Chapter - II

REVIEW OF LITERATURE
SECTION - A

History of Nutrition
"What little we know, what little power we possess, we owe to the accumulated endeavors of our ancestors. Mere gratefulness would already oblige us to study the history of the endeavors, our most precious heirlooms. But we are not to remain idle spectators. It is not enough to appreciate and admire what our ancestors did, we must take up their best traditions, and that implies expert knowledge and craftsmanship, science and practice".

1. SCIENCE OF NUTRITION

What we need to keep body and soul bound together firmly enough to keep in good health, why we like the flavours and colours and why we select caviare instead of cowpeas comprise the study of nutrition.

The science of nutrition may be defined as the study of food in relation to man and the study of man in relation to his food. Both halves of this definition have equal weight. This sounds like a very broad field of study and indeed it is. Its breadth is illustrated by the diagram (Fig 1), which shows how nutrition stretches from soil to cell, including a great part of man’s activities on the way.

![Diagram showing the breadth of the science of nutrition](image)

**Fig. 1: The Science of nutrition covers a wide range of disciplines.**
1.1 A Historical Perspective

Nutrition is a subject that touches everyone. It is the study of how the substance in food affects our bodies and our health.\textsuperscript{120}

The science of nutrition has passed through two main stages. The first stage led to the discovery of the nutrients and man's need for them. The second stage in the development of nutrition is more complex. We now need to consider not only the amount of fat that we eat, but also the different types of fat; not only the carbohydrate, but also what form it is in. We can no longer think of proteins, minerals and vitamins individually, but must pay attention to their interrelationships. The nutrients appear to be as closely related as the springs on a mattress – tread on one and the others move.\textsuperscript{119}

The knowledge that nutrition is essential to well being presents a dramatic story that took centuries to evolve. Although often referred to as a 20th century science, nutrition has been an integral part of science and the practice of medicine for more than two thousand years.\textsuperscript{8} The first record of man's effort to probe the mysteries of nourishment of the body was in ancient times, and the search has continued ever since. In the ancient world the Greek Philosopher Hepocrates (460 – 359 B.C.) pondered the problems of medicine and of the body's reaction to food. Another contribution from the ancient world was Aristotle (384-322 B.C.) who carried out investigations in physiology as well as other areas.

Leonardo da vinci (1452-1519) (Artist, Biologist and Anatomist) from Italy made statements about nutrition that have a modern connotation.
Magenie (1783 – 1855) was first to distinguish between the different kinds of food stuffs, (carbohydrates, fats, proteins). From his experiments on dog he concluded that the protein element was necessary. However even this information was not applied to the study of respiratory exchange for many years. Regnault and Reeset m 1840 showed that the ratio of carbon dioxide expired with the kind of food.\(^{(21)}\) Germany Baron Justus von Liebig (1803 – 1873) taught that fats and carbohydrates were fuel foods and termed the nutrients that formed body tissues during growth” plastic food”, and Karl von Voit (1831 – 1908) believed that the requirement of protein is dependent on the organized mass of tissues; the requirement of fat and carbohydrate is dependent on the amount of mechanical work accomplished.\(^{(21)}\)

In 1883 - 84 Rubner found that carbohydrate and fat were interchangeable in nutrition on the basis of their energy equivalents. One hundred calories in fat were the nutritive equivalent of the same number in carbohydrate. This is the iso-dynamic law of Rubner and is valid except when food is given in large quantity and the specific dynamic action appears. His investigations showed.\(^{(21)}\),

\[
100 \text{ gm fat} = 211 \text{ gm protein} \\
232 \text{ gm starch} \\
234 \text{ gm cane sugar} \\
256 \text{ gm glucose}
\]

That brings us to twentieth century. Never in the whole history of nutrition have the strides of this century been paralleled. Studies of this century have encompassed the discovery and the identification of
certain nutrients (the vitamins, amino acids and certain minerals), the nutrient needs of the body in health and in disease, the specific and interrelated functions that these nutrients play, sources of these nutrients and their use to enrich food to a higher nutritive value all for the benefit of mankind.

The calorimetric studies carried out at the beginning of this century clearly established a relationship between energy and nutrition. Later experiments were able to correlate the nutritional functions of proteins and it was found that food proteins or their amino acids are the antecedents and precursors of many of the body’s catalysts which are necessary for the chemical reactions involved in digestion and nutrition. During last 30 – 40 years there has come an awakening to the importance of mineral elements in nutrition and the nutritive value of foods. It has now been established that these elements are essential.

The vitamins as a class are the other compounds whose importance in nutrition is now well established. Between 1930 and 1940 the majority of vitamins were identified, isolated from foods and synthesized in the laboratory.

The twentieth century ushered in the “One World” concept also with it, concern not only for an adequate diet for our nation but for enough food to feed the world.

The credit of initiating the study of nutrition also goes to Professor L. D. Stamp (1960) who computed standard nutrition unit (SNU).
Nutrition research has demonstrated the relationships of nutritional status to health, vigor and achievement. Three international organizations, actively interested in nutritional aspects of health, stand ready to help. The nutrition committee of Food and Agriculture organization of the United Nations (FAO) is especially concerned with nutritional problems related to production, distribution and consumption of food. The nutrition section of (WHO) World Health Organization, also of the United Nations has as a primary obligation investigation of conditions related to clinical aspects of nutrition. UNICEF (United Nations Children Fund) was established to better health standards of children in needy areas. The agency for international development of United States (AID) also contribute much towards better nutrition for people in developing countries.

The problem of the assessment of nutritional status first attracted international attention in 1932 when the health organization of the league of nations called for a meeting in Berlin to discuss clinical and physical aspects of evaluation. In 1949 the joint FAO / WHO expert committee of nutrition emphasized the need or dietary assessment as a basis for the planning of national nutrition policy. To aid in such assessment, in 1963 the joint committee published a manual on the medical assessment of the nutritional status, which was revised in 1966.

A number of surveys, at international, national and local levels have been conducted to determine nutritional problem. The FAO has conducted international food and nutrition survey since the Second
War. The U.S. Department of Agriculture has also conducted international nutrition surveys.

The ICNND and its successor organizations. the nutrition program of the U.S. Public Health Service have conducted surveys at the request and with the co-operation of the foreign government's concerned in more than thirty countries.

Indian philosophers stressed the importance of food for uplifting the soul and health of the body.

The Indian society has a rich historical past. Its culture and civilization ranks with those of the most civilized countries of the world. Nearly all the civilizations of the old world became extinct for they were not able to withstand on slaughts of the foreigners. India had a number of immigrants and invaders from across the border, but Indian Society assimilated the new culture into its fold by slow process of change and adjustment and continued to maintain its individualistic character in spite of various vicissitudes.

In fact the present society has its roots in the ancient past and even today it is difficult for the majority of the people in this country to accept the twentieth century civilization. The past and present seem to be living side by side in India. The ancient past is the basis and necessary changes are slowly being effected to suit modernization.

It is difficult for people to change and this is much more true in the matter of food habits than in an other aspect of the society. We
still eat some foods in exactly the same way as our ancestor did thousands of years ago.

In the pre-historic period man lived on what ever he could gather around him in the form of fruits, leaves or flesh etc. Slowly his knowledge about food increased and he began to add more and more items in his diet.

The Aryans, who came to India, brought with them knowledge of new food articles, methods of cooking and of raising food crops.

In the early stages of India civilization, we ate vegetables, meat, egg and fish without restriction or taboos, slowly; there was a reaction against the eating of meat because of the indiscriminable killing of animals. As with many other civilizations, food restrictions which started out for one reason or the other continued for centuries when the original premise had completely disappeared. Some restrictions were firmly imposed to protect India from getting into contact with the invaders and adopting their customs, though these rules were said to be intended to maintain the purity of food. For others like the Jews, do not eat non-kosher meat for religious reasons; it is the same with Islamic religion, they do not take pork, ham or bacon. The Hindus do not eat beef, as according to them cow is the most important animal.

The religious movements like Buddhism and Jainism had their impact on food habits as well. The use of meat was further restricted by the founder of these two religions.
After the Arvans settled in India, the country was not disturbed for a quite a long time. This gave an opportunity to them to pay more attention to the food values and the nutritive aspect of food. Different food for students, sages and saints, for warriors, and worshippers, men and women, for nursing and expectant mothers was distinctly suggested so as to enable them to eat and to perform their assigned roles effectively and efficiently. India was, for years, free from outside influences the really noticeable change came with our independence in 1947. Taboos against certain foods began to disappear. This was especially true in towns and cities, where people of different castes and different areas of country came into contact and began to learn to live with each other.

Food is the core of civilization. Different forms of civilizations grew up around food available in different areas. The search for food has led people to migrate to different parts of the world. Great wars have been fought among nations, to have a better living, power and riches, the most important of all riches being food. When one is hungry, one can not think or do anything. A man free from hunger, but not overfed, is in his best form. It is then that culture and civilization thrive.

In the Upanishads, a Hindu religious text, food is called “panacea” because all animate life depends on it. According to them purity of food leads to purity of thoughts and action.

Kashmir lies in the north-west of India. It consists of two parts ‘Jammu’ and ‘Kashmir Valley’.
Kashmir has had a lot of wars and invasions. In the many hundreds of years of the history of Kashmir, the people have come in contact with many other races and tribes, like the Greeks, Romans, Persians, Huns and many others and in each turn have left their influence. The indigenous people took the different civilizations and cultures and blended them with their own.

The people of Kashmir are mostly agriculturist. The only towns which can be called by that name are Jammu and Srinagar.

Rice is the staple food of Kashmir, though they grow wheat as well. Barley is the other important food grain. This is only used by poor people or by hermits and by those who have renounced the world.

In Kashmir, food habits are governed by the climate. It is very cold in winter with a heavy snowfall and quite mild in summer. During winter, fresh vegetables are not available all over the state, except in Jammu and Srinagar. Some fruits are canned in Kashmir. So to get over this difficulty, vegetables such as turnips, radishes, egg plants and cabbages are dehydrated in summer and are used in winter when fresh vegetables are not available. Fish is also dried in the sun and widely used. The Muslim influence and the availability are two reasons why most of Kashmirs are non-vegetarians.

The food of the ordinary people is very simple. Rice is eaten boiled, with meat and vegetable curry. Some of the rice cooked the night before is kept for the next morning and people have it for
breakfast before they go to work in the fields. Both the morning and evening meals are the same.

There is very little difference in the food of the northern and southern parts of Kashmir.

The richer population of Kashmir, having descended or come closely in contact with the Moughal and the Afghan Kings knew a lot about delicious cooking of rice and meat. Especially the Moughals were epicurean by temperament and understood good eating and good living. They introduced Persian cooking, which they had brought with them. Most of meat dishes were originally introduced by the Muslim conquerors; it is not improbable that one may come across the same type of preparations in the Middle East.

Fruit is a very important and a very common article in Kashmiri diet. The climate being so favorable for growing all kinds of fruits, like apples, cherries, peaches, grapes etc; which grow in a cold climate, are grown in abundance and are available to the people, whether they have their own gardens or not. No one is prevented from picking the fruits they like to eat. They eat savoury cakes, milk and yoghurt on festivals.
SECTION - B

Physiology of Nutrition
"You are what you eat"
1. **NUTRITION**

The nutrition is the science that interprets the relationship of food to the functioning of living organism.\(^{(23)}\) It includes the intake of food, liberation of energy, elimination of wastes, and all the synthesis that are essential for maintenance, growth and reproduction.\(^{(28)}\)

Nutrition has been simply defined as "the food you eat and how your body uses it". The physiologic need for food is actually the need for nutrients.

2. **FUNCTIONS OF FOOD**

Food's most basic function is to provide nutrients to the body. Nutrients are the substances in food needed to support life functions.\(^{(29)}\) Nutrients have three general functions, all related to biological needs:

A. Building and maintaining the structure of the organism.
B. Serving as energy source.
C. Regulating biological processes.

A. **The role of nutrients in building and maintenance of organisms:**

Nutrients are the materials necessary for building and maintaining physical structure, including the solid materials and fluids surrounding the cells as well as the cells themselves.

Water, proteins and minerals are the most important building materials because together - these three nutrient classes make up a very large part of body’s total lean mass.\(^{(30)}\)
The proteins are amazing, versatile and vital cellular working molecules. Without them, life would not exist. The building blocks of proteins are amino acids. The body needs amino acids to grow new cells and to replace worn out ones. The body makes enzymes, hormones and chemical messengers of nervous system from its amino acids. Antibodies are formed from amino acids to defend against foreign proteins and other foreign substances. Within the body proteins help to regulate the body’s electrolyte and fluids. Proteins provide the netting on which blood clots are built. Proteins form integral parts of most body structures, such as skin, tendons, ligaments, membranes, muscles, organs and bones.

Although carbohydrates and vitamins together constitute less than one one-hundredth of the weight of the body, these nutrients are nevertheless extremely important parts of body structure. Certain carbohydrates are integral parts of hormones and other important molecules, and the significance of vitamins in body structure is illustrated dramatically by decreased growth which occurs in many vitamin deficiencies.

Fat was once considered merely an inert storehouse of excess energy, to be drawn on in time of need. Today we know that fat tissue is a vital, active part of the body. In addition certain specialized fatty substances have important role as part of cells and organs; phospholipids for example are part of membranes of cells. It is therefore inaccurate to look upon fats as expandable body components as compared to the materials that constitute lean body tissues.
Finally, the old concept of body structure should be revised. Structure was once believed to be a relatively permanent arrangement, like that of a formal living room, whereas materials such as carbohydrates and fats were considered analogous to the fuels expended to heat the room. The materials formerly thought of as mere fuels are now known to be used to some extent as building materials. The modern concept of this continuous, dynamic, process of change, called turnover of body constituents makes the former classification obsolete. All six nutrient classes, and not just water, proteins and minerals, play major roles in the growth and maintenance of living systems.

In considering nutrition water is often overlooked, but it is second only to oxygen in importance to body functioning. Water is an essential component of body structure. It also acts as a solvent for mineral and other physiologically important compounds.

The body needs organic compounds, such as carbohydrates, fats and proteins for proper nutrition but it also needs inorganic materials such as minerals. After the organic compounds have been oxidized, minerals remain to form actual body parts. For example Calcium, Magnesium and Phosphorous are components of bones and teeth.

B. The functions of nutrients as energy sources:
Those nutrients which human cells break down in order to obtain energy are carbohydrates, fats and proteins are called energy nutrients. The energy nutrients used by humans have the following characteristics:-
I. They are all organic compounds which cells can break down to simpler compounds.

II. As a result of their break down, energy is released; the number of units of energy resulting from the breakdown of a given amount varies from nutrient to nutrient, however.

III. Energy nutrients do not include vitamins, minerals or water. The relationship of minerals, vitamins and water to energy are all indirect. In energy releasing reactions the substrates are energy nutrients. Vitamins and minerals are frequently necessary parts of the structures of enzymes which catalyze bio-chemical reactions and water molecules may enter into reactions as well as being liquid in which bio-chemical reactions occur.

C. The functions of nutrients in regulating biological processes:

Because life can continue only within a certain narrow range of conditions, everything that goes on in a living system must be regulated, or controlled. If an organism becomes too hot, too cold, too acid, too non-acid, too abundant with respect to toxic materials or too lacking in needed substances, the organism will die. The mechanisms for controlling the internal environment include certain nutrients in the same way, in the same form in which they occur in the diet, well as many substances that are not properly called nutrients. Genes and hormones, for example need not be ingested because the body is capable of producing them. However, the materials from which they are produced must all be provided from the animals diet.
3. NUTRITIONAL HEALTH OF ADULT FEMALE

Life cannot be sustained without adequate nourishment. Man needs adequate food for sustainable growth, development and also to lead an active and happy life. Health and good nutrition are therefore, considered to be interdependent systems. The need for many nutrients changes at different stages of our lives, social, economic and psychological circumstances all influence nutritional status. Human beings are most vulnerable to the impact of poor nutrition during rapid growth. If the essential nutrients are not present to support growth permanent damage to tissues and organs can occur.

