The available literature on the topic of the thesis is under the following headings-

- Socio demographic Characteristics.
- Food Consumption Pattern.
- Health & Hygiene & cooking practices.
- Nutritional Knowledge.
- Clinical Observation.
- Nutritional Status.
- Nutrient Intake.
- Factors affecting nutritional status and nutrient intake.
- Role of Calcium, Oxalate & Phosphate in stone formation.

**Socio demographic Characteristics**

Dhruv et al. (2001) conducted survey on adult population and indicated in his study that the mean age of the adults was 43 years and majority of subjects 98.3% were Hindus and belonged to the higher income group. Around 6.7% of the subjects had received primary schooling and 66.7% were graduates. Majority of the subjects (75%) were housewives and 15% of them were in service.

Hussain et al. (2008) reported in the study of urban adults that 20%, 48% and 32% belonged to ST/SC, OBC and other category respectively. Nearly two third of them were belong to joint family. 57.8% of female and 13.4% of male subjects were illiterate, subjects with education level of high school or above were 38.8% in case of male and 17.2% for female majority 85.60% were married. Per capita income was less than Rs 400/- in (31.6%) of study subjects whereas (36%) and (32.4%) were per capita income (PCI) Rs.
400/- to Rs. 800/- and more than Rs. 800/- respectively. 36.6% male and 51.7% female were vegetarian while 80% of the adults were of middle SES and 20% were of low SES, 38.1% of male and 24.1% of female had light physical activity pattern.

Rao et al. (2010) observed that 16% of the house in rural area was pacca (Brick wall with RCC roof) in nature whereas katcha (mud wall with thatched roof) observed in 22% and remaining houses 61.9% was semi paccaka. It was also observed that 63.5% of rural families were nuclear type while the percent of joint and extended type of nuclear families were 18.4%, 18.2 respectively. The average family size was 4.9 and involvement of women in agriculture was 15.3% and in labour 28.2%, business 9.2% service 8.9% etc.

Boven et al. (2011) conducted a study on urban & rural adults, in his study reported that mean age of men and women were 42 and 40 years respectively, socioeconomic status was slightly lower in rural area than the urban. Over 80% of the participants were married but the proportion of married was lower in rural men (81%) and women (76%). The proportion of participant with secondary education was lower in rural than urban groups. Over 90% of the sample was of Hindu religion, although the proportion was slightly lower in urban group (85% in men and 87% in women).

Jethi and Chandra (2013) observed in the study of farm women of hills of UttraKhand that the mean age of farm women were in age group of 31-45 yrs. 54.3% respondents were educated up to primary level. The average family size was 6.3 and in that village 49% of respondents has nuclear families and 40% household had agriculture as their major occupation.

Andrew et al. (2013) found that the majority of both urban and rural residents (47.8 and 45.6) had secondary education. The respondents were mainly artisans, farmers, traders, students, apprentices or unemployed.
Prabhat et al. (2014) conducted a study in South Karnataka and found that nuclear families formed 67% and joint families are 24%. Maximum 97% of the families comprised of less than 6 members. Majority of the respondents practised (66%) Hinduism followed by Jainism. There was an essentially similar distribution of the families practising vegetarianism/non-vegetarianism. 64% of male and 54% of females were literate, had graduate and professional degree. 59% of female counterparts were businessmen. Other professions were teachers, professionals while 20 and 21% of male and female adults work on daily basis.

**Food Consumption Pattern**

Rosse et al. (1996) reported that with respect to food consumption, urban women are reported to have better access to a variety of food items. India is known for its diversity in culture and believes, so also their eating behaviours are known to have different dietary habits.

Kumari et al. (2002) conducted a study on rural area of Samastipur district and found that only 5.5% of the adults were consuming green leafy vegetables daily, though 42% of the families were consuming pulse daily the amount consumed was rather low. Around 40% of the families did not consume fruits at all. Only meagre percentages 1.5 were consuming fruits daily. About 23% of the families were consuming milk daily and that too very small. Although, all the family consume fat and oils daily, the amount is small. 45% of household had fleshy items weekly and 38% occasionally.

According to the study of Worsley (2002) the status and explanatory rate of nutrition knowledge is uncertain in public health nutrition. Much of uncertainty about this area has been generated by conceptual confusion about the nature of knowledge and behaviours and nutrition knowledge and food behaviour in particular. In this study, it was found that nutritional knowledge is necessary but not sufficient factor for changes in respondents food behaviours.
Food behaviour is influenced by a number of environmental and intra-individual factors, including motivations. The interplay between motivational factors and information processing is important for nutrition promoters as is the distinction between declarative and procedural knowledge. A brief survey of the recent literature shows that the evidence for the influence of nutrition knowledge on food behaviour is mixed. Nevertheless, recent works suggest that nutrition knowledge may play a small, but pivotal role in the adoption of healthy food habits.

Rasmussen et al. (2006) reported that a large body of epidemiological evidence suggests that a high intake of fruits and vegetables help to promote health and to prevent chronic diseases. In most developing countries, large population groups including children, adolescent and adults eat far less than the recommended amounts of fruits and vegetables.

Rout (2009) said that food habits are predictors of health and nutritional status culture and socioeconomic status of the population influences food choices and pattern of consumption, while consumption of some food items is likely to vary according to season and often based on availability and price, education and income have been shown to be important determinant in food intake.

Mahapatra et al. (2009) carried out a study in rural and urban area of Varanasi district and information related to food consumption was collected and found that about three fourth (74.3%) took meal two times per day where as 90% and 39.9% were habituated for drinking of tea and milk. The mean intake of milk was observed to be 167.0 ± 89.0 ml per day.

