (kg/ m2)} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}
\]

In words, the calculation is expressed as “the weight in kilograms divided by the height in meters squared”. The maternal pre-pregnancy BMI was categorized based on institute of medicine (IOM) as follow: Under weight (BMI < 19.8)

- Normal weight (BMI= 19.8-26)
- Over weight (BMI> 26-29)
- Obese (BMI>29)

(L. Kathleen Mahan Sylvia 2004)
3.11.5 Baby's birth anthropometrics measurements

3.11.5.1 Baby birth weight

Baby birth weight is one of the essential birth characteristics that are reported by the hospital authorities after birth. In the present study birth weight was classified into three levels comprising (<2500 g, 2500-3000 g, >3000 g). The birth weight mean, standard deviation, minimum, maximum and variance for both genders separately were recorded in the fourth chapter (result). Birth weight classification was used to show the association between maternal parity with birth weight classification and baby's gender with birth weight classification.

3.11.5.2 Baby birth length

Baby length is one of the important birth parameter, which is considered as a criterion for monitoring the baby growth pattern. Baby birth length is recorded by the hospital authorities in centimeter scale. This variable is accounted as an continuous variable and it was categorized into three levels based on birth length mean and standard deviation. Moreover by adding and subtracting mean with one standard deviation, the first and second group will be created. Then the third group is considered more than mean added to one standard deviation. As follow; Mean-1 SD (first group)

Mean+1SD (second group)

> Mean +1SD (third group)

3.11.5.3 Baby Birth head circumference

The newborn growth pattern is followed by measuring the baby head circumference. Birth head circumference is an important parameter as far as other birth measurements.
This continuous variable was categorized according to mean head circumference and standard deviation. Similar to baby birth length classification, the same approach is adopted for grouping baby birth head circumference. As follow;

- Mean-1 SD (first group)
- Mean+1SD (second group)
- > Mean +1SD (third group)

### 3.12 Data processing for quantitative variables

Food frequency questionnaire (FFQ) was summarized into 9 variables such as cereals, pulses, leafy vegetables, vegetables, fruits, dairy product, meat, saturated oils and unsaturated oils. Each variable also had some items for instance cereal was subdivided into; jowar, bajra,…see Appendix III.

Through the questionnaire portion size (small, medium, large) and frequency of consumption were asked for each food stuffs. So the corresponding amount values of food stuffs were obtained by portion size × (frequently-consumption).

Another variable was attributed to determined how often food consumed frequently (daily, weekly, monthly, rarely and never).

All food stuffs consumption was considered daily in statistical analysis.

Therefore,

\[
\text{Food –items} = (\text{portion size} \times \text{frequently-consumption})/ a
\]

Where \( a = 1,7,30,100 \) for daily, weekly, monthly and rarely respectively.

Above calculation method was performed for all food stuffs. Then, the cereal variables was created as below

Cereals = chapatti +jowar+ bajra + bread +bakery products + khary + rice + others.
The same approaches were used to construct the rest of eight variables in statistical data analysis.

3.13 Z-score (standard score)

In statistical analysis of data whenever the variables in study possess inequality of scale, it means data have different range scale. Therefore Z score may use in data analysis and it causes to convert the variable into numeric interval approximately (-3.5, 3.5).

For instance Z-score for pulses can be obtained as follows:

\[ Z \text{- Pulses} = \frac{\text{observed value of pulses in sample} - \mu \text{ of pulses}}{\sigma \text{ of pulses}} \]

Where, \( \mu \) and \( \sigma \) are mean and standard deviation of pulses respectively.

The quantity \( z \) represents the distance between the raw score and the mean in units of the standard deviation. The corresponding Z value for each observation may be negative when the raw score is below the mean, and the Z may positive when the observed value is higher than the mean. Z score for each nine food stuffs where are obtained by the above calculating method. (Online 4)