Good nutrition is never an easy goal to achieve. Yet good nutrition is a positive force that affects health and quality of life throughout the life cycle. The concept of ideal nutritional health suggests that all the essential nutrients are supplied to and used efficiently by the individual on a long term basis.

The time to focus on good nutritional and other health habits, then is before a woman becomes pregnant. Maternal nutrition should be a focus during all phases of reproductive life and from childhood to menopause to ensure (including good nutritional status) at the time of conception. Good habits can then be carried into pregnancy, thereby providing optimum health and nutrition from before conception until birth. The Woman entering her child bearing years reflects a host of influences to which she has been exposed throughout her own fetal period, infancy, childhood, and adolescence. The habits, attitudes and values she developed during her earlier years will affect her nutritional status as she comes to maturity. The consequences of inadequate maternal nutrition represents a major health
problem for society. Unfavourable consequences range from failure to conceive to failure of newborn infant to achieve child birth. The nutritional vulnerability of women of child bearing age is such that they are regarded as one of the high risk groups.

Appropriate weight for height prior to pregnancy benefits pregnancy outcome. Weights outside the normal range (10 percent below or 20 percent above, standard weight for height and age) present some medical risk. Under-weight women are therefore advised to gain weight before becoming pregnant, and overweight women to lose excess weight.

Infant’s birth weight strongly correlates with pre-pregnancy weight and is the most potent single predictor of the infant’s future health and survival. A low birth weight baby is statistically more likely than a normal weight baby to contract diseases and low birth weight babies are nearly forty times more likely to die in the first month of life than normal weight babies are.

A major reason why the mother’s pre-pregnancy nutrition is so crucial to a healthy pregnancy is that it determines whether she will be able to grow healthy support tissues: the placenta, the amniotic sac and the umbilical cord, as well as uterus. Malnutrition prior to and around conception keeps these tissues from developing fully.

Prior to pregnancy all women should strive for appropriate body weights. This is especially important for underweight women. Second to underweight women, obese women are urged to attain healthy weights before pregnancy.
A major reason why the mother’s nutrition before pregnancy is so crucial is that it determines whether her uterus will be able to support the growth of a healthy placenta during the first month of pregnancy. If the placenta works perfectly, the foetus wants for nothing, if it doesn’t, no alternative source of sustenance is available and the foetus will fail to thrive.  

### 3.1. Nutritional requirements of the Adult Female

#### 3.1.1. Energy requirements

Energy is required for the many metabolic processes essential for life, physical activity. Energy needs of the adult vary with the body size, with the amount and severity of physical activity, with physiological state, and to a lesser degree, with climate. Energy allowances for adult females are as follows:-

<table>
<thead>
<tr>
<th>Sex</th>
<th>Body Weight (Kg)</th>
<th>Sedentary</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woman</td>
<td>50</td>
<td>1875</td>
<td>2225</td>
<td>2925</td>
</tr>
</tbody>
</table>

#### 3.1.2. Proteins

Protein requirements by the body represents the sum of the needs for the essential amino acids and sufficient utilizable nitrogen for the synthesis of body protein and other nitrogen-containing compounds essential for health. Factors affecting the amount of protein required include protein quality, energy value of the diet, carbohydrate content of the diet, stage of growth and physiological state of the individual and variability among individuals. The average daily requirement of an Indian adult, in terms of a high quality
protein like milk / egg at the physiological level is estimated to be 0.5 g / Kg. The factorial value thus obtained has been increased by 50% to obtain the requirement at the physiological level. Assuming a coefficient of variation of 12.5% the safe level of intake (M + 2SD) for an adult will be 0.625 gms of protein per kg in terms of a high quality protein. When adjusted for the lower quality of dietary proteins with 65 NPU, the safe levels of intake in terms of dietary protein will be 1.0 g/Kg/day. The RDA for adult female is:

### PROTEIN REQUIREMENT OF ADULT FEMALE

<table>
<thead>
<tr>
<th>Sex</th>
<th>Body Weight (Kg)</th>
<th>Requirement (gms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Per Kg</td>
</tr>
<tr>
<td>Woman</td>
<td>50</td>
<td>1.0</td>
</tr>
</tbody>
</table>

3.1.3. **Vitamins:** Vitamins are chemically unrelated organic compounds required in relatively minute amounts for normal growth and maintenance of life. The absence of certain vitamins from the diet will result in characteristic deficiency symptoms.  

i) **Vitamin A:** Vitamin A is essential for normal vision, for maintaining the integrity of epithelial tissues and for a wide variety of metabolic functions. Vitamin A in the human diet exists either as preformed vitamin A (Retinol) or as β-Carotene, which in the body is converted into vitamin A. Only foods of animal origin contain preformed Vitamin A. Since β-Carotene forms a major source of dietary vitamin A in many developing countries including India, the efficiency with which
It is absorbed and utilized becomes important in translating β-Carotene Values into retinol equivalents.

The daily requirement of vitamin A for Non-pregnant and non-lactating women is 600 µg / day Retinol or 2400 µg / day β-Carotene.

ii) \textit{Vitamin D}: Vitamin D is now considered more as a pro-hormone than a vitamin. It can be synthesized in the body in adequate amounts by simple exposure to sunlight even for 5 minutes per day. Indian diets do not supply even one tenth of the present recommendations for Vitamin D. In prescribing medicinal Vitamin D under certain situations where there is a minimal exposure to sunlight, a specific recommendation of daily supplement of 400 µg is made.

iii) \textit{Vitamin E}: Vitamin E is a group of chemically related compounds known as “tocopherols”. It exists in three forms; alpha, β- and gamma- tocopherols, with the alpha form being the most active biologically. Vitamin E functions as an antioxidant and is essential for the prevention of degenerative changes in certain tissues. It prevents the formation of toxic peroxides of unsaturated fatty acids that may damage cells.

A daily intake of Vitamin E (tocopherol) is 0.8 mg/g of essential fatty acids.\(^{36}\)
iv) Vitamin K: Vitamin K, the coagulation vitamin occurs in nature in two forms, phyloquinone (Vitamin K$_1$) and menaquinone or Vitamin K$_2$. A third form is the synthetic compound menadione, Vitamin K$_3$.

Vitamin K functions primarily to promote the normal clotting of blood and to prevent hemorrhage. A vitamin K deficiency will cause an increase in blood clotting time. However this deficiency is rarely seen in the human.(34)

v) Vitamin B Complex:

v.i. Thiamine: Thiamine is found in enriched cereals, whole grain cereals, milk, legumes and meat. Allowances for thiamine are usually related to energy intake$^{36}$, and an intake of 1.1 μg / day is recommended for adult female.$^{36}$ Symptoms of mild thiamine deficiency include increased hypersensitivity, loss of appetite, fatigue and general weakness. An extreme deficiency leads to the disease beri beri characterized by damage to nervous system.

v.ii. Riboflavin: Symptoms of a riboflavin deficiency include dermatitis, cheilosis (Drying and cracking of lips), angular stomatitis (inflammation of mucous membranes of mouth) and damage to conjunctiva of the eye.$^{34}$ Riboflavin requirements are related to caloric intake and the RDA is established at 1.3 μg / day for the adult female.$^{36}$
**v.iii. Niacin:** Pellagra, a disease characterized by rough or inflamed skin, nervousness, mental depression and intestinal disorders is caused by niacin deficiency. Niacin recommended intakes are also related to calorie intake\(^{(34)}\) and are 1.4 \(\mu\)g / day for the adult woman.\(^{(36)}\)

**v.iv. Vitamin B\(_6\):** Vitamin B\(_6\) is a collective term referring to three pyridine compounds; pyridoxine, pyridoxal, and pyridoxamine. A deficiency of Vitamin B\(_6\) can cause skin lesions, including glossitis (inflammation of tongue), dermatitis, stomatitis and cheilosis. The recommended daily intake for vitamin B\(_6\) is 2.0 \(\mu\)g / day for the adult female.

**v.v. Folacin: A general name for folic acid and related compounds plays a role in the formation of purines and pyrimidines from which nucleic acids are derived.** It functions in the formation of red blood cells and also plays a role in certain amino acid interconversions and methylation reactions.

A folacin deficiency results in accumulation of immature red blood cells (megalo blasts) in the bone marrow, leading to macrocytic anaemia. Other deficiency symptoms include glossitis, gastrointestinal disturbances and neurological damage.\(^{(34)}\)

The RDA for folacin for a woman is 400 mcg per day.\(^{(36)}\)
vi. Vitamin \( B_{12} \): Vitamin \( B_{12} \), or Cobalamine, is required for normal red blood cell formation. Its deficiency results in pernicious anaemia characterized by megaloblastic red blood cells and eventually extensive neurological damage. Vitamin \( B_{12} \) corrects the blood abnormalities of pernicious anaemia and arrests the program of nervous tissue damage. The RDA for adult women is 1 \( \mu g / \) day.

vi. Vitamin C: Vitamin C plays a role in the synthesis of collagen, wound healing amino acid and carbohydrate metabolism and synthesis of some hormones. It also has an influence on the absorption and metabolism of Iron.

Early signs of vitamin C deficiency include weakness, irritability, bleeding gums, gingivitis, loosening of teeth, and a tendency to bruise easily. The daily requirement of vitamin C for an adult female is 40 mgs / day.

3.1.4. Minerals: Twenty six or more different minerals are found in varying amounts in the body, and about 15 of these are necessary for good nutrition. Certain minerals are required by the body in relatively large amounts and are referred to as macro-nutrients. These include Calcium, Phosphorous, Sodium, Chloride and Magnesium. Iron, Manganese, Copper, Iodine, Zinc, Cobalt, Fluorine, Selenium and Chromium are trace or micro-nutrients and are required in smaller amounts.
Calcium: Calcium is present in the body in greater amounts than any other mineral, and approximately 99% of body calcium is concentrated in the skeletal system. Throughout life calcium builds and shapes the framework of the body and gives strength to bones and teeth. The remaining 1% percent is distributed through the soft tissues.

The ICMR has recommended a daily intake of 400 mg for Non-pregnant non-lactating women.

An insufficient supply of calcium may result in stunted growth, poor quality of teeth and bone, or other bone disorders “osteoporosis” a disorder of bone metabolism that occurs in middle and old age, is often attributed to low calcium intake. Other nutrients however, such as vitamin D and fluoride, may also be involved.

Phosphorous: Phosphorous is the second most abundant mineral in the body, with 70 – 80% being found in bone and teeth. Since phosphorous deficiency is unlikely on the types of diets consumed in India, ensuring an adequate phosphorous intake may not present a problem. Calcium: Phosphorous ratio of 1:1 may be maintained in most age group, except in infancy.

Magnesium, Sodium and Potassium: Magnesium is a component of cells and is essential for various metabolic reactions. Magnesium concentrates in the bone and it is important for maintaining electrical potential in nerves and muscle membrane. Magnesium deficiency leads to
neuromuscular dysfunction. Magnesium occurs widely in foods and plant foods are particularly rich in Magnesium. Dietary deficiency of magnesium is therefore unlikely to occur in the Indian population. No specific recommendations are made with regard to dietary intake of magnesium.

Since Sodium intake is high in India and a high intake is associated with hypertension there is a need for fixing limits of intake of Sodium. There is no information available on the body turnover of sodium and potassium in a tropical country like India where sodium and potassium can be lost significantly in sweat. In the absence of such data no specific recommendations of sodium and potassium are made.36

iv) Trace Elements: At present fifteen trace elements are believed to be essential for the mammalian species; of which eight elements are known to be required by man. These are Iron, Zinc, Copper, Chromium, Cobalt, Iodine, manganese, Molybdenum and selenium. However, only the deficiency of a few of these elements is observed in man. Iron and Iodine deficiencies are widespread while deficiencies of Cu, Zn, Cr, and Se have been reported in recent years. Suggested daily intake of trace elements by an Indian adult (male and female) is Chromium 67 µg, Copper 2.2 mg, manganese 5.5 mg, Zinc 15.5 mg and Iodine 150 µg per day.38

v) Iron: The best known micronutrient is probably iron. and two-thirds of the iron in the body is present in blood mainly as a component of haemoglobin.34
Iron absorption from common Indian diets determined earlier using chemical balance method yielded figures ranging from 7 to 20%, with a median figures around 10% for an adult female, iron absorption is 8.0% from rice based diet, 5.0% from mixed cereal diet and 3.3% from wheat / millet diet.\(^1\)

In women during reproductive age, besides the basal loss, iron is lost by menstrual loss of blood.

The median blood loss is 30 ml equivalent to an additional daily requirement of 0.5 mg of iron. Many normal women lose much more blood, the figure reaching 80 ml in about 10% of women corresponding to a loss of 1.0 mg iron / day or more. This daily menstrual loss of iron is compiled from the iron content of blood lost during the menstrual period averaged over a month. Menstrual loss of iron in Indian women has been taken to correspond to a daily loss of 8 μg / Kg body weight or 0.5 mg /day. An upper limit of menstrual loss of iron of 1.0 mg / day would mean a menstrual loss of 16 μg / kg. Adopting this higher value, the total basal plus menstrual loss of iron in women would be 30 μg / Kg / day.

Iron requirement of adult female (Non-pregnant non-lactating) is 30 mg / day.\(^{36}\)
### RECOMMENDED DIETARY ALLOWANCES FOR ADULT FEMALE

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sedentary</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Kcal</td>
<td>1875</td>
<td>2225</td>
<td>2925</td>
</tr>
<tr>
<td>Protein g</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Calcium mg</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Iron mg</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Vitamin A (Retinol) mcg</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>β-Carotene mcg</td>
<td>2400</td>
<td>2400</td>
<td>2400</td>
</tr>
<tr>
<td>Thiamine mg</td>
<td>0.9</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Riboflavin mg</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Niacin mg</td>
<td>12</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Pyridoxine mg</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Vitamin C mg</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folic Acid mcg</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Vitamin B₁₂ mcg</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

ICMR: 1989

### 4. NUTRITIONAL HEALTH OF PREGNANT WOMEN

The effects of nutrition extends over years. A woman’s nutrition prior to and throughout pregnancy and lactation affects not only her own health but also the growth, development and health of her child even long after it has been born. A healthy, well nourished women whose nutritional status was good prior to becoming pregnant has a very good chance of delivering a healthy full term baby for normal birth weight. Maternal nutrition is critically important to both mother and child.

The woman who has done a lot already to ensure an optimal pregnancy outcome. Then, during the pregnancy itself if she eats a variety of nutrient - dense foods, her own and her infants health will benefit further.
Full nutrient stores before pregnancy are essential both to conception and to healthy infant development during pregnancy. In the early weeks, before many women are even aware that they are pregnant, significant developmental changes occur that depend on a woman’s nutrient stores.

An underweight woman who fails to gain weight adequately during pregnancy is most likely to bear a baby with a dangerously low birthweight. Infants birth-weight is the most potent single indicator of an infant's future health status, some researchers suspect that poor nutrition during gestation may even set the stage for developing cardiovascular disease and a week immune system in the future person’s later life.

A low birth weight baby, defined as one who weighs less than 5.5 pounds (2500 grams), is nearly forty times more likely to die in the first year of life than is a normal weight baby. Such a baby is also likely to be unable to do its job to obtaining nourishment by sucking or to win its attention by energetic, vigorous cries and other healthy behavior. The low-birth weight infant may become an apathetic, neglected baby, and this compounds the original malnutrition problem and leads to illness. For these reasons, underweight women are advised to try to gain weight before becoming pregnant or to strive to gain adequately during pregnancy.