National Adult Nutrition Surveys (2011) it was indicated that participant were ranked the food choice motives based on importance to them when making their food selection – taste, cost (price), health and nutrition, convenience, feel good (mood) and weight control. Taste 41%, followed by
health and nutrition 36% were considered the most important motives by the majority 77% of adults. There were no significant differences between men and women with the exception of weight control.

Boven et al. (2011) conducted a study on consumption pattern of urban and rural adults and indicated that the median intake of fruit in urban male adult (146 g) was higher than the rural group (101 g). For vegetables, sugars and dairy products there was a trend of increased consumption from rural to urban (e.g. sugar consumption in women was 26 gm in rural and 35 gm in urban), which is significantly higher.

Prabhat et al. (2012) observed that the consumption of cereals was daily. Fruit and eggs were consumed two times a week to 2 to 3 times a month. It was notable that intake of grains was appreciable since 28-46.3% women consumed daily. It was also observed comparatively less percentage of women from vegetarian group were overweight against those of non vegetarian. Central obesity was prevalent in 90-100% of women regardless of their BMI.

Jethi and Chandra (2013) studied on the rural females of hills of Uttrakhand and reported that the intake of cereals and pulses was less than recommended dietary intake (RDI) during both the season (summer and winter). Consumption of all food groups except fats and oils was found to be higher among the women of adopted villages. Milk consumption was more than RDI in adopted village under VPKAS project. Consumption of green leafy vegetables and other vegetables was more during winter season due to seasonal availability, but it was still lower than RDI. The consumption of other vegetables, fruits, fats, & oil was lower than suggested level.

Andrew et al. (2013) studied the food consumption pattern of the urban and rural adult of Nigeria and observed that all consumed fruits only 15.7% on both urban and rural area did so every day. Daily consumption of uncooked vegetables was generally low but urban participant were better consumer than
rural areas (6.9 % to 5.4%). On the other hand, daily intake of cooked vegetables was relatively high specially among the rural residents. A large proportion of respondents rarely or sometimes consumed soft drink, sweet/chocolate, tea or coffee with sugar and fast food/pastries. The intake of fast foods, noodles and pastries were higher in the urban than rural areas.

It was also reported that because of economic development people have begun to shift from consumption of traditional foods towards the consumption of processed and refined foods. Information on the food consumption patterns in the general population will no doubt be a useful tool in formulating public health intervention against NCDS. In this study, it was concluded that the adult population maintained their traditional food habits which is high in roots and tubers, cereals and vegetables and consumed less of the foods considered to be less healthy such as fast food/pastries, chocolate, minerals, sugar and alcohol. However, the consumption of fruits which are considered to have potential health benefits was very low. The continued consumption of these traditional foods and avoidance of less health ones should be emphasised through health education while a surveillance team should be established by stakeholders to routinely monitor any changes in their dietary habit for early intervention aimed at sustaining the healthy food consumption pattern.

Shirdhar et al. (2014) reported that 32.2% respondents were vegetarian and 67.2% were non-vegetarian. Among vegetarian, 56.5% were men and 43.3% were women and 32.2% lived in a rural region and 35.9% were urban and rest of migrants. Vegetarians had a significantly higher standard of living were less likely to smoke (7.5%) or drink (5.7%) alcohol and more likely to be urban dwelling. Vegetarian consume greater amount of legumes vegetables roots and tubers dairy and sugar while non-vegetarian had greater intake of cereals, fruits, spices and salt as well as more fats and oils.
Iza et al. (2014) found that the frequency of food consumption is associated with several socioeconomic, demographic, personal and environmental factors such as gender, age, economic status, place of residence, nutrition knowledge, attitudes, self-efficacy, perceived barriers, family structure. Daily consumption of healthy food such as fruit and vegetables is related to the availability, accessibility, cost and quality of the food.

International and national studies suggest that dietary pattern may differ between population in urban and rural areas due greatly to the particular phenomenon of each region for example the fact that the population residing in rural areas have lower level of education and income. The dietary habits of the urban population present a considerable reduction in household consumption of food which requires longer preparation time such as rice beans and roasted potatoes. It was also observed that in urban areas a tendency to decreasing intake of fruit and vegetables and an increase in the daily consumption of food with high sugar and fat quantities such as soft drinks, bread, beer, pizza and filled cookies while in rural population there was a tendency to increasing the intake of grains.

Addiction Habit

Hussain M.A. et al. (2008) showed that 51.5% of male and 30.4% of female have tobacco consumption.

Ebrahim et al. (2010) reported in his study that smoking and drinking alcohol were rare among women. It was also observed that the smoking and alcohol consumption was more in rural than the urban.

National Adult Nutrition Survey (2011) indicated that 89% of 18-64 years old (men 92%, women 86%) and 72% of adults aged 65 years and over (men 77% and women 67%) reported that they were alcohol consumers. Among self reported alcohol consumers 29% of men and 24 % of women aged
18-64 years reported alcohol consumption greater than the maximum recommended weekly alcohol intakes.

Arlappa N. (2012) found in his study of urban population of Khamman town that the proportion of smokers and alcoholics was 27.2% each, among the urban adult population.

Qureshi et al. (2013) observed in the study of urban and rural areas of Hyderabad that the proportion of smokers and alcoholics was 38% and 34% respectively, and the proportion of smokers and alcoholics was relatively high in rural areas.

**Health, Hygiene and cooking practices**

Deshpande et al. (1994) in their study concluded that women in rural area posses average knowledge (50%) about the health practices but they should receive more education through available media. The efforts by voluntary women organization should also be directed to rural women necessary practical education regarding health practices, by conducting campus and rural stay programmes.

Moser C.M. et al. (1996) reported that there are three distinctive characteristics along which urban poverty and vulnerability differ from rural poverty, commoditization, environmental hazards and social fragmentation.

Prasad, B.A. (2013) said that sanitation is linked with the livelihoods and incomes. Urban poverty is generally associated with poor quality housing, overcrowded, unsanitary slum settlements, ill health related to spread of infectious diseases, the threat of exposure to environmental hazards and fear of eviction from illegal squatter in precarious location.

Mittal M. (2013) found that most of the samples were following healthy practices related to health, hygiene and nutrition. 85% and 95% of the study group was consuming the right food to keep their bones healthy and for blood
formation respectively. Most of the subjects were following healthy cooking practices like washing vegetables before cutting them and also cooking in covered vessels or pressure cookers to keep the nutrients intact. Most of them were also following healthy sanitation practices by keeping their surroundings clean and also taking care of the hand hygiene.

**Nutritional Knowledge**

Azemati B. et al. (2013) found that malnutrition is mostly due to lack of nutritional knowledge rather than food insufficiency. The data of the budget of the family shows that expenses on food item constitute 41.3% of the whole income of an average urban family while this ratio is 65% for a rural family. It was indicated that for knowledge, 26.5, 52.7, 20.8% for attitude 27.6, 48.9, and 23.5% and for practice 27.4, 51.7 and 20.9% of individual had desirable, moderate and weak knowledge scores. This study emphasized that age, gender and education are among the factors that can influence nutritional knowledge attitude and practice.

Mittal, M. (2013) conducted study on rural women in the village Bashahpur, Gurgaon and observed that the general awareness about the commonly occurring diseases, their symptoms, health and hygiene was found to be average. About half of the samples got 50% of the responses correct. The mean awareness score and the mean awareness quotient were found to be 12 (±3.2) and 0.54 (±0.12) respectively. The maximum score was found to be 18 out of 22. The awareness about the cases and symptoms of anaemia was 17% and 34% respectively, which was very low. Most of the samples knew that calcium provides strength to the bones and also knew the food products rich in calcium. While 60% of the subjects were aware about the ill-effects of high SFA intake, only 16% knew that vegetable oil prevents heart diseases. About 75% of the samples were aware about the role of fruits and salads in relieving constipation. While 97% of the study group knew vitamin A rich sources, only
50% of them were aware about the role of vitamin A in preventing night-blindness. The awareness about cleanliness and hygiene was found to be higher with 100% samples knowing the cause of malaria and 81% knowing the importance of hand hygiene.

Zhang YP. et al. (1993) reported that nutrition knowledge attitudes practices (KAP) surveys of adults aged 18 to 55 were conducted in an urban and a rural area of Sichuan. The results indicated that the nutrition levels in both sites were low, and an awareness of the relationship between nutrition and certain common diseases was lacking. However, both urban and rural adults possessed good attitudes toward nutrition and nutrition education. Large differences existed between urban and rural adults' food patterns, with the rural diet more monotonous than the urban one.

Du W. et al. (2010) reported that the total scores of the field of nutrition knowledge and nutrition attitude were higher in urban adults than those in rural adults. The total scores of the questionnaire and the field of dietary behaviour and social environment influence were better in females than in males, which indicated that the female put more attention on nutrition. There was no difference among age groups on nutrition literacy. The nutrition literacy increased with educational level. The highest score on nutrition knowledge, nutrition attitude and social environment influence fields were observed in the group with college education. The study showed that the nutritional literacy status of adults was influenced by the area, gender and educational level. Urban adult, female and higher educational level were positive factors for nutrition literacy.

Lin W. et al. (2010) reported that adults' knowledge on 'relationship between diet and disease' and 'comparison of foods in terms of specific nutrients' is acceptable. However, they lack knowledge on 'daily serving requirements' and 'weight and weight loss'. Although they recognize the
importance of nutrition, nutrition was not the major concern of food selection. Significant differences were found among gender and age groups. Females of most age groups are better than males in many aspects of nutrition knowledge, attitude and behaviour except emotional and external eating behaviour. Young (age 19-30) and prime (age 31-44) adults have better knowledge than that of middle adults (age 45-64), while prime adults hold a more positive attitude than young adults. As for nutrition behaviour, prime and middle adults are better than young adults. Nutrition knowledge and attitude of adults in urban areas is generally better than those in suburban and remote areas. However, adults in urban areas perform ‘emotional and external cued eating’ more frequently than those in suburban and remote areas.

**Clinical Observations**

Ahmed (2008) conducted study on nutritional status amongst the women of rural Bangladesh found that out of total 501 women participants, regarding nutritional deficiency, about half of the rural women (52%) had some form of signs relating to vitamin A deficiency and 65% had signs of vitamin B complex deficiency either in the form of glossitis or of angular stomatitis or both.

Rao Mallikharjuna K. (2010) observed that the prevalence of bitot spots a sign of vitamin A deficiency was 0.3% among rural women. The prevalence of angular stomatitis sign of B complex vitamin deficiency 0.8% and about 12% of rural women had dental caries. The prevalence of goitre was 0.8%.

Gupta et al. (2012) said that clinical examination or observation is a method based on examination for changes and related to inadequate nutrition, that can be seen in superficial epithelial tissues, especially skin, eyes, hair, or in organs near the surface of the body. Nutrition is the most basic need being a major determinant of health, labour productivity and mental development.
Clinical examination is an important indicator, which reveals nutritional deficiency signs for assessment of nutritional status of communities. Assessment of nutritional states of community is one of the first step in the formulation of any public health strategy to combat malnutrition (Indu et al. 2012).

Moyel N.et al. (2012) reported that thinness and sparseness of hair found among 10% respondents, easy pluck ability of hair 18%, pale conjunctiva 26%, swollen gums 10%, dental cavities 34%, rough and dry skin 14%, spoon shaped nails in 4% respondents.

**Nutritional Status**

Ismail M.N. et al. (1995) found that in Malayas prevalence of CED for males and females were 7% and 11% in urban areas and 11% and 14% in rural areas respectively. In the males it is interesting to note that there is a two-fold difference between urban and rural, while a high prevalence overweight woman even in the rural areas should be viewed as a potential health problem of future.