The infant of an obese mother may be larger than normal and born late or it may be large in size even if born prematurely. In the latter case a large premature baby may not be recognized as such and may not receive the special care it requires from medical staff. Also, obese pregnant women more often suffer gestational diabetes, hypertension and infection after the birth than do women of healthy weight.
The placenta is a sort of pillow of tissue in which maternal blood vessels lie side by side with fetal blood vessels entering it through the umbilical cord. This close association between the two circulatory systems permits the mother's bloodstream to deliver nutrients and oxygen to the fetus and to carry away fetal waste products. (Source: Warlan G M / Insel P M, Perspectives in Nutrition (2nd ed.))

If the mother's nutrient stores are inadequate during the period when the body is preparing to develop placenta, then the placenta will never develop properly. As consequence, no matter how well she eats later, the woman's unborn baby will not receive optimal nourishment.

The infant is likely to be a low birth weight baby with all of the associated risks. After getting such a poor start on life, children may be ill equipped even as adults, to store sufficient nutrients and a girl may also be unable to grow an adequate placenta. In turn she may bear an infant who is unable to reach full potential.

4.1. The events of pregnancy:

On implantation of the newly fertilized ovum (or zygote) in the uterine wall, a placenta begins to grow inside the uterus. The placenta which is shown in Fig. 2, is a sort of cushion of tissues in which the mother's and baby's blood vessels interwine and exchange materials. The two bloods never mix, but nutrients and oxygen cross from the
mother’s blood into the baby’s blood, while wastes move out of the baby’s blood, ultimately to be excreted by the mother. The amniotic sac forms to cradle the baby, cushioning its transport of molecules, the placenta is a highly metabolic organ with some 60 sets of enzymes of its own. It actively gathers up hormones, nutrients and protein molecules such as antibodies and transfers them into fetal blood stream. It also produces hormones that maintain pregnancy and prepare the mothers breasts for lactation.

During the two weeks following fertilization, the zygote divides into many cells, and these cells sort themselves to three layers. No increase in size takes place at this time, but it is a critical period developmentally. Adverse influences such as smoking, drug abuse and malnutrition at this time lead to failure to implant or to abnormalities that can cause loss of zygote, possibly even before the women knows she is pregnant. Both mother and child will benefit most from an optimal supply of nutrients uncontaminated by other materials.

The next six weeks of the development of the embryo register astonishing physical changes. At eight weeks, the foetus has a complete central nervous system, a beating heart, a fully formed digestive system and the beginning of facial features.

Each organ and tissue type grows with its own characteristic pattern and timing. Each organ depends most on it supply of nutrients during its own intensive growth period. For example, the foetus’s heart and brain are well developed at 14 weeks; the lungs, ten weeks
later. Therefore early malnutrition impairs the heart and brain; late malnutrition impairs the lungs.

Events during a critical period can occur only at that time and at no other. Whatever nutrients and other environmental conditions are necessary during this period must be supplied on time if the organ is to reach its full potential. If the development of an organ is limited during a critical period, recovery is impossible. Thus early malnutrition often does irreversible damage, although this may not become fully apparent until maturity and may never be attributed to events of pregnancy.

- Women likely to develop nutrient deficiencies include those who:-
  - Are young (adolescents).
  - Have had many recent previous pregnancies.
  - Lack nutrition knowledge, have too little money to purchase adequate food, or have too little family support.
  - Ordinarily consumed an inadequate diet due to food faddism, preferences, weight loss “dietting”, limited food choices or other reasons.
  - Smoke cigarettes or abuse alcohol or drugs.
  - Are lactose intolerant or suffer chronic health conditions requiring special diets.
  - Are over-weight or under-weight at conception.
  - Are carrying twins or triplets.
  - Gain insufficient weight or excessive weight during pregnancy.
  - Have a low level of education.
The last seven months of pregnancy, the fetal period, bring about a tremendous increase in the size of foetus. Critical periods of cell division and development occur in organ after organ. The amniotic sac fills with fluid and the mother's body changes. The uterus and its supporting muscles increase in size, the breasts may become tender and full, the nipples may darken in preparation for lactation and the mother's blood volume increases by half to accommodate for the added load of materials it must carry. Gestation lasts approximately 40 weeks and ends with the birth of infant.\(^{12}\)

4.2. Physiological Changes and Resulting problems in pregnancy:

During pregnancy the foetus need for oxygen, nutrients and excretion increases the burden on mother's lungs, heart and kidneys. Although the mother's digestion and metabolic processes work very efficiently, some discomfort accompanies the changes her body undergoes to accommodate the foetus.

4.2.1. Heart burn. Constipation and hemorrhoids: Progestin's produced by the placenta relax muscles in both the uterus and the intestinal tract. This often causes heartburn as stomach acid steps up though the lower esophageal sphincter into the esophagus. When that happens, the woman should avoid lying down after eating, reduce fat consumption so that foods pass quickly from the stomach into the small intestine, and avoid spicy foods if they are not tolerated. She should also consume liquids between meals to decrease volume and pressure in the stomach.
Constipation often results from the relaxation of intestinal muscles, especially late in pregnancy as the foetus competes for space with the Gastro-intestinal tract. Consuming more water, dietary fibre, and dried fruits and exercise can help a pregnant woman avoid constipation and an often accompanying problem, hemorrhoids. Straining can lead to hemorrhoids, which are more likely to occur during pregnancy anyway because of physiological changes occurring during pregnancy.

4.2.2. Edema: Estrogens and progestins combine to cause connective tissue to retain fluid during pregnancy. Blood volume also greatly expands during pregnancy and normally contributes some edema. Overall, edema generally spells trouble only if hypertension and the appearance of protein in the urine accompany fluid retention.

4.2.3. Morning Sickness: Nausea is common in the early stages of pregnancy; it is possibly a reaction of pregnancy-related hormones circulating in the blood stream. Although known as “Morning Sickness” nausea may occur at any time and persist all day. It is often the first signal to a woman that she is pregnant. Some women partially control mild nausea by eating soda crackers, or dry cereal before getting out of bed, avoiding large fluid intakes early in the morning, cooking with open windows to dissipate nauseating smells, eating smaller, more frequent on meals, and avoiding foods that increase nausea. Usually, nausea, stops after the first trimester, but it can continue throughout the entire pregnancy.
4.2.4. *Gestational Diabetes:* Hormones synthesized by the placenta antagonize the action of hormone insulin. This antagonism can precipitate gestational diabetes, often beginning in weeks 20 to 24, particularly in women with family histories of diabetes.

4.2.5. *Anaemia:* To supply fetal needs, the mother’s blood volume expands up to approximately 150% of normal. But the red cell mass expands only 20% to 30% above normal and this occurs more slowly. This leaves proportionately fewer red cells in a pregnant woman’s blood stream. The lower reaction of red blood cells is a condition known as physiological anaemia, since it is a normal response to pregnancy, rather than the result of poor nutrient intake. If during pregnancy, however, iron stores and/or dietary intake – particularly of iron and folate is inadequate, resulting anaemia may require medical attention.

4.2.6. *Pregnancy-induced hypertension:* A high risk to pregnancy results from pregnancy-induced hypertension. These disorders, also known as in mild forms as pre-eclampsia and in severe forms as eclampsia, resolves once the pregnancy state end. Early signs and symptoms include a rise in blood pressure, excess protein in urine and fluid retention. Good nutrition especially an adequate (about 2 gms/day) may prevent or lessen the disorder.¹³²

4.3. *Nutrient needs during pregnancy:* Between the moment of conception and the moment of birth, innumerable events determine the course and outcome of fetal
development and ultimately, the health of the new born infant. Each organ needs nutrients most during its own intensive growth period. A nutrient deficiency during one stage of development might affect the heart and during another stage, the developing limbs.

A woman’s nutrient needs during pregnancy and lactation are higher than at any other time in her adult life and are greater for certain nutrients than for others.\(^{37}\)

4.3.1. Energy: The total caloric cost of producing the foetus, the placenta and other maternal tissues and of establishing reserves is about 80,000 Kcal. For most woman an extra allowance of 300 Kcal / per day during the second and third trimester will permit satisfactory weight gain. An allowance of at least 36 Kcal per Kg pregnant weight is needed for satisfactory utilization of protein, with 40 Kcal per Kg being an average intake.

The caloric requirement may vary as much as 800 – 900 Kcal, depending on the activity of the women. Some adolescent pregnant girls are so sedentary that their caloric need is increased by only 150 Kcal. But women who have several children and the associated household duties or women whose employment involves body movement require more than the 300 Kcal per day increase. The adequacy of the caloric requirement can be evaluated by maintaining desirable rate of weight gain.
4.3.2. Protein: About 925 gms protein is deposited in the foetus and maternal tissue during pregnancy. The rate of deposit in these tissues averages 0.6, 1.8, 4.8 and 6.1 g per day during the four quarters of pregnancy. Protein may be stored in the body at a uniform rate during the entire pregnancy and is made available to the specialized tissues as needed.

4.3.3. Minerals: The efficiency of absorption of minerals such as Calcium and Iron improves during pregnancy, but the demands of the foetus and other developing tissues necessitate increases in the diet during the second and third trimester. The full term foetus contains about 28 gms calcium. Some calcium and phosphorous deposition takes place early in pregnancy, but most of the calcification of bones occurs during the last two months of pregnancy. The first set of teeth begins to form about the eight week of prenatal life, and they are well formed by the end of the prenatal period. The 6 – year molars, which are the first permanent teeth to erupt, begin to calcify just before birth.

If the mobile reserve of calcium is lacking in the mother, the demands of the foetus can be met, perhaps inadequately, only at severe expense to the mother.

i) Iodine: The daily allowance of 175μg iodine is easily met by using iodized salt. If sodium restriction is required for any reason, a supplement may be prescribed.

ii) Sodium: During pregnancy the sodium requirement increases to take care of fetal needs. The enlarging maternal
issues and the expanding blood volume. The homeostatic mechanism spare sodium loss that might otherwise occur because of the increased glomerular filtration rate.

RECOMMENDED DIETARY ALLOWANCES OF A PREGNANT WOMAN

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Normal Adult Woman</th>
<th>Pregnant Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Kcal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>1875</td>
<td>+ 300</td>
</tr>
<tr>
<td>Moderate</td>
<td>2225</td>
<td>+ 300</td>
</tr>
<tr>
<td>Heavy</td>
<td>2925</td>
<td>+ 300</td>
</tr>
<tr>
<td>Protein gm</td>
<td>50</td>
<td>+ 15</td>
</tr>
<tr>
<td>Fat g</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Calcium mg</td>
<td>400</td>
<td>1000</td>
</tr>
<tr>
<td>Iron mg</td>
<td>30</td>
<td>38</td>
</tr>
<tr>
<td>Retinol mcg</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>β-Carotene mcg</td>
<td>2400</td>
<td>2400</td>
</tr>
<tr>
<td><strong>Thiamine mg</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>0.9</td>
<td>+ 0.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.3</td>
<td>+ 0.2</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.5</td>
<td>+ 0.2</td>
</tr>
<tr>
<td><strong>Riboflavin mg</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>1.1</td>
<td>+ 0.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.3</td>
<td>+ 0.2</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.5</td>
<td>+ 0.2</td>
</tr>
<tr>
<td><strong>Niacin mg</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>12</td>
<td>+ 2</td>
</tr>
<tr>
<td>Moderate</td>
<td>14</td>
<td>+ 2</td>
</tr>
<tr>
<td>Heavy</td>
<td>16</td>
<td>+ 2</td>
</tr>
<tr>
<td>Pyridoxine mg</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Ascorbic Acid mg</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folic Acid mcg</td>
<td>100</td>
<td>400</td>
</tr>
<tr>
<td>Vitamin B₁₂ mcg</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

ICMR: 1989

Food intake during pregnancy is important, but entering pregnancy with nutrient reserves has many advantages. It provides a margin of safety if food intake is interfered with, during the early stages of pregnancy – for example, morning.
sickness (nausea and vomiting). The amount of each small nutrient that can be stored in the body varies from small to large. However, a well nourished body usually has a small surplus of all nutrients. This surplus can be crucial in the first trimester of pregnancy when the ability to eat is impaired by hormonal shifts and the tissues and organs of the embryo are being differentiated. This is the time when adequate nutrition is believed to help protect against some birth defects.

Good pre-pregnancy nutritional status also is an indicator of reasonably good eating practices.

Most of the health problems that occur during pregnancy can be reduced or prevented by nutritional adjustment. Among these problems are nausea, anaemia, pica, heart burn, urinary urgency, muscle cramps, bloating, toxemia and excessive alcohol consumption.

To overcome these disturbances following nutritional adjustments can be made.

❖ Nausea: eat dry toast or crackers before arising; drink fluid between meals only, eat no fats and oils, use skim milk.
❖ Constipation: eat high fiber foods such as fresh fruits, vegetables, prcences, and whole grain breads.
❖ Anaemia’s: increase intake of iron and the vitamins associated with red blood cell formation (Folacin, $B_6$, $B_{12}$ and C)
❖ Heart burn: eat bland foods; plan small and frequent meals.
Urinary urgency: generally avoid consuming tea, coffee, spices and alcoholic beverages.

Muscle cramps: increase calcium and decrease phosphorous intake.

Bloating cramping: Plan frequent and small meals; eat no greasy foods reduce roughage and cold beverages.^{38}

5. NUTRITIONAL HEALTH OF LACTATING WOMEN

Nursing mother has not only to nourish herself but also the nursing infant. The baby is born with liberal stores of iron, protein, vitamin C and other vitamins and these have to be supplied either from the mother’s diet or her tissues. If the diet is lacking in the nutrients needed by the foetus they are removed from maternal stores.^{39}

One of the remarkable phenomena in nutrition is that even a poor mother on a low plane of nutrition is able to nurse her infant satisfactorily at least for the first few months of life so inspite of a more satisfactory state of nutrition. But this is not justification for neglecting her own nutrition as this may be achieved at some cost to the mother. If she becomes tired and irritable as a result she is not likely to take good care of her child and provide the maternal stimulation which is so important for its development.^{40}
Severe under-nutrition reduces the amount of breast milk produced. Infants born to under-nourished mothers get a smaller amount of milk.\(^{(41)}\)

Once baby is happily established on the breast, the mother’s diet is just as important as it was before the birth.

A well balanced diet is needed for milk production. The depletion of nutrients of the mother through milk has to be made good through food intake in order to protect the health of the mother.\(^{(1)}\)

5.1. Events of Lactation:

Almost all women can breast feed their children. Major problem are usually due to a lack of information. Anatomic problems in breasts, such as inverted nipples, can be corrected during pregnancy. Breast size is no indication of success in breast feeding.
5.1.1. Producing Human Milk: During pregnancy, cells in the breast aggregate to form milk producing cells called lobules fig 3. Hormones from the placenta stimulate these changes in the breast. After birth, the rise in the maternal production of the hormone prolactin acts to maintain these changes in the breast and in turn enhances the ability to produce milk. During pregnancy, breast weight increases by 1 to 2 pounds. The hormones prolactin also stimulates the synthesis of milk. Suckling stimulates prolactin release. Milk synthesis then occurs as an infant nurses.

Most protein found in human milk is synthesized by breast tissue. Some proteins also enter the milk directly from maternal circulation. These proteins include immune factors and enzymes, long-chain fatty acids, found as triglycerides in breast milk, are synthesized by breast tissue. The monosaccharide galactose is synthesized in the breast while glucose enters from maternal circulation. Together these monosaccharides form the disaccharide lactose, the main carbohydrate in the human milk.