Ramachandran A. et al. (2003) Asian Indian phenotypes have high body fat with relatively less lean body mass and marked abdominal obesity. A growing number of urban women aged above 35 years with gradual showing down of metabolic rate are falling victim to sedentary life styles, rich food, lack of exercise and diets with increased protein and reduced carbohydrates have been shown to improve body composition, lipid and lipoprotein, protein profile and glycaemic regulation associated with treatment of obesity and weight loss.

NFHS-3 report (2005-06), according to this report the prevalence of under nutrition in adults is higher in rural area as compare to urban area. Over the last three decades there has been a progressive decline in under nutrition and some decrease in over nutrition both in urban and rural areas. Prevalence of
both under nutrition and over nutrition are higher in women as compared to men.

Brett G. et al. (2008) said that families in rural India simply do not have the resources to obtain sufficient food. Malnutrition leads to death, disability, stunted mental and physical growth and slowed national socio-economic development. Nutrition is one of the key factors, which helps each person to attain his/her full potential as an adult and it depends to a great extent on the quality and quantity of food. Body mass index is considered to be more nutritionally and genetically related. Thus, in a country with diverse ethnic group like India it is more appropriate to use BMI as an indicator of the nutritional status of the adult population. Malnutrition remains a devastating problem in rural area with over 28% of the population malnourished. An association was found with age, family size, number of male member in the family, caste. A significant association between BMI and educational status was exists.

Hussain M.A. et al. (2008) conducted study on urban adult of Varanasi district and observed that mean height, weight and BMI were 160.0cm, 57.38 kg and 19.84 kg/m$^2$ for men and 150 cm, 51.86 kg and 22.92 kg/m$^2$ for women respectively. About 42.11% of men and 15.5% of women were thin, while 13.53% of men and 24.13% of women overweight/obese.

Banik S.D. (2009) in his cross-sectional study in the perspective of anthropometric assessment of health and nutritional status has been undertaken among the adult male samples (aged 18 years and above) of three endogamous and tribal communities of eastern India viz. Oraons, Saraks and Dhimals. The situation of the Oraons was worse (53.10%) followed by the Sarak (27.85%) and the Dhimals (27.04%) with respect to low body mass index (BMI) and high degree of undernutrition (BMI < 18.49 kg/m$^2$). Sizeable proportion of each of these populations was observed to have poor nutrition, as evaluated by the
standard cut-off values of MUAC. This study displayed that prevalence of high level of under nutrition and considerable percentage of non-obesity in these populations. Age variation of anthropometric characteristics and nutritional status grossly showed conspicuous negative trend of the parameters with the advancement of age with a minor exception.

Sundar A. (2009) said that the individuals belonging to the higher age groups exhibited higher mean BMI values and a higher prevalence of overweight and obesity. The increase of overweight and obesity among middle and higher aged individual could be attributed to the accumulation of body fat, increased energy intake, fat rich diet and relatively less energy expenditure due to lesser environment in physical activities and a general modification in lifestyles.

Ebrahim et al. (2010) observed that there were strong significant differences in BMI of both men and women between urban and rural people. The average BMI for urban men and women was 24.3 kg/m$^2$ and 25.9kg/m$^2$ while in rural areas of men and women was 21.9kg/m$^2$ and 22.5kg/m$^2$ respectively. Obesity prevalence (BMI 7.25kg/m$^2$) was in urban women (53.5%) than lower in men (18.0%). Percentage Body fat estimated from skin fold thickness showed markedly higher values among urban women and men than the rural dwellers.

Rao, Mallikharjuna K et al. (2010) observed that the prevalence of chronic energy deficiency (CED) was significantly higher among tribal women than the rural women and the prevalence of overweight and obesity was higher among rural women than the tribal women. 34.1% rural women have normal BMI while 11.4% have obese but maximum percentage (54.5%) of rural women were having low BMI and suffered from CED.

Dhruv S. et al. (2011) conducted a cross-sectional study among the urban population of Vadodara city and reported that the mean BMI and waist
circumference was $25\text{kg/m}^2$ and 88 cm respectively. The subjects had higher waist hip ratio (0.86). It was also observed that the prevalence of overweight was 21.7% and that of obesity was 48.3% among the subjects. Majority of the subjects had higher than normal values for waist circumference and waist hip ratio.

Mandal S. et al. (2011) indicted in the study that women’s nutritional status has important implication for her health as well as the health of her children. One commonly measured used indicator i.e. body mass index (BMI $\text{Kg/m}^2$) was used to evaluate the nutritional status of the subjects. Based on BMI, chronic energy deficiency (CED) was used as a measure of under nutrition. The mean BMI of the subjects was 20.05 $\text{Kg/m}^2$. They also found that there was a significant increase age trend in mean BMI. The overall age combined prevalence of CED was 28.3%, overall only 4.5% belonged to the overweight category.

Subramaniam S. V. et al. (2011) conducted a cross-sectional analysis of nationally representative sample of women aged 15-49 years drawn from 54 Demographic and Health Survey conducted between 1994 and 2008. They reported that the mean BMI across all 54 countries was 23.0 and the percentage of overweight was consistently higher among women of higher SES.