5.1.2. The let down reflex: An important brain – breast connection – the let down reflex is necessary for breast feeding (fig 4.) The brain releases the hormone oxytocin to allow the breast tissue to “let down” or release the milk from storage sites to travel to the nipple area. A tingling sensation signals the let – down reflex shortly before milk flow begins. It the let down reflex doesn’t operate, little milk is available to the infant.
The let-down reflex is easily inhibited by nervous tension, a lack of confidence and fatigue.\(^\text{36}\)

Adequate nutrition of the mother supports successful lactation and without it lactation is likely to falter or fail.

### 5.2 Nutritional requirements of lactating women:

By continuing to eat nutrient dense food and fluid at frequent intervals throughout lactation, the mother who chooses to breastfeed her infant will be nutritionally prepared to do so. An inadequate diet doesn’t support the stamina, patience and self-confidence that nursing and infants demands.

#### 5.2.1. Food energy:

A nursing mother produces about 25 ounces of milk a day, more or less depending primarily on the infants demand for milk. This milk output amounts to about
525 Kcal per day and the mother's body requires extra energy to produce it. The energy allowance for a woman during the first six months of lactation is a generous 640 Kcals a day above her ordinary need. The committee on dietary allowances suggests that 500 Kcals come from added food and the rest from the body stores of fat accumulated during pregnancy for that purpose. 

5.2.2. Protein: During lactation protein requirement has been computed on the basis of secretion in milk of 9.4 g per day during 0 – 6 months and 6.6 gms during 6 – 24 months which correspond to 820 ml and 600 ml of milk respectively with protein content 1.15 g / 100 ml.

Assuming a 70 percent efficiency of conversion of dietary protein into milk protein and a 25 percent of individual variation the safe daily intake will be 16.8 gm and 12.0 gm during the first six months and during 6 -12 months respectively. The nutrition expert committee has recommended, during lactation all daily intake of 25 gm the first 6 months and 18 gm during 6 – 12 months of lactation.

5.2.3. Fat: Although the total amount of fat in breast milk is not influenced by the mother’s diet, the composition of the milk fat reflects the composition of mother’s diet.

The requirements of linoleic acid during lactation increases 5.7 en %, Invisible fat requirement is 17.5 en % and visible fat should be 45 gm.
5.2.4. Calcium: The increased amount of calcium that was required during gestation for mineralisation of the foetal skeleton is now diverted into mother’s milk production. Both during pregnancy and lactation 1000 mg has been prescribed by ICMR. The retention of calcium in lactating women is about 30 percent, hence an extra amount of 600 mg is prescribed. 500 ml of milk or milk products should be given to lactating mother to meet 1000 mg of calcium.

5.2.5. Iron: The iron requirement during lactation remains same as adult women of 30 mg / day. The baby is born with a relatively larger reserve of iron since milk is not a good source of iron. A good allowance of iron in the mother’s requirement during lactation does not convey additional iron in the mother’s requirement during lactation is the sum of the requirement of the mother and that required to make up the iron lost in breast milk. Since there is amenorrhoea during lactation the basal requirement will be same as in adult woman 14 μg / Kg.

5.2.6. Vitamin A: The quantity of Vitamin A present in 650 ml of human milk is 300 mcg, so the ICMR recommends an additional allowance of 350 mcg of retinol. This can be achieved by including liver, fish liver oils, egg yolk and green leafy vegetables in the diet.

5.2.7. Vitamin B: As calorie and protein requirements are increased during lactation, B-vitamin requirements are also increased. Additional B-vitamins are required for the amounts that are present in human milk.
Recent studies have shown that thiamine content of breast milk in poor mothers in rice eating areas is lower than that of a well to do mothers. Supplementation to such mothers with thiamine was shown to increase the concentration of this vitamin in the milk. Thus deficiency of thiamine in the diet may affect not only the adult but may have repercussions also on the nutrition of the breast fed infants.

In lactating women blood folate levels drop constantly, reflecting the stress imposed by maintaining folate content of breast milk at approximately 25 µg /day. An additional allowance of 50 µg of folate could be provided during lactation.

The amount of vitamin B\textsubscript{12} secreted in milk per day is 0.25 – 0.3 µg. An additional intake of 0.5 µg /day would cover the needs during lactation.

If the diet meets the requirement of protein and calcium the requirement of riboflavin would be met. Milk is not only a good source of calcium but also a good source of riboflavin.

5.2.8. Vitamin C: The additional needs during lactation are calculated on the basis of the vitamin C secreted in milk. Assuming a daily milk secretion of 700 ml milk with an Ascorbic Acid content of 3 mg / dl by well nourished women, the additional requirement during lactation will be 20 mg. taking into consideration of the cooking losses (50%) the committee recommends an additional intake of 40 mg per day during lactation.
5.2.9. Fluid: An increased intake of fluids is necessary for adequate milk production, since milk is a fluid tissue. Water and beverages such as juices, tea, coffee and milk all add to the fluid necessary to produce milk (42).

**RECOMMENDED DIETARY ALLOWANCES OF A LACTATING MOTHER**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Normal Adult Woman</th>
<th>Lactating Mother</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sedentary</td>
<td>0-6 Months</td>
</tr>
<tr>
<td>Energy Kcal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>1875</td>
<td>+ 550</td>
</tr>
<tr>
<td>Moderate</td>
<td>2225</td>
<td>+ 550</td>
</tr>
<tr>
<td>Heavy</td>
<td>2925</td>
<td>+ 550</td>
</tr>
<tr>
<td>Protein g</td>
<td>50</td>
<td>+ 25</td>
</tr>
<tr>
<td>Fat g</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Calcium mg</td>
<td>400</td>
<td>1000</td>
</tr>
<tr>
<td>Iron mg</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Retinol mcg</td>
<td>600</td>
<td>950</td>
</tr>
<tr>
<td>β-Carotene mcg</td>
<td>2400</td>
<td>3800</td>
</tr>
<tr>
<td>Thiamine mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>0.9</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.1</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.2</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Riboflavin mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>1.1</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.3</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.5</td>
<td>+ 0.3</td>
</tr>
<tr>
<td>Niacin mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>12</td>
<td>+ 4</td>
</tr>
<tr>
<td>Moderate</td>
<td>14</td>
<td>+ 4</td>
</tr>
<tr>
<td>Heavy</td>
<td>10</td>
<td>+ 4</td>
</tr>
<tr>
<td>Pyridoxine mg</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Ascorbic Acid mg</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Folic Acid mcg</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Vitamin B&lt;sub&gt;12&lt;/sub&gt; mcg</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

ICMR: 1989
SECTION - C

Studies on Nutrition
1. STUDIES ON NUTRITION

1.1 STUDIES RELATED TO NUTRITIONAL ANTHROPOMETRY

Leela M.Sai / Busi B.R., (1995) studied the effect of physiological state such as pregnancy, lactation or NPL state on the nutritional status of women. The study comprised of 726 Andhra women from low to middle groups. The nutritional status of women was studied by anthropometry, dietary and clinical methods. The results indicate that the women in the state of lactation are too burdened during which their body measurement showed lower values, the dietary intakes were only 50% adequate and the incidence of nutritional deficiencies is also high as indicated by high mean nutritional deficiency scores. Among lactating women the women experiencing amenorrhoea are worse as indicated by all these parameters.

To find out the degree of current under-nutrition in rural reproductive age women, 49 villages of two adjoining rural block of Varanse 6130 Non-pregnant and non-lactating rural women in the age group 18-45 years were studied by Srivastava M. et al (1998) for socio-demographic characteristics and anthropometry, i.e. weight, height and mid-arm circumference. Their percentiles for age and for weight for height were calculated by using cubic spline method. The women in 90th centile weighed < 38 Kg and those in > 90th centile weighed 47 – 48 Kg, 74.2% had weight < 45 Kg. The 50th centile and 90th centile values were around 22 and 24 cm, respectively. Mid-arm circumference and height had significant linear correlation with weight. Around 50% rural U.P. women in pre-pregnancy state are undernourished. With age these rural women did not change in weight or mid-arm circumference.
In NFHS-2 (1998-99) ever married women 15 – 49 years were evaluated the mean BMI for women in West Bengal was found to be 2 Kg/m² varying within a narrow range of 18-23 for all age groups. 44% of women in West Bengal have a BMI below 18.5 Kg/m², indicating a high prevalence of nutritional deficiency. Nutritional problems, as indicated by BMI, are particularly serious for women age 20 – 29, rural women, illiterate women, women who are not Hindu or Muslim, women in scheduled castes and scheduled tribes, women who are employed by someone else or who work on a family farm or in a family business, and women from households with a low standard of living. It was found that education and the standard of living are strongly related to chronic energy deficiency. Illiterate women and women with a low standard of living are more than three times as likely to have a low BMI as women who at least completed high school and women from households with a high standard of living.

In West Bengal, the haemoglobin levels were tested for 92% of women, compared with 88% of women in India as a whole. Overall, 63% of women have some degree of anaemia. 45% of women are mildly anaemic, 16% are moderately anaemic and 2% are severely anaemic. The prevalence of anaemia is higher for breast feeding women than for other women, but there is also a difference in the prevalence of anaemia between pregnant women and Non-pregnant women who are not breast feeding. However, pregnant women have a much higher prevalence of moderate anaemia 26% than Non-pregnant women 14 – 19%.

In order to identify differences in growth and nutritional status between early (upto 17 years old) and late (17 to 19 years old) adolescent mothers during pregnancy and to measure the risk to have an intrauterine growth retardation (IGR : birth weight < 10 degree percentile) a
A retrospective longitudinal study was carried out by Bolzan A. et al (1999) in 300 adolescent pregnancies. Nutritional status was estimated according to the body mass index measured during the first (< 20 weeks) and last (> 33 weeks) prenatal-control and by the weight gain during pregnancy. When a mother had a weight gain < 25 degree percentile she was considered at risk to have an IGR. Neonatal anthropometry included birth-weight, recumbent length, cephalic perimeter and body mass index. Comparison between both groups of mothers was performed by one way ANOVA and Mantel Haenszed stratified procedure. Odds – ratio was also calculated. Results showed no statistically significant differences in growth between both early and late adolescent pregnancies and between both groups of new borns. When a mother had a weight gain < 25 degrees percentile the relative risk to have an IGR increase up to three times (O.R. = 2.71 I.C. 95% : 1.31/ 6.45). There were highly significant differences in growth between new borns from mothers at risk and from mothers not at risk (P < 0.01). The study showed that the risk to have an IGR is significantly related to nutritional status and not to age itself in adolescent pregnancies.\(^{40}\)

Saxena Vartika et al (2000) studied 400 pregnant women upto to 28 weeks of gestational age. All the women were followed up at four weekly interval for the assessment of weight gain, however some women defaulted hence, follow up of all women at periodic interval was not possible. All the women were clinically examined. Their height was measured up to nearest 1 cm, and weight upto nearest of 0.5 Kg. Hb. level was estimated by Sahli’s method. Dietary intake was assessed by oral questionnaire method for one dietary cycle. The same procedure was reported on subsequent visits of pregnant women till termination of pregnancy. The Hb level less than 11 gm/dl at time of registration of women was used for classification of under-nutrition. Prevalence of iron deficiency and iodine deficiency were assessed
on the basis of pallor in the lower conjunctiva and presence of neck swelling
diagnosed as goitre using the criteria for the diagnosis of goitre.

On the basis of clinical signs and symptoms 36.3% women were
found to be having iron deficiency, 2.0% women reported history of night
blindness, 1.5% women had shown clinical evidence of iodine deficiency.
Overall 23.3% were having BMI < 18.5 Kg/m². Majority of women
(72.5%) were having BMI in the range of 18.5 – 25.0 Kg/m². 38% women
were found to be suffering from anaemia. Out of which 3.7% women were
severely anaemic (Hb < 6.5gm/dl). 22.8% and 11.5% women were suffering
from mild and moderate degree of anaemia respectively. Average weight
gain among those delivering upto 40 weeks and beyond was 5.4 Kg and 6.6
Kg respectively. Overall 29.5% women were not taking adequate calories.\cite{10}

For some women, postpartum retention of weight gained during
pregnancy may contribute to obesity. A recent 10 – week randomized
intervention (at energy metabolism Lab, Jean Mayer USDA Human
Research Centre on Aging Tufts University, Boston USA) showed that
infants of initially overweight lactating mothers who exercised and dieted to
lose an average of 0.5 kg/week grew normally. The findings of this study
support the Institute of Medicine guidelines for weight loss in overweight
women who are exclusively breast feeding their child.\cite{47}

Pre-pregnancy weight and pre-pregnancy body mass index in the
categorization of the nutritional state of the pregnant women. The study
was formed by 109 pregnant women. They were evaluated in the first
trimester of pregnancy at the “Centro do Attention Nutritional Infantile
In each one of them the Nutritional state was classified according to three criteria: integral nutritional diagnosis, pre-pregnancy weight and pre-pregnancy BMI. For the evaluation of effectiveness of diagnosis criteria, the other two approaches were compared with the integral nutritional diagnosis. The analysis of the frequency, sensibility, specificity and predictive values were applied. The integral nutritional diagnosis showed: 75.2% (n = 82) well nourished and 14.8% (n = 27) under-nourished. The sensibility of pre-pregnancy weight was 0.93 and of the pre-pregnancy body mass Index was 0.52, with a positive predictive value of 0.60 and 0.82 respectively. The specificity of the first indicator was 0.79 and of the second was 0.96, with negative predictive value of 0.97 and 0.86 respectively. The pregnancy weight demonstrated to be effective to under-nourished women.

Winkvest A (2003) found that women in affluent societies retain some weight with each pregnancy, beyond that of non-pregnant women. Women in less affluent societies retain less weight with each pregnancy. During lactation, women in both affluent and less affluent societies experience only modest weight loss. During the NP/NL interval, women in affluent societies tend to gain weight, whereas weight of women in less affluent societies is likely to fluctuate.

1.2 STUDIES RELATED TO DIETARY OR NUTRIENT INTAKE

Kaur Malkit (1985) reported that ninety young women in the age group of 16 to 20 years from the women hostel of Punjab Agricultural University, Ludhiana were selected to assess their nutritional status. The subjects were classified into three groups of 30 each on the basis of their haemoglobin and food habits i.e. anaemic vegetarian (AV), anaemic non-vegetarian (ANV) and non-anaemic (NA) group.
The mean daily intake of pulses, roots and tubers, other vegetables, meat, fish and egg, milk and milk products, sugar and jaggery, fats and oils among the subjects of the AV, ANV and NA groups was adequate as compared to RDI (ICMR, 1984). The intake of cereals and green-leafy vegetables was, however, inadequate. The seasonal differences in the average daily intake of pulses and other vegetables were significant (p < 0.05). The mean daily energy, iron and zinc intake was inadequate while the intake of protein, calcium, copper, cobalt, phosphorous and ascorbic acid was sufficient in all the groups. The seasonal differences in the average daily intake of protein were significant only in the NA group. The ionizable iron was 5.97 to 7.06 per cent of the total iron in the diets consumed by the subjects in both the seasons and was comparatively higher in the diets of ANV group.

The average weights and heights of the subjects were normal. The mean mid-arm circumference values of the subjects were between 80 to 90 percent of standards, while the mean triceps skin fold thickness value was more than the standards.

The average haemoglobin (Hb) levels of the subjects of AV, ANV and NA group was 10.4 ± 0.11, 10.7 ± 0.13 and 12.5 ± 0.10 g/dl respectively. The average packed cell volume among the subjects of all the groups was within the normal range while mean corpuscular concentration value was significantly high among the subjects of NA group as compared to other two groups. The mean serum iron values were 81.2 and 123.1 μg/dl in the anaemic and non-anaemic group and was in the normal range. The corresponding figures for total iron binding capacity and per cent transferrin saturation were 534, 306 μg/dl and 16.1, 40.5 percent respectively confirming iron deficiency in the anaemic subjects. The data also indicated
that malaria and menstrual flow affected significantly (p < 0.01) the blood iron status of the subjects.

The respiration frequency (RF), pulmonary ventilation rate (PVR), oxygen consumption and energy expenditure during cycling was higher in the anaemic group by 15.07, 11.65, 28.57 and 28.68 per cent respectively as compared to non-anaemic group. On the other hand there was an increase of 17.13 per cent in the mechanical work done in case of non-anaemic subjects which perhaps was associated with better iron status of the non-anaemic subjects.

Statistically, positive and highly significant (p < 0.01) correlation coefficients were found between dietary energy and protein. The coefficient of correlation between Hb and mechanical workout was positive and highly significant (p < 0.01). However, the coefficient correlation of Hb, RF, PVR and energy expenditure were negatively and significantly (p < 0.01) correlated confirming the adverse effect of iron deficiency anaemia on physical work performance.

The dietary nutrient intake of persons aged 10-72 years (23 males and 30 females) was investigated by Kazuko Hiraj et al (1994) using the 24-hour recall method living in Southeastern Nepal. The mean daily consumption of food averaged 433 and 437 gm of cereal, 25 and 20 gm of fat, 59 and 60 gm of coloured vegetable for males and females respectively.. For the majority of subjects, milk and dairy product (249 and 213 g for males and females respectively ) was almost the sole source of food of animal origin. The levels of energy intake (2427 and 2275 Kcal for males and females respectively), protein (63.0 and 57.3g), and vitamin B 2.16 and 2.04 mg) were related to the level of consumption of cereal (r = 0.89, r =

[63]
0.77 and \( r = 0.9 \), \( p < 0.001 \), respectively) and rice (\( r = 0.69 \), \( r = 0.50 \) and \( r = 0.58 \), \( p < 0.001 \), respectively). The energy intake was supplied with 10.9 and 10.4% by protein, 18.6 and 15.8% by fat and 70.6 and 73.8% by carbohydrate for males and females respectively. The intake levels of Ca (612 and 466 mg), Fe (13.1 and 11.9 mg), and vitamin B\(_2\) (1.06 and 0.80 mg) were correlated with the protein intake (\( r = 0.57 \), \( r = 0.87 \) and \( r = 0.60 \), \( p < 0.001 \), respectively), the daily mean intakes of vitamin A and C were 1406 IU and 101.0 mg for males and 1182 IU and 78.9 mg for females, respectively.\(^{50}\)

Food quantity and quality has been studied [Menghetti E et al (1994)] in a group of 197 pregnant women during their last quarter of pregnancy. The results were that nourishment both in quantity and in quality enough close to the LARN advices, with a slight reduction of calories per day (about 300) and a slight lipa excess (+ 5%) to the depriment of the carbohydrates. Correct was the number of meals per day (4-5) while the “Mediterranean diet” has been kept by the 53% of subjects. Fish consumption was scanty (18%) of the cases.\(^{51}\)

Baturin A.K. et al (1995) studied Nutrient and energy intake in 892 pregnant women during III trimester of pregnancy. Daily protein intake was 65-66 g and animal protein made up 60% of total protein intake. Total fat consumption was 80-81g, carbohydrates intake was 240-250g. Total energy intake in Ekaterinburgs and Moscow’s pregnant made up 2031 and 1978 Kcal respectively. Body mass gain from I to III trimesters have formed about 9 Kg or 0.41 Kg per week. Body mass index (BMI) averaged 25.1 and 25.7 in Ekaterinburgh’s and Moscow’s pregnant on day of survey. About 2.5% of women had BMI lower than 19.8. The results were compared with data of developed countries and conclusion was made about
sufficient energy and macronutrient intakes, but fat intake was moderately high and formed 33-35% of total energy. \(^{(52)}\)

Ivanova L (1995) studied the influence of dietary intakes during I and III trimester of pregnancy on iron status and anaemia incidence in 44 healthy pregnant women. More than 70% of the women studied had low dietary intake of iron during pregnancy, but only 21% were anaemic. The half of women with anaemia were with iron deficient anaemia. The results of iron intake might overestimate the risk of developing iron deficiency. Iron status during pregnancy is influenced by the dietary intake and diet structure, iron body stores and adaptive mechanisms. \(^{(55)}\)

Gorbitz et al (1995) investigated the dietary composition and followed the changes in serum lipids during pregnancy among 20 women age 25 – 36 years. The womens diet was stable during pregnancy, but the intake of vitamin D, iron and fibre was lower than the national recommendations. Fat provided about 31% of energy, saturated fat 12%. The total cholesterol concentration rose from 4.4. \((95\% \text{ confidence interval } 4.2 – 4.6)\) to \(7.0 \text{ mmol/l} \ ((6.5 – 7.5) \text{ (p < 0.0001) without changes in dietary composition. Even in thus group of health conscious, pregnant women the diet did not meet the national dietary recommendations. In addition the composition of fat in the diet was unfavorable.}^{(56)}\)

A nutritional survey of a Hungarian group of pregnant women was carried out by Antal M et al (1997); one hundred and twenty nine women aged 25.9 years, entered the study, but only 70 completed all the protocol. Average body weight gain was 12.4 Kg and the mean birth weight of the new borns was 3,386 g. Mean energy and nutrient intakes of pregnant women showed similar patterns as in Hungarian Non-pregnant women of
the same age. The mean energy intake was high (11 MJ), being 10% higher than for Non-pregnant women. The mean protein and lipid intakes were also high, 91.9g and 108.4g respectively exceeding by 7% and 6% the intakes of the Non-pregnant women. Dietary intakes of saturated fatty acids and monounsaturated fatty acids were close to 12% of energy, and the intake of polyunsaturated fatty acids was 7.6% of total energy. Palmitic acid (16:0), oleic acid (18:1 n-9) and linoleic acid (18:2 n-6) made the greatest contribution to the total peak area of SFA’s MUFAS’s respectively. The ratio of P/S (Polyunsaturated/saturated fatty acids) was appropriate: 0.65; however, the ratio of linoleic acid (18:2 n-6) to linolenic acid (18:3 n-3) was high: 16. The cholesterol intake was low (245g) but it was still by 75% higher than in Non-pregnant women. The excess sodium intake (6.5g) was very similar to that of Non-pregnant women. Mean values for retinol, tocopherol, ascorbic acid, cobalamin and copper intakes were higher than the Hungarian recommended dietary allowances (RDA). Thiamine, riboflavin, pyridoxine, niacin, calcium, iron and zinc intakes were insufficient. Data showed an imbalance in the energy and nutrient intakes of Hungarian pregnant women, and this could be harmful for both the mother and pregnancy outcome. 

A study was taken by Wu B et al (1998) to see the improvement of the intakes of various nutrients including protein, fat, carbohydrate, fibres, calcium, iron, zinc et al in pregnant women after appropriate diet consultation by doctors. 100 cases of pregnant women attending diet consultation clinics were randomly selected in which, 50 cases came for the first time and another 50 cases (study group) were for the third visit at least. The diet consultation of the study group after the second consultation were compared with that before consultation and with concurrent control group. After diet consultation, except for retinol the intake of various nutrients,
including calorie intake, protein, fibers, magnesium, calcium, phosphorous, iron, zinc, vitamin E, riboflavin, thiamine, nicotinic acid, in study group were significantly improved compared with that of the study group before diet consultation and of the control group (p < 0.01). Hence it was concluded that diet consultation plays excellent role in promoting scientific and appropriate nutrient intake of pregnant women.\cite{13}

Roglska Niedzwiedz M et al (2000) studied nutrition of pregnant women in Lubuski district and reported that nutrition in the third trimester in women from small town in Lubuski district was improper. Energy, minerals and vitamins intake bellow safe levels of the Polish RDA, only fat intake was above. Women with low protein intake (below 90% safe level of Polish RDA) consumed simultaneously significantly less energy, minerals and vitamins (except vitamin A, E and B\textsubscript{12}) in comparison to women with proper level of protein in diet. Women with low protein intake were generally unemployed, had two or more children and low educational level.\cite{7}

Claudia de Mello Meirelles (2001) compared the dietary and anthropometric profile of 24 ovo-lacto vegetarian and 36 omnivorous female adolescents, between 15 and 18 years old. Weight, height and skin folds were measured. Food frequency questionnaires and a three day food record were used for dietary assessment. Vegetarians presented subscapular, suprailiac and mid-axillary skin-folds. Statistically higher than omnivorous, but the percent body fat was not different. The vegetarian diet provided smaller amounts of energy than that of the omnivores (p < 0.05) and only 17% of the vegetarians was able to reach the recommended allowances for protein. Regarding calcium 83% of the vegetarians and 69% of the omnivores ate less than 2/3 of recommended allowances and a
significantly higher percentage of vegetarians presented low ingestion of iron, riboflavin, and niacin than omnivores ($p < 0.05$). It was concluded that the intake of vegetarians was lower in fat and cholesterol and less adequate in micronutrients than the omnivores ones.$^{381}$

Department of Food and Nutrition the University of Georgia reported that in pregnant women with low exposure to lead, high intakes of calcium (> 2000mg/day) decreased the serum concentration of lead, which could potentially minimize fetal exposure to lead. This is twice the amount of Ca recommended for women during pregnancy and approached the upper level for calcium of 2500 mg/day. The mechanism by which high Ca intake blunts pregnancy induced increases in maternal blood lead may involve decreased lead absorption the intestine or decreased maternal bone resorption with subsequent release of lead. Either mechanism could decrease maternal blood concentrations of lead and potentially limit fetal accumulation of lead.$^{59}$

Swensen A. R. et al (2001) evaluated nutrient intake from dietary sources for 95 pregnant women enrolled in the special supplemental program for women, infants and children (WIC). Women were recruited from Minneapolis and St. Paul area WIC clinics between January and June 1999. Based on estimates from the WIC clinics, the study was described to 159 (63%) of the 251 potentially eligible women. Of these 159 women, 107 (67%) completed the in-person interview. Ninety five (89%) were included in the nutrition analysis. Each woman completed a 1 - hour in-person interview that included a questionnaire, anthropometric measurements and a venous blood sample. A shortened Block 98 food frequency questionnaire was used to assess dietary intake. Serum ferritin was measured was measured for 86 women; Means medians and standard deviations of dietary
intake were explored as well as body mass index distributions. Additionally, the percentage of women consuming less than two-thirds of the recommended dietary allowances (RDA) for certain nutrients was calculated. Overall, the women reported consuming only 85% of the RDA for energy. The average percentage of energy from fat was higher than recommended (37%) vs (30%). The most notable nutrient shortfall was iron, 90% of the women reported consuming less than 2/3 of the RDA. Additionally, serum ferritin analysis classified 22% of the women with iron deficiency anaemia < 12 mg l\(^{-1}\).

Jood S (2002) carried out a study to determine average daily food intakes of 90 rural pregnant women belonging to arid, semi-arid and wet zones of Haryana State, Northern India. As a result of questionnaires and interviews food intake for three consecutive days were collected. Intakes of cereals, pulses, roots and tubers, other vegetables and sugar and jaggery by the respondents were significantly lower than the prescribed Indian RDI. The consumption of milk and milk products and fats and oils was significantly higher than RDI whereas, green-leafy vegetables and fruits were the most limited food items. As the diets of rural pregnant women were inadequate with respect to some food groups which resulted in lower intake of protein, \(\beta\)-carotene and Ascorbic Acid. Despite their poor intake there weights and heights were not much below the standards, BMI classification projected that only about one-fourth of the respondents were underweight.

Backstrand J. R. et al (2002); found that higher plasma ferritin concentrations were associated with greater intakes of non-heme iron and ascorbic acid after control for age, BMI, breast feeding, season, and the time since the birth of the last child. Higher ascorbic acid intakes, but not higher
intakes of heme and non-heme iron, predicted a lower risk of low haemoglobin and hematocrit values after control for the background variables. Consumption of the alcoholic beverage pulque predicted a lower risk of low ferritin and low haemoglobin value. Seasonal variation in ferritin, haemoglobin and hematocrit values was observed.

Ma A et al (2002) examined the relationship between iron status and dietary nutrients, through a cross sectional study in pregnant women. The intake of foods and food ingredients were surveyed by using 24-hour dietary recall. Blood haemoglobin, hematocrit, serum iron, serum ferritin, transferrin and soluble transferrin receptor were measured in 1189 clinically normal pregnant women in the third trimester of pregnancy. The result showed that the average daily intake of rice and wheat was 504.2g in the anaemia group and 468.6g in the normal group. Carbohydrates accounted for 63.69% and 63.09% of energy in the anaemia and normal groups, respectively. Intake of fat was very low; 18.38% of energy in anaemia group and 19.23% of energy in normal group. Soybean intake was 109.4 g/day and 63.6 g/day in the anaemia and normal group, respectively (p < 0.001). There were lower intakes of green vegetables (172.1 g/day) and fruits (154.9 g/day) in the anaemia group than in the normal group (246.2 g/day green vegetables (p < 0.001) and 196.4 g/day fruit (p < 0.001). Intakes of retinol and ascorbic acid were much lower in the anaemia than in the normal group (p < 0.001). In the anaemia group, vitamin A intake was only 54.76% of the Chinese recommended daily allowance (RDA) and ascorbic acid intake was 53.35% of the Chinese RDA. Intake of total vitamin E was 14.55 mg/day in the anaemia group compared with 17.35 mg/day in the normal group (p < 0.016). Moreover intake of iron in pregnant women with anaemia was slightly lower than that in the serum iron in women with anaemia at 0.89 micro g //, which was significantly lower than 1.09 micro g // in the normal
group (p < 0.001). There were lower average values of ferritin (14.70 micro g //l) and transferrin (3.34 g //l) in the anaemia group than in the normal group (20.40 micro g //l ferritin (p < 0.001) and 3.44 g // transferrin (p < 0.001). Soluble transferrin receptor was significantly higher (32.90 n mol //l) in the anaemia than in the normal group (23.58 n mol //l; p < 0.001). The result of this study indicate that anaemia might be attributed to a low iron intake, a low intake of enhancers of iron absorption and a high intake of inhibitors of iron absorption from a traditional Chinese diet rich in grains.15

Hernandez et al (2003) showed that women randomized to the calcium supplements experienced a small decline in blood lead levels (overall reduction of 0.29 µg/dl; 95% confidence interval = -0.85 to 0.26). The effect was more apparent among women who were compliant with supplement use and had high bone lead levels (patella bone lead > or = 5 microgram/gm bone). Among this subgroup, supplement use was associated with an estimated reduction in mean blood lead of 1.16 µg/dl (95% confidence interval = 2.08 to −0.23), an overall reduction of 16.4%.

Among lactating women with relatively high lead burden calcium supplementation was associated with a modes reduction in blood lead levels.64

Takimoto H et al (2003) carried a study to describe the nutritional status in Japanese pregnant and lactating women at a national level, through a comparison with their Non-pregnant/non lactating controls. Data on 330 pregnant and 388 lactating women and their one – by one matched Non-pregnant non-lactating controls showed that there were fewer smokers, drinkers and exercisers in pregnant women compared to their controls (p < 0.01). Both pregnant and lactating women showed significantly higher
intakes of carbohydrates, calcium and vitamin B₂. Mean iron intakes ranged 10.3 – 11.5 mg. in four groups, all being lower than the recommended intake level of Non-pregnant / non-lactating women (12mg/day). Pregnant women consumed more fruits, milk and milk products, and less alcohol beverages and fish/shellfish compared to controls. Lactating women consumed more grain, vegetables, milk and milk products and less alcohol beverages. There were 22.9% anaemic subjects (Hb 11g/dl) in pregnant women, and 11.1% anaemic subjects (Hb < 12g/dl) in lactating women and 15.7% in Non-pregnant/ non-lactating women. None of the pregnant subjects was severely anaemic (Hb < 8g/dl). No significant differences were observed in iron intakes between anaemic and non-anaemic women in each group.