Venkaiah K. et al. (2011) conducted a community based cross-sectional study to assess the diet and nutritional status in Orissa state, India reported that 53% of the men were correctly classified as either with chronic energy deficiency (CED) or without CED. Similarly, overall 54% of the women were correctly classified as either with CED or without CED. The sensitivity of the model was 65% for both men and women and the specificity was 46% and 41% respectively for men and women along with high sensitivity. It was also observed a strong relationship between the dietary patterns and the nutritional status of the adults.
Amare B. et al. (2012) have conducted a cross-sectional community based survey involving 356 participants (71.3% female and 28.7% male with mean age 37.7% years urban residents in Northwest Ethiopia. Undernourished, overweight and obese subjects composed 12.9%, 21.3% and 5.9% of the participants, respectively, men were taller heavier and had higher waist to hip ratio compared to women (p <0.05). Fish, fresh fruits and vegetables were consumed less frequently or never at all by a large proportion of all the subjects. Oil and butter were eaten daily by most of the participants. Mean energy intake fell below the estimated energy requirements in women (1929 versus 2013 Kcal/day, p=0.05), while it was significantly higher in men participants (300 vs. 2510 Kcal/day p=0.007). Protein intake was inadequate (<0.8 g/kg/day) in 11.2% of the participants, whereas only 2.8% reported carbohydrate intake below the RDA (130g/day). Inadequate intakes of calcium, iron, thiamine, riboflavin, niacin and ascorbic acid were seen in 90.4%, 100%, 73%, 92.4%, 86.2% and 95.5% of the participants.

The study explored the relationship between somatic status, dietary intake, energy expenditure and nutrient intake among rural women in South India. Results indicated that 18.7% of women were suffering with chronic energy deficiency 42.3% were normal 27% were overweight and 12% were obese. Body mass index increased in women with increasing age with an increase TSF and waist-hip ratio. Food frequency indicated that the diet was cereals based with less of vegetables and fruits, low in diversity and over dependence an locally grown produce. The diets were sufficient in energy and protein content though high in fat, calcium and thiamine were adequate, whereas iron, vitamin A, riboflavin, niacin, and vitamin C were inadequate. The energy expenditure of women with low BMI was more than the intake (-276 Kcal/day), in normal women the difference between expenditure and intake was -131 Kcal/day and in overweight women it was -6 Kcal/day. Obese women had an intake of +65 Kcal. Using TSF and WHR, similar results were
seen where in calories deficit was higher in women with lesser body fat. As women grew older, the physical activity lessened and gradually calorie intake was more than needed resulting in slow increase in weight over years (Prakruthi B. S. and Prakash J. 2012)

Kapoor S. et al. (2012) conducted a cross-sectional study on 1435 male adults. Males of India categorized on the basis of nutritional status (undernourished and normal) and age groups. Nutritional status was assessed by body mass index and mid upper arm circumference in association with various skin fold thickness. It was also observed that under nutrition increased with advancing age. Correlation analysis of height, weight, skin fold thickness and adiposity indices with age and BMI reflects a significant decline in various anthropometric variables with progressing age except for body fat percent.

Nutritional status as reflected by height, weight and other anthropometric measurements are true indicators of a population’s health status as these anthropometric variables are closely related to a population’s nutrition, genetic makeup, environmental characteristic, social and cultural conditions, lifestyle functional status etc. Anthropometric appraisal has always been an essential feature of nutritional evaluation for determining malnutrition, overweight, obese, muscular mass loss and adipose tissue redistribution.

Jethi & Chandra (2013) found that prevalence of chronic energy deficiency was found to be higher among the farm women of non-adopted village than adopted one by VPKAS project running in the hills of Uttrakhand.

Qureshi A. et al. (2013) conducted study an rural and urban adults of Hyderabad and surrounding villages. The prevalence of overweight/obesity (BMI ≥ 23.0) and abdominal obesity was about 72% each and the proportion of smokers and alcoholics was 38% and 34%, respectively and prevalence of overweight was significantly higher among subjects with sedentary physical activity and those regarding in urban area. It was also reported in the study that
the mean height and weight among rural men were 165.1 cm and 71.1 kg while the corresponding figures for females were 150.9 cm and 52.3 kg, respectively. In case of urban adult men the mean height and weight were 169.5 cm and 70.0 kg while for women 159.7 cm, 65.0 kg, respectively. A significant difference was observed with respect to variable such as socio-economic status, smoking and alcohol consumption, physical activity and obesity between rural and urban adults. They also found that association between nutritional status & different socio-demographic factors and a significant difference was observed between nutritional status and socio-economic status, alcohol consumption, physical activity and obesity except for smoking higher among adults of urban areas with sedentary activity and those belong to middle socioeconomic status and residing in puccka houses.

Neuman M. et al. (2013) said that in the last two decades the mean BMI has increased globally, notable increase occurring in low and middle income countries (LMICS). Urbanisation or substantial population growth in urban areas of LMICS is frequently cited as an underlying cause of the rise in global overweight. It was found that urban residents of LMICS are more likely to work in sedentary employment use motorized transportation and eat diet high in processed grains and sugars of the population in LMICS migrates into urban areas, hence the mean BMI will correspondingly increase.

Sen J. et al. (2013) studied 600 adults of Bengalee Hindu caste population of age group 20-60 yrs residing in the district of Jalpaiguri, West Bengal, India indicated that the male individuals were taller and heavier than their female counterparts. The mean height and weight were significantly higher among the male (163.94± 6.03 cm and 57.88 ± 8.76 kg) than the females (151.35 ± 5.63 cm and 53.15 ± 8.35 kg). The mean BMI observed to be significantly higher among females (23.19 ± 3.28 kg/m²) when compared with men (21.50 ± 2.82 kg/m²). The prevalence of overweight was higher among the male as compare to female individuals (23.67% versus 20.33%) but the
difference was not significant. It was also found in their study that prevalence of overweight was significantly different with respect to age and monthly income while the prevalence of obesity was significantly different with respect to sex, age, monthly income, marital status and education.

Ramachandran P. (2013) reported that it is well recognised that there are large differences in stature and consequently in body weights of adults between countries and even between different regions in large countries. Research studies mostly from developed countries had shown that BMI < 18.5 kg/m² is associated with low dietary intake and therefore has been accepted as the indicator of food insecurity. Low BMI is associated with functional changes such as reduced work capacity for manual work and increased susceptibility to infection.

Prabhat A. et al. (2014) conducted study in adult men and women of South Karnataka and indicated that the mean age of anthropometric profile of the participant of male and female was 54.0 and 47.0, mean height was 165.0 and 157.0, respectively. Female were shorter than their male counterparts and also lighter since men weighed on an average 64.6 kg, while female weighed 60.3 kg, their actual body weight closer to their ideal body weight. Thereby men and women were found in the normal body mass index. The mean waist and hip circumference for males were 92.9 cm and 84.6 cm, respectively. The waist circumferences for both men and women were high indicating abdominal adiposity. When waist hip ratio was computed all men and women had WHR more than 1.0, thus, have central obesity. It was concluded that majority of the couples had ideal body weight, but their WHR was high indication of central obesity, i.e. the characteristics of Indian population.

**Nutrient Intake**

NNMB report (2002) according to this report intake of protein, energy, vitamin A and riboflavin were less than RAD in almost all states.
Harinarayan C.V. (2007) observed that the daily dietary calcium intake of both the urban and rural population was low compared with RDA. Dietary calcium and phosphorus was significantly lower in rural adults than in urban adults.

Kumari S. and Singh S. (2008) – The intake of energy calcium and iron were lower than respective RDA. Protein intake was almost closer to RDA. Percentage of RDA met was higher for protein followed by energy. It was also found percentage of RDA met for energy and protein was comparatively higher for females than males whereas it was lower for calcium and iron for females.

Mahapatra S.C. et al. (2009) conducted a study on rural and urban adult and indicated that 65.3% of rural and 50.9% of urban male respondents were taking energy less than RDA while 36.4% of rural and 17.7% of urban women were taking energy less than their RDA. The energy intake decreased as age advanced in both the rural and urban area. It was also indicated that adults 74.6% in urban area and 69.3% in rural area took protein less than 80% of RDA where as in female subjects this percentage was found to be much lower than the male subjects in both the areas.

Ebrahim S et al. (2010) has also found that for both men and women fat intake was more than the rural people.

Bowen L. et al. (2011) conducted a study among urban and rural respondents and found that the energy intake was lowest in rural participant than the urban in both men and women. Rural men & women have average energy intake 2731 and 2151 Kcal while in urban men and women it was 3225 Kcal and 2644 Kcal respectively. The same pattern was seen for fat, saturated fat, carbohydrate and protein, all these nutrients intake was lower in rural than the urban respondents. Carbohydrate intake in rural male & female was 334 gm & 344 gm while in urban it was 501 gm & 413 gm respectively. Fat intake was
found 73 gm & 59 gm of rural male and female on the other hand in urban area it was 92 gm & 72 gm respectively.

National Adult Nutrition Survey (2011) found that men had higher intakes of energy and all macronutrients than women. For both men and women energy intake decrease with increase of age. Over half of energy intake in the adult population came from meats, breads, potatoes, dairy products and biscuits/cakes. Among 18-64 years old fat provided 37% of food energy on average with 63% of the populations exceeding the generally recommended upper limit of 35% food energy from fat. Carbohydrate provided 45% of food energy on average. The main contributor to fat intakes were meat, milk, fats and oils and to carbohydrate intakes were breads, potatoes and breakfast cereals.

Jethi R. and Chandra N. (2013) concluded that energy consumption per capita per day in adopted and non-adopted village was 2054 Kcal and 1739 Kcal which is 7.7 and 21.8 percent less than recommended level. Iron intake in the daily diet of women in adopted and non adopted village was found to be 18 mg and 16 mg which is respectively 40% and 46.6% less than the RDA level (30 gm).

Prabhat A. et al. (2014) indicated that energy intake in general for both males and females was less, compared to RDAs. Nevertheless females were found to meet 85% of requirement while male member consumed only 64% of the RDA. Protein intake of males was found to be 83% RDA while female consume enough proteins thereby their mean intake was essentially similar to their respective RDAs. Fat intake in general was high wherein intake among females was markedly higher as compared to males. Female were consuming three times more fat than their RDA while men consume 1.3 times higher. Calcium, iron intake was satisfactory. Majority of nutrients consumed by
females were higher those of males according to percentage sufficiency calculated.

Sridhar et al. (2014) reported that vegetarian consume less fat and protein and more carbohydrate. It was also observed that a higher proportion of vegetarians consuming protein, iron, calcium at RDA level than non vegetarian with less total energy intake. Both vegetarian and non vegetarians consumed less fibre than the RDA.

Factors Affecting Nutritional Status & Nutrient Intake

Sweeting H. et al. (1994) – Nutritional status was found to be positively related with any level of education and mode of payment.

Christina A. et al. (2002) said that food selection and intake is a multifactorial behaviour influenced by affordability and the food culture prevalent. Food studies have demonstrated that family income positively correlates the frequency and quantity of consuming protective foods and energy foods. Although knowledge about foods and their requirements play an important role in food selection since there is a close association between food intake behaviours and nutritional status of people. It is apparent that such data help to assess risk factors in the development of non-communicable disease in the given community.

Hussain M.A. et al. (2008) found that per capita income significantly associated with BMI. Subjects with low per capita income were higher risk of thinness as compare to that of high per capita income, who were at higher risk for obesity particularly in females. It was also observed that tobacco consumption was independently associated with low BMI may be due to the effect of tobacco on physiological process that leads to changes in appetite, food preferences and basal metabolic rates. Subject with low SES pose to higher risk for CED because due to low SES they have low dietary intake and
vegetarian diet which were deficient in many nutrients. Female subjects from joint family system and belonging to other caste category are less active and thereby likely to spend less calories and likely to have more positive energy balance. Education, occupation, dietary pattern, per capita family income significantly influencing for men whereas for women caste, type of family, pattern of physical activity and marital status exerted significant influence.