1.3 STUDIES RELATED TO NUTRITIONAL DEFICIENCIES:

A study was carried out by Satija Vidula (1985) for partial fulfillment of M.Sc. degree in Food Nutrition conducted on 20 nursing mothers from middle and low socio-economic groups for a period of five months after child birth. The nutritional intake of the mother, change in anthropometric measurements, amount of breast milk produced per day and the rate of growth of infants, were observed at definite intervals.

The study showed that the diet of lactating mothers from both the income groups was deficient in major nutrients, minerals and vitamins. The deficit was more in case of mothers from low socio-economic group. The weight, arm circumference and skin fold thickness of the mothers from both the groups decreased significantly. Surprisingly, colostrum was fed to the infants by majority of the mothers. A shorter period of satisfactory lactation was observed in both the groups. The amount of breast milk produced per day increased from first to fifth month in the middle socio-economic group.
Whereas the amount decreased after third month in low socio-economic
group. Very few mothers from both the groups could feed more than 700g
breast milk / day. Early initiation of supplementary feeds was observed in
both the income groups, the major reasons being mothers’ convenience and
insufficiency of breast milk. The rate of growth of infants from middle
socio-economic group was within the normal range but the low socio-
economic group infants showed a slower rate of growth. There was no
influence of mothers’ diet on the amount of breast milk.

According to NIPCCD report (1992) over half the pregnant women in
the world have a haemoglobin level indicative of anaemia. For developing
countries, the figure rises to 55%, or to 60%, if China is excluded. Even
among the much better nourished populations of the developed countries
nearly one in every five pregnant women is anaemic.

The picture is slightly better for Non-pregnant women. Nevertheless,
over one-third of all women in the world suffer from anaemia. In
developing countries the equivalent figure is as high as 44% (very slightly
more if China is excluded) and 13% in developed countries. The situation is
particularly acute in parts of Asia. In Southern Asia a populous area
including Afghanistan, Bangladesh, India and Pakistan, which account for
29% of the worlds births, there are 24 million women who are both pregnant
and anaemic. This indicates that three quarters of all pregnant women in the
region are at an increased risk of obstetric complications and hence of
maternal death. Not surprisingly, 58% of these same women are anaemic
even when not pregnant. In 1985-86 a national study of nearly 4000
pregnant women in India, found a mean Hb level of 90 g % with 88% of
pregnant women having a Hb level below the norm of 11.5 g %.
In Africa as a whole, one half of all pregnant women are anaemic, as are over 40% of Non-pregnant women. In Latin America overall prevalence is somewhat lower, at nearly 40% for pregnant women and 30% for Non-pregnant women.

Levels in the developed countries are also surprisingly high, with an average of 18% pregnant women and 12% of Non-pregnant women anaemic.\(^{(67)}\)

Sachdeva R/Manon S.K. (1994); studied sixty-six young women from low and lower-middle income groups selected from 8 villages of Ludhiana district in the first trimester of pregnancy were divided equally into experimental (E) and control (C) groups, out of which only 60 subjects reached to the term. Folefer and calcium tablets were supplied to E group from second trimester till delivery along with regular medical supervision and nutrition education about additional nutrients needs. Intake of all the nutrients were less than the Recommended dietary Allowances in the E and C groups during the third trimester. However, the requirement of iron, calcium, folic acid, vitamin B\(_{12}\), Vitamin D and ascorbic acid were met in group E due to supplementation. The Fe, Ca, and Cu levels improved significantly during the third trimester in E group. The cord serum levels of Fe, Ca, and Cu were also significantly higher in group E. The relationship between maternal and cord blood levels of Fe, Ca and Cu were also significantly higher in group E. The relationship between maternal and cord blood levels of Fe, Ca, Cu and Zn were significant, the coefficients of correlation being 0.67, 0.92, 0.97 and 0.43 respectively. Serum Mn had an insignificant correlation with other minerals. The results indicated that 86.7, 94.7 and 44.8% variation \((r^2)\) in cord serum Ca, Cu and Fe levels was determined by the corresponding maternal serum levels. They concluded
that regular medical supervision, supplementation and nutrition education significantly improved the nutriture of pregnant women and their neonates.188.

Directorate Health Services Bhutan (1994-95) study analyzing the haemoglobin test results for 4887 pregnant women attending the National Referral Hospital in Thimphu showed that only a quarter of the women had an acceptable concentration of haemoglobin. The proportion of women with haemoglobin levels less than 12g/dl (the cut off point for Thimphu’s altitude) was 78% in 1994 and 76% in 1995. For Non-pregnant women between the ages of 15 and 45 years, the prevalence of IDA was 21% according to a nationwide nutrition survey in 1989 covering 1367 women.199

In Sri-Lanka, the Family Health Bureau 1994 nutrition and health survey found that the percentage of non-pregnant women with haemoglobin levels below 12 g/dl was highest in the estate sector (59.4%) and lowest in the urban sector (39.7%) with the rural sector between the two 46%.70

Brunvand L et al (1995) carried a cross-sectional study in women in 18th week of pregnancy. Thirty-eight Pakistani women and 38 Norwegian women referred to routine ultrasound examination at Aker and Ulleval Hospitals in Oslo participated. Analysis was undertaken of phytate (Inositol hexophosphate) and its degradation products in bread and chapatti. Twenty-six (68%) of the Pakistani and six (17%) of the Norwegian women had ferritin levels below 12 micro g/l and a highly significant difference in serum ferritin was found between the groups (p < 0.001). Only one of the Pakistani and seven of the Norwegian women were supplemented with iron, non-hem iron, organic fibre, tea, ascorbic acid, meat or cereals. The content
of inositol hexaphosphate (phytate) inositol phosphate well know inhibitors of iron absorption were measured in bread and chapatti and the estimated dietary intake was much higher in the Pakistani group, mean (95% CI) was 1175 μmol/day (933 – 1417) and 507 μmol/day (417-597) respectively, p < 0.001. Hence it was concluded that the main reason for high incidence of iron deficiency among pregnant Pakistani in Norway than among pregnant Norwegians may be because of the fact that there is a combination of higher parity and a less common use of iron supplementation in pregnancy in the Pakistani group and a higher content of phytate in Pakistani diet.¹²

O. Keefe et al (1995) observed that in a study designed to estimate the requirement of dietary folate in Non-pregnant women, 17 women (21-27 y) consumed 200, 300, or 400 micrograms/day of total folate for 70 d which was provided by low folate conventional food (30 micrograms) plus supplemental folic acid. Group means for initial serum and erythrocyte folate and plasma homocysteine concentrations were not significantly different. Serum and erythrocyte folate decreased relative to the initial value in the 200 micrograms/d group (43.4+/−12.1%, 13.6+/−16.6%, respectively, mean +/-SD), in contrast to an increase in the 400 micrograms/d group (16.8+/−52.0%, 10.2+/−18.5% respectively). The final folate in the 200 and 300 microgram/d group (6.4+/−0.8 n mol /l, 7.3+/−1.1 n mol /l, respectively) was significantly lower than that of the 400 micrograms/d group 14.3+/−2.0 n mol /l), with evidence in the 200 micrograms/d and 300 micrograms/d groups of low (< 6.8 n mol /l serum folate concentrations. Difference in final erythrocyte folate did not reach statistical significance, although low value (< 362 micrograms/d group, plasma homocysteine was negatively correlated with serum and erythrocyte folate. and final mean plasma homocysteine (12.6+/−1.7μmol mol /l was
significantly higher than that of the 300 or 400 micrograms/d group. Elevated plasma homocysteine levels (> 16 μmol/l) were observed in the 200 micrograms/d group only.\textsuperscript{72}

In Nepal the micro nutrient survey (1996) showed that prevalence of nutritional anaemia in women was 67.7\%, with pregnant women having a higher prevalence (74.6\%) than Non-pregnant women (66.7\%).\textsuperscript{73}

Mackey A.D. et al (1998) assessed longitudinally the nutrient intakes of lactating women during the post-partum period. Dietary data from lactating women were collected by means of 2 day food records at 3 and 6 months postpartum. Mean energy intakes were below the recommended dietary allowances. Mean intakes of most nutrients met or exceeded recommended standards except for zinc and vitamins D and E at both 3 and 6 months postpartum. Calcium and folate intakes were also below standards at 6 months. Although mean iron intake exceeded the standard at both measurement times, there was a significant decline from 3 to 6 months. Relative frequencies of months meeting various percentages of standards differed significantly from 3 to 6 months for calcium; iron, folate; and vitamins E, D and B\textsubscript{6}. At 6 months, significant increases were noted in the number of women reporting calcium, folate, and vitamin B\textsubscript{6} intakes at less than one half of the recommended amounts.\textsuperscript{74}

In pregnancy the additional demands for iron are thought to be met principally through increased maternal dietary absorption and by mobilization of maternal iron stores. In a general population sample of 576 women Robinson S. et al (1998) examined the maternal and dietary characteristics which influence iron stores (assessed by serum ferritin concentration) in early pregnancy. The effects of these characteristics were
lower in multiparous women \( (p < 0.0001) \) and in those with a lower BMI \( (p = 0.01) \) and those with increased alcohol intake \( (p < 0.0001) \) the proportion of women with serum ferritin values \( \leq 12 \) micrograms/l rose from 14% of the women in the lowest quarter of Ca intake to 29% of the women in the highest quarter. Mean cell volume and Hb concentration were not related to Ca intake in early pregnancy. Although Ca added to test meals reduces iron absorption. Long term Ca supplementation has not been shown to lower plasma ferritin concentration. Suggesting that high habitual Ca intakes would be unlikely to influence iron status in Non-pregnant individuals. The above findings show that in early pregnancy there is an association between high dietary calcium intake and lower Fe stores. This effect of Ca on one aspect of Fe-status may result from its influence on Fe bioavailability. \(^{(75)}\)

The frequency of anaemia, iron deficiency and iron body stores was assessed by Fujimori E et al (1999) in 155 pregnant teenagers of low socioeconomic status in prenatal care unit of a beneficent hospital in Sao Paulo, Brazil. By the criterion of the WHO \((\text{Hb} < 12 \text{g/dl})\) 14.2% of pregnant adolescents had anaemia. The iron deficiency diagnostic by saturation of transferrin \(< 16\%\) and zinc protoporphyrin concentration \(> 60 \) (mol/mol) hence were 45.8 and 42.6% respectively. The iron body store \((\text{serum ferritin} < 12 \text{micrograms/l})\) was depleted for 48.4% of adolescents. It is concluded that the iron nutritional status of these adolescents were characteristics of pregravidic inadequate iron store. Despite low percentage of the anaemia, the high frequency of iron deficiency and depletion of iron supplementation in teenagers. \(^{(76)}\)

Kapil U et al (1999) studied micronutrient deficiency disorders among pregnant women in three urban slum communities of New Delhi prevalence of anaemia, IDD and VAD amongst pregnant women was
8.8%, 22.9% and 4.8% respectively. 10% of the pregnant women had cocomitant presence of all three MDDS. Pregnant women having combined prevalence of IDD and anaemia, IDD and VAD, and VAD and anaemia was 15.1%, 0.18% and 2.69% respectively. 99% of the pregnant women were consuming salt with iodine content of more than 15ppm which was recommended at household level. Results on dietary intake showed that 18%, 34%, 85% and 57% of the pregnant women were consuming less than 50% of calories, proteins, iron and β-carotene respectively as compared to their RDA. 40% of the pregnant women were suffering from various morbidity conditions on the day of survey. Hence it is concluded that the prevalence of micronutrient deficiencies amongst pregnant women of urban slum communities is high.

Rahman S et al (1999). The health and nutritional status of many urban slum dwellers in the developing world is said to be deteriorating. The nutritional profile of 328 adults, Non-pregnant women from the slums of Dinajpur, Bangladesh, confirms this. Results of a cross sectional survey showed that approximately half the women were acutely malnourished and all but six were anaemic. This, despite the fact that the slums of Dinajpur are considered relatively ‘better off’ than many in developing world; most families having permanent land tenureship and access to basic education and health services.

A study carried out by Nucci L B et al (2001) on nutritional status of pregnant women showed over-weight nutritional status (obesity and pre-obesity) in 25% of adult pregnant women and it was associated with increased risk for several adverse pregnancy outcomes, such as gestational diabetes and pre-eclampsia. Age adjusted prevalence (and 95%CI) based on pre-pregnancy weight were: underweight 5.7% (5.1% - 6.3%), and obesity
Obesity was more frequently observed in older black women, with a lower educational level and multiparous.\textsuperscript{77f}

Additional calcium is required during lactation and several calcium regulatory factors are involved in calcium balance in lactating rural women who have marginal nutrition and consume a high fibre diet, negative calcium balance may be expected. Desantnago S et al (2002) evaluated calcium balance and its association with potential calcium regulatory factors in lactating rural Mexican women who had marginal nutrition and consumed a high fibre diet. This cross sectional study included women at 1, 3, 6 and 12 months of lactation (L1, L3 and L12 groups) and women who had weaned their infants (W group). Age matched, non-lactating women (NL group) were also included. Calcium balance and concentrations of calcium regulatory factors were determined, correlation analysis was performed by using data from all of the lactating women. Calcium balance in the L1, L3 and L6 groups was negative and was significantly different (p < 0.05) from that in the W and NL groups. Serum parathyroid hormone (PTH) and 1, 25 dihydroxy vitamin D concentrations were significantly higher (p < 0.05) in W group than in the L and NL groups. Calcium balance was positively associated with serum estradiol concentrations (r = 0.5R p< 0.05) and negatively associated with serum 1 – 25 dihydroxy vitamin D concentrations (r = -0.52, p < 0.05). Breast milk calcium concentrations (r = 0.5, p < 0.05) and negatively with serum estradiol concentrations (r = 0.51, p < 0.05). Negative calcium balance was observed during lactation in rural Mexican women who consumed a high fibre diet. Furthermore, the data suggest that the hormones estradiol and PTHrP are involved in the regulation of calcium balance and of the calcium content of milk during lactation.\textsuperscript{80}
A study carried out by Bently M E/Griffths P L (2003) on 4032 ever-married women aged 15 – 49 from 3872 households Andhra Pradesh revealed that prevalence of anaemia was high among all women. In all 32.4% of women had mild (100 – 109.99 g/l for pregnant women, 100 – 119.99 for Non-pregnant women), 14.19% had moderate (70-99.99 g/l), and 2.2 had severe anaemia (<70g/l). Protective factors include Muslim religion, reported consumption of alcohol or pulses and high socioeconomic status, particularly in urban areas. Poor urban women had the highest rates and odds of being anaemic. Fifty-two percent of thin, 50% of normal BMI, and 41% of overweight women were anaemic.¹⁸¹
SECTION - D

Dietary Practices / Habits
"A well-planned and well-executed effort to change behaviours in ways that improve nutrition can and does make a difference."

Alan Berg*

(* Senior Nutrition Advisor the World Bank)
DIETARY PRACTICES / HABITS

Nutritional practices play a significant role in maintaining the health status of an individual. Practice permitting an adequate diet (in quality and quantity) contribute to the health of the individual. An adequate diet has a marked effect upon a person's vitality, emotional stability and enthusiasm for life and work.\(^{(18)}\)

Good nutrition is a positive factor affecting the quality of life throughout the earlier life cycle and is to a large extent determined by food habits.\(^{(34)}\)

Nutritional practices or habits may be defined as "The way in which individuals or groups of individuals in response to social and cultural pressures select; consume and utilize portions of the available food supply."\(^{(82)}\)

Food habits begin with the first feeding of an infant. Feeling of dependence and love begin to be associated with food. Lifetime attitudes towards eating generally reflect early association of the way in which foods needs of a person were met. Thus, food habits are formed within the matrix of human relationship.\(^{(83)}\)

Nutritional practices and patterns are developed by people's tendency to settle into fixed habits.\(^{(18)}\) Food habits are the end result of all the experiences people have had with food and all the attitudes, preferences, and dislikes people have developed in relation to food.\(^{(34)}\) The development of food habit is a very human process. We know that food is necessary to sustain life and health. But we also recognize that persons eat for may other reasons and that they seldom eat just to supply their bodies with "good
nutrition". Food has many meanings, and all our food habits are intimately tied up with our whole way of life.