Rao Mallikarjuna K. et al. (2010) said that the nutritional status of women is linked to their status in society. The demographic consequences of the women has formed expression in various forms such as female infanticide, higher death rate, lower sex ratio, low literacy level and lower level of employment of women in non agricultural sector as compared to men. Generally at household level, cultural norms and practices and socioeconomic factors determining the extent of nutritional status among women.

Kaur G. et al. (2012) conducted a study on adult women of age group (21-60 years) of Ludhiana and reported that a gradual increase in anthropometric and body composition parameters such as weight, waist circumference, hip circumference, body mass index, fat mass and visceral fat ratio was observed with the advancement of age.

Jethi R. and Chandra N. (2013) reported that education, energy consumption and protein consumption have significantly positive relationship with nutritional status of respondents whereas family size has significantly negative relationship with nutritional status.

Role of Calcium, Oxalate & Phosphorus in Stone Formation

Sing P. P et al. (1972) indicated that among the urban population oxalic acid intake is comparatively high in the upper income group. It has been observed that in his group tea intake is higher and green leafy vegetables are
liberally supplemented to enhance the mineral, vitamin and roughage values of diet is also rich in oxalate content.

Holmes R. P. et al. (2000) emphasize that the amount of oxalate ingested may be an important risk factors in the development of idiopathic calcium oxalate lithiasis. The main sources of dietary oxalate are plants and plant products principally seeds and leafy plants related to spinach and rhubarb. In contrast, negligible amount of oxalate occur in foods of animal origin. The consumption of large amount of oxalate induces the calcium oxalate deposit in body tissues and stone disease. The concentration of calcium in urine is normally much higher than oxalates. Small changes in oxalate concentration have much greater effects on calcium crystallisation. Urinary oxalate is derived predominantly form two major sources: Liver synthesis and the absorption of dietary oxalate.

It was found that oxalate intakes ranged from 44 to 357 mg/day with a mean daily intake for the whole group of 152mg/day. There is variability between the amounts of oxalate present in food items content absorbed. This variability caused by food processing, food preparation and factors that influence the bioavailability of the food oxalate after its ingestion is another consideration. A normal portion of an oxalate rich food such as spinach intake may exceed 1000mg/day.

Paul M. and Brinda D. (2002) said that renal stone formation is one of the common infections of the urinary tract since ancient times and its evidence varies from country to country, region to region, race to race, sex to sex an according to age. There has been an upsurge in the incidence of renal stone disease in Europe and United States over the past thirty years. This condition affects one to 20% of the general population with a lifetime incidence of 2 to 5percent in Asia, 8 to 15 percent in Europe and North America and 20 percent in Saudi Arabia. The incidence of urinary stones in India is also high in North,
Northwest and central India moderate in Deccan Plateau and for less in Southern parts. Epidemiological surveys have shown a very high incidence of urolithiasis in Rajasthan and Jodhpur.

Common epidemiologic risk factors for calcium oxalate stone are age, sex, geography, family history and body size. Although the incidence rates are three times higher in men than in women, individual with a family history of stone disease have a nearly threefold higher risk of developing urolithiasis than in those without a family history. Recent evidence suggests that the risks of stone disease increases with increasing body weight.

A higher prevalence of stone disease in workers exposed to heat and sweat probably because of changes in urinary biochemistry. It is well documented that population living in hot environment have a high incidence of stone disease which has been partly attributed to low urinary volumes besides the hormonal effects on calcium metabolism and super saturation of calcium salts. Chronic dehydration may be considered a common cause of urolithiasis. Inadequate fluid consumption decreases total urinary volume thereby increasing the concentration of stone forming salts.

In general, the crystallization of stone forming salts owes to an abnormal urinary composition that is either higher in crystallisation promoters like calcium, oxalate and uric acid or lower in inhibitors (citrate, glycoaminoglycons, and nephrocalcin) or both.

Ismail A.et al. (2005) reported that oxalate is component of calcium oxalate kidney stones, whereas phytate is an inhibitor of calcium kidney stone formation. Soybean and soya foods have relatively high concentration of oxalate raises a concern regarding the risk of kidney stone for human consuming soy foods. Oxalate binds with calcium in human urine to form a
poorly soluble salt that is typically near saturation. Small crystal formation occurs when urinary calcium and oxalate concentration reach super saturation. A kidney stone forms when the calcium oxalate crystals aggregate or deposit on a “seed” crystal such as uric acid. In human urine, calcium oxalate super saturation is influenced more by oxalate concentration than calcium concentration. About 2-8% of the oxalate in ingested soy foods is absorbed and excreted in the urine by healthy human. Kidney stone formers exhibit a higher rate of oxalate absorption than non-stone formers and their increase in urinary oxalate after consumption of soy foods may be large enough to increase the risk of calcium oxalate precipitation which potentially increases their risk of kidney stone. Soybean also contains high concentrations of myoinositol hexakisphosphate (phytate 8). Phytate 8 has long been considered as an antinutrient because it reduces the bioavailability of minerals in humans but it is also a potential inhibitor of calcium kidney stone formation related to both its antioxidants activity and its ability to inhibit crystal formation. Although human synthesize phytate, most urinary phytate originates from the diet and not form endogenous synthesize.

Foods containing greater than 10 mg of oxalate per serving are considered high oxalate foods by the American Dietetic Association. Humans prone to form calcium oxalate kidney stone are recommended to limit their intake of soy foods containing greater than 10 mg oxalate per serving. Consuming foods containing phytate may lower the risk of forming calcium oxalate kidney stones.

Zimmermann D. J. et al. (2005) concluded that oxalate rich diet increase the percentage of intestinal soluble oxalate absorption. Subjects with high endogenous synthesis will experience hyperoxaluria. Under a long term oxalate rich diet there exists an as yet unexplained adaptation reducing, though not
eliminating an increase in the percentage of the intestinal oxalate absorption. As a high-oxalate load in urine plays a central role in calcium oxalate stone growth, these results stress the necessity to eliminate oxalate-rich food. Hyperoxaluria is a major risk factor for calcium oxalate urolithiasis, a typically occurring in different societies. Except for the rare condition of primary hyperoxaluria, hyperoxaluria appears to be sustained by an increased dietary load. In normal individuals the majority of urinary oxalate is derived from endogenous metabolism while 10-20% is generally assumed to be derived from oral ingestion. While evidence has found that dietary oxalate may contribute up to 50% of the oxalate excreted in urine. Dietary oxalate may play a more significant role in calcium oxalate stone formation. Oxalate is present in large quantities in food of vegetable origin, cereals grains and some roots. Food stuffs that contain high levels of oxalate include spinach, rhubarb, beetroot, black tea, cocoa powder and some nuts. The mean oxalate intake under a western diet is approximately 100-150 mg/day. However urban diets of the upper income group in India were reported to contain 600 mg oxalate per day and seasonal rural diets as much as 2000 mg.

Unfortunately knowledge of the extent of gastrointestinal absorption form high oxalate diets is still limited. Apart from the amount and chemical form of the oxalate in the ingested food stuff, the amount of free oxalate in the gastrointestinal tract or physiological parameters, of the individual such as intestinal pH and transit time, oxalate absorption also depends on the amount of divalent cations, such as calcium and magnesium, simultaneously present in the chyme. These cations derived from ingested food stuff, liquids and digestive secretions are able to bind oxalate in the gut and decrease oxalate absorption.

Emmanuel et al. (2006) used trimetric analysis to estimate the level of oxalate in some Nigerian leafy vegetables treated in different ways in two set
of experiments. The treatment was boiling with retention of the water used, for boiling and freezing followed by boiling without retention of water used for boiling. Results obtained showed that the former in which five different vegetables were used led to significant increase $P < 0.05$ in the oxalate content of vegetable preparation. The exception was Veronia Amygalalina in which there was a significant decrease in the oxalate content after boiling. The later in which three selected vegetables were used however led to significant decrease ($P <0.05$) in the level of oxalate of the vegetable preparation a significant amount having been lost in the decanted water used for boiling vegetables provides a good means of reducing the oxalate content of leafy vegetables and consequently the associated food safety problem.

Taylor E.N. and Curhan G.C. (2007) concluded that most kidney stone consist of calcium oxalate and higher urinary oxalate increases the risk of calcium oxalate nephrolithiasis. Taylor study has examined the relation between oxalate intake and incident nephrolithiasis. Food frequency questionnaires were used to assess oxalate intake every 4 year. A total of 4605 incidents kidney stones were documented over a combined 44 years of follow up. Mean oxalate intakes were 214 mg/d in men, 185 mg/d in older women and 183 mg/d in younger women and were similar in stone formers and non-stone formers. Spinach accounted for $> 40\%$ of oxalate intake. For participants in the highest compared with lowest quintile of dietary oxalate, the relative risks for stone were 1.22 (95% confidence interval, 1.03 to 1.45, $P = 0.01$ for trend) for men and 1.21 (95% confidence interval 1.01 to 1.44 $P = 0.05$ for trend) for older women. Risk was higher in men with lower dietary calcium ($P = 0.08$ for interaction). The relative risks for participants who are eight or more servings of spinach per month compared with fewer than 1 serving per month were 1.30 (95% CI 1.08 to 1.58) for men and 1.34 (95% CI 1.10 to 1.64) for older
women. Oxalate intake and spinach were not associated with risk in younger women.

Vijaybharathi P.S. and M. Amirthaveni M. (2008) reported that diet has a key role in determining urinary chemistry and can influence the risk of stone formation. The nutritional risk factor includes an inadequate intake of fluids or excessive intake of foods rich in oxalates, sodium, calcium or animal protein. Diet influences urinary constituents and pH which may affect stone nucleation and growth. The intake of carbohydrate and fat is positively correlated and the intake of calcium is inversely correlated with urinary oxalate excretion in stone formers. High salts diets can increase urinary calcium and enhance the potential for sodium urate induced calcium oxalate stone. It also decreases renal excretion of citrate which is an inhibitor of calcareous stone formation. Urinary pH has an important role in the formation of almost all urinary stones. Personality, emotional status, exercise, pulmonary ventilation and dietary habit are known to influence urinary pH. Uric acid stones are easily formed in acidic urine while calcium phosphate and magnesium ammonium phosphate stones are frequently formed in alkaline urine. Uric acid stone patients excrete acid urine with low calcium constantly. A better understanding of the relationship between diet and the risk of urinary tract calculus formation will have the potential to provide simpler and more cost effective measures of the prevention.

Harinarayan C.V. et al.(2008) said that the daily dietary calcium intake of both the urban and rural population was low compared to that of recommended daily/dietary allowances (RDA) issued by the Indian Council of Medical Research (ICMR). Dietary calcium and phosphorous was significantly lower (P < 0.001) in both the rural adult and children the dietary phytate to calcium ration was significantly (P < 0.001) higher in rural adult and children
compare to that of urban adult and children with increased bone mineral density and have the potential to increase the peak bone mass.

Gupta M. et al. (2011) said that inhibitors are the molecules which increase the super saturation required to initiate stone nucleation, decrease the stone crystal growth and aggregation whereas promoters causes reduction of the formation product of the supersaturated solutions. Calcium, Sodium, Oxalate, Urate, low urine pH act as promoters while citrate, magnesium, pyrophosphate act as inhibitors. The loss of balance between the urinary promoters and inhibitors has been suggested to increase the risk of stone formation more than disturbance in any single substances.