Nutritional practices and patterns are developed by people's tendency to settle into fixed habits. Eventually they characterize regional and national eating practices either poor or good. Food habits are generally classified as good when a person eats the kind and amounts of food needed for good nutrition. Poor food habits, including eating only what a person likes, regardless of individual nutrient requirements can result in a poor nutritional status. Food habits, good or bad, however, can be an extremely powerful force in determining what a person eats. The best way to be well nourished throughout life is to develop food habits and attitudes that are conducive to the selection of a healthy diet. Food habits of a community furnish presumptive evidence of the nutritional status of its population.

The nutritional status of an individual is the result of many interacting factors operating simultaneously on the individual in the physical, ecological and cultural setting of the community. Attempts to improve nutritional conditions cannot be made intelligently unless the factors other than the knowledge of nutrition which determines food choices are known and considered. The quantity of various foods consumed and the associated food practices or habits are a reflection of the economic conditions and the social, cultural and educational values of a community.

The various macro level variables which affect nutritional practices can be categorized as follows:-

Macro levels variables:-

1.1. Economic factor.
1.2. Cultural factor
1.3. Beliefs, superstitions, taboos, Attitudes and practices.
1.4. Customs and traditions
1.5. Joint family system.
1.6. Religion
1.7. Social factor
1.8. Ecological factor
1.9. Psychological factors
1.10. Education
1.11. Knowledge in nutrition
1.12. Population
1.13. Food advertising
1.14. Working women
1.15. Fast food restaurants

Embracing all these factors is the influence of women, who are the decision makers in the home. The food choices that women make is also influenced by time pressure.

1.1 Economic Factors:

Economic status has a definite bearing on the amount of food people eat for it is income that decides the standard of living of a family. The poor generally spend a high proportion of their income on food (in South India the poorest families spend 80% of their budgets on food, the affluent on 45%). More money generally means a better diet. As the poor enjoy some increase to additional food expenditures. In rural India when the very poor have extra income to spend, 75% of it goes for food. This percentage declines as total income increase.
The upper income rural Indians spend only 34% of each additional increase of income on food.

Income levels also set the pattern of foods to be purchased and consumed. The poor spend most of it on food grains, the rich much less so. The allocation for cereals declines and that for milk products increases as household move into the middle class income levels. Also higher the income, larger is the percentage of the increase spent on fruits, vegetables and other variety food items. Thus, income is a major determinant of diet quantity and quality.\(^{(18)}\).

1.2. **Cultural factors:**

Culture may be defined as the way of life of a group of people – usually of one nationality or from a particular locality. Food habits are a deeply rooted aspect of many cultures. One culture may consider food only as a means of satisfying hunger; another may consider eating a duty; a virtue or a form of pleasure; still another may feel eating is a means of family or social sharing.\(^{(84)}\)

One of the major factors influencing the inadequacy of the diet is certain traditions, which decide as to which food should be eaten.\(^{(85)}\) Major importance in the whole cultural background of the family are the beliefs, superstitions, taboos, attitudes and practices about food.\(^{(86)}\)

1.3. **Beliefs, superstitions, taboos, attitudes and practices:**

These factors are powerful and can pose problems in nutrition education. Family attitudes regarding health and disease influence the attitudes regarding feeding the members. Women and children are
often the direct victims of discriminations in food priorities. Prevailing customs may prevent people from consuming valuable foods even when they are available. In traditional Indian society men and children eat first and women last. Men receive a large quantity of food than women.

Beliefs are crucial in the acceptance or rejection of foods. The beliefs of any community are the products of social interactions deeply entrenched environmental in the minds of that community because of deep faith. Many of the foods fads and fallacies stem from ignorance about nutritive values of foods and quantitative and qualitative requirements. Wrong beliefs and practices are the result of such ignorance.

Family attitudes towards the feeding of children and pregnant women in health and disease are often the direct cause of malnutrition. Prevailing beliefs may prevent people from consuming a valuable food even when available.

Cultural considerations control the diet in lactation. The new mother is not allowed to eat any new food, as it is believed to affect the health of child when she is feed. But she is given extra milk, Ghee, Garlic, Jaggery water and white gourd for increasing her milk. Brinjal, drumstick leaves and roasted bengal gram are avoided as they would ‘dry up’ the milk in the breast.

Thus many prohibitions and taboos affect the consumption of valuable food by expectant and nursing mothers.\(^{(1)}\)
There are two general food taboos for adult women of Waluguen in Tanganyika. They are not allowed to eat eggs or twin bananas as they are supposed to lead to the risk of having twins, which is a serious misfortune. Other beliefs of consumption of eggs by women are that they may lead to irregular menstruation or disappearance of it altogether and that if a woman becomes pregnant, the child will be still born.\(^8^7\)

Some of the beliefs existing in India are that papaya is believed to cause abortions. Jaggery is believed to heat up the body system.\(^8^9\)

1.4. Customs and traditions:

Each family develops its own traditions in serving foods and any deviations from them can be distorting. Customs of cooking and handling food differ widely and social organization of the domestic groups varies in different societies.

From one place to another opinions differ about certain foods; the belief that a particular food is dangerous probably rests on mixture of traditional beliefs and personal experience.\(^1\)

Women’s food habits have been greatly influenced by marriage. Meals are usually planned according to the husbands likes and dislikes, super-imposing the wife’s original dietary habits. If there are children, thy also alter the mothers food habits.\(^8^8\)

Customs, beliefs and superstitions are forceful in the use of foods. Many of the practices which stem from culture are harmful to nutrition since they are based on false notions and ignorance.
1.5. Joint Family System:

The joint family system is an important social institution. It is a cradle of customs and tradition and the nursery of culture. Most of the food habits are formed within that joint family in the early period of childhood.¹³

Both Hindus and Muslims tend to live in joint family groups. The number of inmates in any one household may be large and constantly fluctuating. It is well known characteristic of poor Indian families to cook the same amount of food, not matter how many persons are there to eat it. Thus the total amount of food eaten by the household is more constant than the amount available for each individual.⁸⁸

In joint families in the matter of diets of pregnant and lactating women, the mothers, mothers-in-law and grand-mothers often have authority and this tells upon nutrition of the vulnerable groups of population.⁹⁰

Thus even the type of a family to which a person belongs influence his nutritional practices.¹⁸

1.6. Religion:

Almost all religions place some regulations on the use of foods. The association of a food with religion gives some clue to its importance in daily living.⁵ Religion play an important role in determining the food habits of people and has to some extent influenced the general health of its followers to the better or for worse.
Among the major religions of mankind Buddhism preached effectively against the custom of eating animal food. Under the influence of Buddhist thought a large number of people all over Asia are traditionally vegetarians and refuse to take any animal food except milk under any circumstances and are happy living on heavily starch foods.

Mohammedans do not eat pork, most Hindus will not eat beef and some Hindu communities consume no food of animal origin except milk and milk products because their religion forbids the taking of life. The Jewish religion forbids pork, shell-fish and the consumption of meat and dairy products at the same meal.

1.7. Social Factor:

The social status attributed to certain food may be much more important to people than any nutritive value it contains. Hence food habits in any setting are highly socialized. These habits perform significant social functions, some of which may not always be evident.

Food is a symbol of social acceptance, warmth and friendliness, people tend to accept food more readily from those persons they view as friends or allies. They accept advice about food from persons they consider to be authorities or with whom they can feel warm relationships. Persons tend to distrust foods given to them by strangers and outsiders. Emotional feelings about persons are transferred to their food. The more alien the authority figure, the more such persons are considered to be unconcerned, and their food suggestions will be considered outlandish or even harmful.
1.8. Ecological Factors:

Individuals and populations do not live alone in nature but in association with other organisms in an abiotic environment. There exists a network of relationship of each and every part, living and non-living. Such a community of plants and animals together with environment that controls it called an ecosystem. An ecosystem is made up of two large parts. The physical environment and the biological community. The physical components of a typical natural eco-system are - energy, water, atmosphere, fire, gravity, topography, geological substraction and soil. The biological factors are green plants, non-green plants, animals and man. The physical environment provides the energy, raw materials and living space that the biological community needs and uses for its growth and maintenance. In this context, it can be stated that a number of ecological factors –

- Availability of food
- Geographical location
- Floods, famines and wars
- Industrialization and urbanization influence the nutritional practices of various groups.

1.9. Psychological Factors:

Knowledge of the emotional value of food is of course, much older than knowledge of its nutritive value, both in the historical and in the individual biologic organism. One of the most primordial of human urges was that of eating. When pre-historic man foraged for food, he did so to satisfy his urge to eat and to survive and not to satisfy his nutritional requirements. Food is even more meaningful to people today as a symbol of love and gratification, as a sign of
emotional identification. Food may even serve as a weapon of interpersonal warfare between giver and receiver. From childhood food is treated as a symbol of emotional value rather than as a source of calories. In the infant food intake is usually associated with love, protection, pleasure and comfort.\(^{(18)}\)

1.10. Education:

Education and enlightenment are the best vehicles of a desired change. A change in people attitude towards health and disease is most important if any lasting changes for the better have to be brought about in their food habits. A mother, somewhat informed about nutrition will not use money to buy a soft drink for her baby and will instead invest it in milk. Education is important for the people to have good aims. Educational process may include things like providing practical suggestions for preparing foods in attractive ways. But while doing so, one must respect the likes and dislikes of a person or a community associated with a culture.

Food habits and taboos are forms of groups and not mere individual behaviour. Their alteration can therefore be achieved only by education.\(^{(91)}\)

1.11. Knowledge in nutrition:-

In most developing countries the problem of malnutrition is not due to lack of food, as much as lack of knowledge about the foods that are available and frequently this is made more grievous by harmful traditions.
1.12. **Population:**

Malnutrition and uncontrolled fertility are phenomena of worldwide concern and they are closely interrelated. More babies mean more mouths to feed, with consequent malnutrition when food is scarce. Ill-fed families have high reproduction despite high pregnancy wastage. 

1.13. **Food Advertising:**

Food advertisers have successfully changed the nations food habits by appealing to people’s visual and olfactory senses and psychological and cultural make-up the mass media, including newspaper and magazines, radio and television, exert a tremendous influence on the changing of old food habits and the initiation of new ones. The mass media can be very effective in persuading people to buy certain food items and change their eating behaviors.

1.14. **Working women:**

The increase in the number of women who work outside the home to partially or fully support their families, has meant a decrease in the amount of time spent in meal preparation, an increase in use of convenience foods, an increase in the number of meals prepared and eaten outside the home and an increase in the incidence of snacking and “eating on the run”.

1.15. **Fast food restaurants:**

The growth and success of the fast-food restaurant has been phenomenal and is related to other societal changes, an increase in the number of women working outside the home, an increase in per-capita disposable income and an increase in leisure time for many
people. More families with middle and low incomes are eating fewer meals at home and more snacks – type meals at fast-food restaurants than ever before.

Fast food choices provide many essential nutrients but are high in calories with fat supplying approximately 42 percent of the total calories. Fast-food meals generally are low in vitamin A, vitamin C, Calcium and fibre.
SECTION - E

Studies on Dietary Practices / Habits
1. STUDIES ON DIETARY PRACTICES / HABITS

1.1 Studies on dietary practices:

Jean (1950) found from his studies that women’s food habits have been greatly influenced by marriage. Meals were planned according to the husband’s likes and dislikes, super imposed on the wife’s original dietary habits. If there were children, they also altered mothers food habits.

Edwards et al. (1954) reported the influence of superstitions on food habits of women. In Manning, South Carolina, there is a traditional belief that milk, eggs, fish, yellow vegetables, grape fruit, tomatoes, butter, liver and beans should not be eaten. In Anniston, Alabama the belief also extends to other foods such as bacon, yam and onions. The eating of green food appears to be a taboo during the post-partum period among women in Lovisiana. Approximately one-third of women who visit the country health department, reported that they eat only rice, potatoes and milk during the postpartum period. This may be due to the idea that green colour of vegetables might show up in the mother’s milk. Fish too is widely tabooed in North Carolina, Georgia, South Carolina and Kentucky. As many as 35% of the rural Negro women apparently adhere to this practice. Comments indicated that some felt it would poison them and others stated that it would prove fatal if consumed for several weeks after child birth. The continuation of “fish and milk” was thought to be specially dangerous. Other strange ill found notions included that cheese, bananas and ice-cream will make a person sick, cooked cabbage and other “strong tasting” green will upset the stomach and “taint” the milk.

Moller (1961) reported that there are two general food taboos for adult women of Waluguen in Tanganyika. They are not allowed to eat eggs
or twin bananas as they are supposed to lead to the risk of having twins, which is a serious misfortune. Other beliefs of consumption of eggs by women are that they lead to irregular menstruation or disappearance of it altogether and that if a woman becomes pregnant, the child will be still born. 

A study carried out by Burgess and Dean (1962) shows that the levels of living depend ultimately on levels of income. In the lower income groups, whose expenditure on food may exceed 50 percent of the total income, any rise in economic status usually reflected in an increase in the quantity of food consumed with little change in quality. At higher economic levels, however increased income usually results in greater expenditure on foods such as meat, eggs and milk products with a consequent improvement in the nutritive value of family diets. At yet higher levels, expenditure on foods may increase further, but this may not result in an improvement in the diet from the nutritional standpoint. Well to do families tend to prefer expensive cuts of meat, packaged foods, fruits out of season and other luxuries, such as butter fat, candies, cakes and ice-cream which may prove detrimental to health.

Brown et al (1963) found that house-wives have some nutritional beliefs in U.S.A, but these beliefs do not necessarily influence their food purchases.

Bageli et al; (1964) studied the dietary habits in a rural area near Calcutta and in the city of Calcutta. He found that rural families spend 92% of the total income on food whereas the urban families spend around 58%. This difference was found to be due to a difference in expenditure pattern. In the rural areas, expenses for items other than food are negligible as
compared to the amount spent for food, whereas in the urban areas expenses like rent for living rooms, clothing, education for children, amusement etc. pile up to about 35% of the total expenditure. The investigators observed food attitudes and food habits especially related to children feeding and pregnancy and found that in rural areas women were more-tied down by rigid customs regarding dietary habits, whereas those in the urban areas, were comparatively flexible. Another distinct difference was the strong tendency among the poor urban families to consume foods of prestige value such as sugar, biscuits, lozenges, bread, tea etc; while their rural counterparts consumed puffed rice, jaggery, chapatti and seasonal fruits. In the urban families rigid dietary restrictions do not exist possibly due to the reason that the mothers have less time. Secondly they are influenced by cultural practices from various other communities and other economic groups.

The food distribution in the family depends upon the status and role and interpersonal relationship among the members of the family rather than on their nutritional needs Rao (1966) reported that in Telangana region of Andhra Pradesh the Senior and earning wage earners are served first and are also given the best diet both in quantity and quality while the vulnerable segments namely the children and women of child baring age get the left overs, with the exception of milk, biscuits and other such items which are usually given to children.

Jenner (1968) reported that in certain parts of West Africa, the man of the family eats first, than come the sons, then the daughters and then the wife or wives. The man takes care to leave a little on his plate for the sons, to this the mothers may add a little but often she does not. The mother serves for herself in another dish what she and the daughter well eat, but the
mother gives each daughter a piece of meat corresponding to about half of what she eats herself or to a fourth or fifth of what the father eats.

Monica Byrne et al, 1962 and Parvthi Rao (1968) indicated that in joint families, in the matter of child feeding and the diets of pregnant and lactating women, the mothers, mother-in-law and grand-mothers often have authority and this tells upon the nutrition of the vulnerable groups of population. A young mother, particularly one who needs help in the house with her children, does not like to antagonize the older women for fear of disapproval which thus forms into habits directed by the older women.

Wilson and Lamb (1968) studied food beliefs of American women in order to demonstrate that the food choice would not be affected by economic stress but more by education. They found that participants whose education includes home economics and nutrition did not accept the food fallacies accepted by their peers in other disciplines. Their correct beliefs about food could be attributed to education in home economics and nutrition.

Devadas (1968) reported that in some South Indian villages, no special food is given to pregnant women, but the quantity of rice and milk are restricted for fear of the foetus becoming ‘big’ and making the delivery difficult. Similarly new lactating mother should not eat any new food as it will affect the health of child when she is feeding. But she is given extra milk, ghee, garlic, rasam, jaggery water and ash gourd for increasing her milk. Brinjal, drumstick leaves and roasted Bengal gram are avoided as they would “dry up” the milk in the breast.
Arota et al. (1973) reported that different religious groups had different attitudes, taboos and beliefs with respect to certain foods. Rice, curds, banana and orange were considered to induce cold by over 90% of the Hindus and Jain mothers. Two-thirds of Muslims, Christians and Sikh mothers reported that meat and egg were supposed to be ‘hot’ foods among non-vegetarians and onions among Jain’s. Over one and half of the Muslim mothers and a lesser proportion of Mothers in other religions believed that consumption of sugar resulted in worm infestation. ‘Massor dal’ (lentil) was considered a cause of joint pains and indigestion by Jain mothers, who avoided its cooking in view of its resemblance to the colour of flesh.

Storrer (1977) conducted a survey in Baroda, India and commented that “why people eat and what they eat depend upon what local foods are available, on ability to import food and on personal economy, but this is not all.” She observed that peoples beliefs about food have an important influence on food behavior which constitutes food selection / preparation, serving and consumption. These beliefs may be religious, traditional, medicinal or pseudo scientific in origin.

Storrer said that there are several different food belief systems operating throughout the world and one which is widely distributed in varying forms is that of ‘hot’ and ‘cold’ foods. This classification has been observed in South America, Central America, Malaya, China and India. These beliefs in many parts of the world are of ancient origin.

In India, by tradition, it is the women who have acquired the skills and assimilated the beliefs governing food and its preparation. Hence, the information on ‘hot’ and ‘cold’ concept and its application was obtained from women.
The data revealed that the 'hot' foods were said to produce giddiness, thirst, fatigue, sweating, inflammatory reactions and accelerated effect on digestion. The 'cold' foods were said to cause cheerfulness and pleasure of mind, to sustain life and to impart strength and steadiness to the body. Cereals, pulses, green leafy vegetables, other vegetables, milk and milk products and fruits were said to be 'cold' foods while flesh foods and spices were labeled as 'hot' foods. Oils and roots and tubers were distributed in both the categories. Regarding the application of beliefs, 'hot' foods were avoided during pregnancy and 'cold' foods during lactation. During infancy and childhood certain of both 'hot' and 'cold' were avoided. During fever time 'hot' foods were avoided and 'cold' foods during cough and cold.

The author concluded that to the Indian communities, food beliefs are not idle superstition but concepts which are important and meaningful to them especially during physiological stress.\(^{(10)}\)

Wong Ho et al, (1997) collected data on the food consumption pattern of ethnic Chinese women in Hong Kong during pregnancy, in order to identify any risk of nutritional imbalance in this population, one hundred and sixty-seven primagravid ethnic Chinese women attending the antenatal booking clinic at the Prince of Wales Hospital in the new territories region were recruited. Among the study sample, subjects with less than 7 years of residence in Hong Kong were identified as recent immigrants \((n = 25)\), while the remainder \((n = 142)\) were classified as local. Half of the recent immigrants originated on the Chinese mainland and half from Indonesian. The eating patterns of the entire sample were compared with intake recommended in the Taiwan Food Guide. Comparisons were made between local and immigrant regarding age, educational standard and consumption of food from each food group. The median intake of meat and meat
substitutes was significantly higher than recommendation. There was no significant difference between actual and recommended intake of fruit but the consumption of dairy products, bread and cereals and vegetables were all significantly below minimum recommendation.  

Nutritional beliefs and practices in 100 pregnant and 100 lactating women were assessed in an urban and rural area of Lahore by Mahmood S et al (1997). A structured questionnaire was used for the purpose. Seventy seven percent women and 54% of their husbands were illiterate, 50.5% belonged to a family with a per-capita income of more than Rs. 300.00 pre month, 52.5% had 7 or more family members and 56% were living in nuclear families. The age of mothers, type of family, literacy, family income, parity and gravidity had not significantly influenced the nutritional beliefs and practices, only urban and rural differences were statistically significant. 84% of mothers had knowledge that diet should be changed by increasing, adding or avoiding some special food items in the diet during pregnancy and lactation, but only 65.5% practiced them. The reason for this deficient knowledge and practice of dietary intake are lack of nutritional knowledge and poor economy. However, this can be overcome by improving nutritional knowledge of population in general and vulnerable group in particular through media and MCH services on the use of locally available low cost nutritious foods and to avoid undue food restrictions. Improvement of applied nutrition knowledge of medical professional is also necessary.  

Zobairi S E et al (1998) took up a study to determine knowledge, attitude and practice of diet and nutrition during pregnancy among women in Karachi, Pakistan. Quantitative and qualitative data were obtained from a randomized convenience sample of 150 pregnant women from out patient
clinics of 3 hospitals, Aga Khan University Hospital (AKUH), Karachi Adventist Hospital and Civil Hospital. Daily calorie intake was based on a single day. Two dietary patterns were observed. Meals among individuals with monthly income under Rs. 5000/= consisted of flatbread, lentils and/or vegetables. Meat was eaten under twice/week. Calories came primarily from flat bread, cereals and cooking oil. Those with income over Rs. 10,000/= per month ate a great variety of foods and meat frequently. The source of calories was diverse and more balanced. The women preferred milk and fresh fruits during pregnancy. Milk was desired for fetal bone development, enhanced lactation, good skin, and a settled stomach. Desired foods were described as cold and justified since the womb was a source of heat production. Lower socio-economic status (SES) groups did not trust their judgment about beneficial foods and could not afford the food they desired. Many women had food avoidances, such as hot food. The percentage of women with food avoidances increased with increased SES. Most women valued increased food consumption during pregnancy, but 68% did not increase their caloric intake and 40% decreased caloric intake. The mean caloric intakes from low to high SES, were 1087, 1656 and 1750 Kcal/day/woman, respectively.  

Barbara H. J. Gordon (2000) studied 193 Korean American consisted of 97 men and 96 women 19 of whom were aged 55 years or older. The majority had lived in the United States longer than 5 years. More than 60% of food shoppers were women. The majority shopped at American food markets as much as they did at Korean Stores. Younger subjects used taste, whereas older respondents used nutritional value to guide their food choices (p < .05)
In bread, cereal, rice and pasta group, more subjects continued to consume rice daily compared to bread. Nearly all consumed rice at least once each day. Whereas the most subjects over age 55 years did so more often; Japanese sticky rice was preferred to the long grain variety. Traditional roasted barley or beverages from water of boiled corn were consumed after meals.

Among vegetable and fruit groups vegetables were consumed more frequently than were meat products. Nearly 80% consumed Kimchi daily. Overall there was no change with the length of residence here. Women consumed fruits and vegetables significantly more often than did men. Seventy percent of women consumed salad at least several times a week, while only 53% of men had similar eating habits (p > .03). A variety of blanched vegetables were eaten at least once a day. Frequency of orange and apple consumption among women (84% and 81%) was also higher than it was for men (61% and 63%) p > .001 and p > .01 respectively.

Milk, Yogurt and dairy groups nearly 40% of the respondents consumed milk daily. In all age groups, milk consumption several times each week was high. Yogurt and meat, poultry, fish, and tofu group pork was consumed less often then were beef and chicken. Ham, sausage and bacon were rarely eaten; the majority of subjects who did consume these items were younger than 35 years of age. Few consumed oxtail or bone marrow soup once per week, but nearly 50% did so once per month. Fish remained a frequent component of diet as did beef. Tofu products were consumed once weekly to daily by 93% of subjects regardless of their length of residence.
Fats and oils sesame and corn oil were used daily by most subjects. Only a few subjects used butter, margarine or mayonnaise.\textsuperscript{105}

Frequency of eating or meal patterns during pregnancy may be a component of maternal nutrition relevant to pregnancy outcome. To identify meal patterns of pregnant women and investigate the relation between these meal patterns and preterm delivery Siega-Riz AM et al (2001) performed an analysis using data from the pregnancy, Infection and Nutrition Study (n = 2065). Women recruited from August 1995 to December 1998 were categorized by meal patterns on the basis of their reported number of meals (breakfast, lunch and dinner) and snacks consumed per day during the second trimester. An optimal pattern was defined according to the Institute of Medicine recommendation of three meals and two or more snacks per day. In this population 72\% of the women met this recommendation and 235 delivered preterm. Women who consumed meals / snacks less frequently were slightly heavier prior to pregnancy were older and had a lower total energy intake. In addition, these women had a higher risk of delivering preterm. There was no meaningful difference in the risk by early versus late preterm delivery but those who delivered after premature rupture of the membranes had a higher risk than those who delivered after preterm labour. This study supports previous animal model work of an association between decreased frequency of eating and preterm delivery.\textsuperscript{106}

Sharma et al, (2003) In a study to see dietary effect of dietary habits on prevalence of anaemia in pregnant women of Delhi found that there is a very high prevalence of anaemia during pregnancy in Delhi, probably due to very low frequency of meat eating in India. Different types of dietary habits had no effect on the prevalence of anaemia in pregnant women. The mean age of women was 26.5 years. Most women were in the second (26\%) or
third trimester (63.2%) of pregnancy. Prevalence of anaemia was found to be very high. Of 1150 women 96% were anaemic (89.8% mildly anaemic, 3% severely anaemic). Anaemia was seen in 96.18% cases in vegetarian women, 95.3% in halal meat eaters and 96.2% in jhatka meat eaters (not significant). Although the percentage of women with < 11 g/dl Hb was less in the jhatka group eating meat more than 5 times per month, than in halal meat eater and vegetarians, the difference was not statistically significant.

1.2. Studies on Knowledge of Nutrition:

Young et al; (1956) reported on what the home makers know about nutrition. He found that actual performance of the home maker in feeding her family was found to be considerably better than her theoretical knowledge on the subject. However, the food groups about which knowledge was weakest were also most poorly used. The adequacy of food used was related to nutritional knowledge.

Mothers nutritional knowledge was studied by Devadas et al, (1967) while conducting an investigation on 99 pre-schoolers who came from 82 rural families. A diet survey was conducted to elicit the information on feeding pre-school children. Mothers were tested for their nutrition knowledge in relation to their education, caste, occupation and the nutritional status of their children. Results revealed that the socio-economic factors tests did not have much influence on the mother’s knowledge related to feeding practices of children.

Sims, (1976) reported that direct relationship exists between nutritional knowledge and occupation; High occupational groups had better knowledge of nutrition than the lower occupational groups.

[105]
He further reported that family size was negatively related to nutritional knowledge. Families with small size had better nutritional knowledge than families with large size. This difference was found to be significant in this study at 0.01 level. There was a positive and higher correlation between nutritional knowledge of mothers and their family income. Higher income groups had more knowledge than the lower income groups. This result was found significant at 0.01 level.

Smith et al. (1986) conducted a study to determine the effectiveness of the supplemental food program for women, infants and children (WIC) for mothers and their anaemic children under five years of age. The intervention of the experimental group included individual counselling, group nutrition classes and provision of WIC food vouchers for purchasing foods containing essential nutrients that were deficient in the diets of high risk population. The parents, Guardians were also counselled on meal planning, shopping for food and food storage and preparations. Each child's diet was assessed after 6 months. The 30 minute education classes consisted of audio-visual presentations followed by discussions. Subjects like the importance of breast feeding, of infant nutrition, of childhood nutrition and of consuming adequate amounts of Vitamin A and C, Iron and protein and Calcium were presented. The result of 24 hour dietary assessment in the experimental group at the end of the study showed that the intake of 8% of the participants were still below the RDA for vitamin A, while 4% were below RDA for Iron and Folacin. The difference in the mean pre and post test results of participants in the educational presentation indicated an increase in their knowledge on each subject, with difference in the pre and post tests for the vitamins A and C presence. Intervention process affected the out-come in the statistically significant way.
A pilot dietary survey using telephone was conducted by Susanna et al (1995) to evaluate the current dietary intake, food habits and nutrition knowledge of 198 random sample of adults aged between 18 – 60, and to arouse the awareness of the government health related professionals and the public on diet and related diseases. The study revealed that there was a high intake of meat group (=327 g/d), low intake of rice and cereals (3.8 bowls /d), inadequate consumption of vegetables (3.6 servings /d) and fruits (1.7 servings /d) – when compared to the established healthy food guides. Milk intake was only 0.6 cup /d. Processed food high in animal fat, protein and sodium were popular among the adults. 96% household used pure vegetable oils for cooking, 69% never ate unlicensed street foods, 55% never drank alcohol. 14% were estimated to be obese (BMI: 25 – 40) only 43% regularly preformed physical exercise more than 45 minutes a week. Considering the repeatedly reported high mean total serum cholesterol of Hong Kong adults (5.0 – 5.5 m mol //), imprudent dietary practices and increasing episodes of myocardial infarction in the younger Hong Kong adults, increases in morbidity and mortality from cardio and cerebo-vascular diseases in Hong Kong is foreseeable in the future. Thus, before it becomes too late and too costly to combat the disease it is necessary to identify the risk factors of degenerative diseases to promote healthy life styles, and to establish the healthy eating guidelines and community nutrition education for the population.\(^{(112)}\)

Wu B et at; (1998) studied the improvement of the intakes of various nutrients including protein, fat, carbohydrates fibers, calcium, iron, Zinc et al, in pregnant women after appropriate diet consultation by doctors. In total 100 cases of pregnant women coming to for diet consultation clinic were randomly selected, in which 50 cases (control group) came for the first time and another 50 cases (study group) were for the third visit at least. The diet
nutrition of the study group after the second consultation was compared with that before consultation and with concurrent control group. The results of the study showed that after diet consultation, except for retinol, the intake of various nutrients, including calorie intake, protein, fibers, magnesium calcium, phosphorous, iron zinc, vitamin E, riboflavin, thiamine, nicotinic acid in the study group were significantly improved compared with that of the study group before diet consultation and of the control group (p < 0.01). Hence they concluded diet consultation plays excellent role in promoting scientific and appropriate nutrient intake of pregnant women.'
of Food and Nutrition. The analysis of the results of the study showed that though pregnancy is a difficult period for a woman, it did not make the subjects pay particular attention to their diet. The study showed also that the majority of women does have knowledge on the influence of diet and the influence of her nourishment before pregnancy on the development of foetus; however, it hardly results in the change of their eating habits.

Fowles E R; (2002) described the differences between low and middle income pregnant women’s general nutritional knowledge, usual dietary intake and weight gain. Total 109 women were selected for the study. He found that women with a low Pre-pregnant body mass index (BMI) gained less weight, and women with high BMI tended to gain more weight than recommended. Most women had inadequate general nutritional knowledge and their dietary intake did not meet all the nutritional requirement of pregnancy. Women attending the free prenatal clinic had more accurate knowledge of recommended number of servings for some good groups (fruits and vegetables, meats and dairy) than women in childbirth education classes. No differences were noted between the groups in total weight gain.