CHAPTER - I

General Introduction
The studies on structural and nutritional aspects of human edibles were relatively recent in its origin. Towards the end of eighteenth century scientist Lavoisier, said to have founded 'Nutrition' as a science. But, only in the twentieth century did Governments begin to assume responsibilities for seeing that the poorer and under privileged section of society receives enough of the right type of food. Apart from the poorer and weaker section, nutritional status of different human edibles appears to be of extreme importance for human health in general (Davidson et.al., 1975).

Concern about food exists throughout the world, but the aspects of concern differ with location. In undeveloped regions of the world, the bulk of population is involved in food production, yet, attainment of adequate amounts and kinds of basic nutrients remain an ever-present problem (Fennema & Tannenbaum 1985). In developing regions of the world, food production is highly mechanized and efficient, a small portion of the population is involved in food production, food is available in abundance, and much of it is processed.

The quality of food in terms of its nutrients, such as protein, carbohydrate, fat, vitamins etc. have been studied considerably in different parts of the world. However, the same has not been done extensively for inorganic compounds.

As far as the inorganic components of human edibles are concerned, Theodore de Saussure (1767-1845), a French chemist, did much to formalize and clarify the principles of agriculture and food chemistry. He studied the mineral contents of plants by 'ashing', and made the first accurate elemental analysis of alcohol (11807) by combustion technique. Joseph Louise Gay-Lussac (1778-1850) and Louis-Jacques Thenerd (1777-1857) devised in 1811 the first method for quantitatively determining percentage of carbon, hydrogen and nitrogen in dry vegetable substances.
Although, studies on nutrient status of human edibles have been carried out in different parts of the world, very fewer studies on this aspect have been conducted in Indian context. As far as the Northeast India is concerned, there is hardly any report in this regard. With this in view, some attempts have been made in the present investigation to know the nutritional status of different edibles consumed by the people of Northeast India and the nutrient quality of traditional food of the local tribes.

The study areas involved in the present investigation include two urban localities from Northeast India, viz., the City of Guwahati the state capital of Assam and the City of Shillong, the state capital of Meghalaya. Both the cities are characterized by their cosmopolitan nature of population structure. As expected in any urban area, the human edibles in the present study sites are generally of more or less similar types for different communities residing here. However, certain traditional foods find a place in the daily dietary component of various communities.

Some of the important ways to assess the food quality are the microstructural studies and the chemical analysis. Therefore, the present study was divided into five aspects, namely microstructure of some edibles, assessment of essential elemental status in common edibles, determination of the status of pollutants in common food (especially heavy metals), assessment of some essential elements in certain edibles of limited popularity as well as some traditional foods and microbial contamination of some common human edibles.

The first aspect deals with the 'Microstructure' of some commonly consumed food and food products along with studies on structural changes that may take place during freezing. Microstructures of a given food or food products determine its own characteristics (Hermansson et al., 2000). As for example, microstructure of yogurt, cheese, butter, ghee etc. have their own characters like that of taste, colour, odour etc. as
well as response to environment (freezing or heating etc.), even though they are obtained from the same substance that is milk. Also the quality of food and food products changes with time (e.g., during preservation etc.), which changes the microstructure. Thus microstructure of food may determine the quality, palatability, taste etc. which can easily be determined with the help of high resolution microscope. This is why the use of scanning electron microscope (SEM) in determination of structural features in a wide variety of food and food stuffs is finding its increasing applications. Recently, several food processing industries are operating to design or create the microstructure which gives palatability and stability (during preservation etc.), for which the use of scanning and transmission electron microscopes (SEM & TEM) are being made. For the total characterization of microstructure of a complex food structure, as for example, an emulsion, foam or mixed-gel, consideration of not only the sizes and distribution of dispersed continuous phase regions, but also fine structures within each phase and its interfaces are important. Electron microscopy (both SEM & TEM) is found to play a very important role in this regard (Hermansson et.al., 2000).

The relevance of microstructural studies of edibles in Northeast region lies in the fact that the geo-climatic conditions, soil structure and composition in terms of elements etc. in this region of the country is quite different from the rest of India which may influence the food because chemical composition is known to influence structural features of living system (Williams, 1990).

The second aspect of the study is about the qualitative and quantitative assessment of essential trace elements in different types of edibles viz., rice, pulses, cereals, vegetables, fruits, spices, fish, meat, eggs etc. commonly available in the present study area. It is known that the elements are variably distributed throughout the globe’s soil in different concentrations, depending upon the part of the globe. Again, depending
on the concentrations of an element in the soil of a particular place, the element will be absorbed by a plant in a particular fashion. Thus the concentration of the same element in a particular plant may be different in different geographical locations. Therefore, it becomes obvious that vegetables and other cultivars those are grown in Northeastern parts of India can differ in their concentrations of essential elements from that of the rest of the country. Keeping this fact in consideration, several vegetables from the City of New Delhi and Bangalore were compared with those from the City of Guwahati and Shillong in terms of contents of some essential elements. The importances of trace elements were discovered in the nineteenth century. But, only during past few decades considerable progress was made in the field of trace elements and its importance in human as well as in animal health (Abdullah et.al., 1996). Rapid developments in analytical technologies and sophisticated instrumentations introduced during last few decades have helped to determine the presence of the most naturally occurring trace elements in living systems and their food chain. Tissue analysis of human body shows the presence of these elements in different proportions depending on the food consumed and environmental conditions of the habitat. The relevance of the study lies in the fact that the importance of elements in human nutrition is becoming clearer day-by-day with invention and innovation of new technologies. It was observed that, deficiency of essential elements can bring about certain physiological changes and/or abnormalities in living organisms as well as in human being which can be reversed by the supplementation of the same. As for example, anemia caused by deficiency of iron can be rectified with supplementation of the element. Considering the above facts, a through study was undertaken to determine the concentrations of certain important elements viz., cobalt, chromium, copper, iron, manganese, selenium and zinc in various edibles e.g., rice, pulses, cereals, vegetables, fruits & nuts, spices, fish, meat, egg etc. available in the
markets of the present study area. The quantitative analysis was carried out with the help of atomic absorption spectrophotometer, following the usual procedure.

The third aspect of the present study is the qualitative and quantitative determination of some heavy metals, e.g., cadmium, nickel and lead in certain common human edibles, e.g., rice, legumes, pulses, vegetables, fruits, spices, fish, meat, eggs etc. The selection of the aforementioned heavy metals were made because of the toxic effects of cadmium, nickel and lead on human body are amply highlighted in literature. Chronic low level exposure to toxic metals which has become a global problem, show a dangerous trend because, the slow accumulation of these metals do not show immediate adverse effect until later in life (Quig 1998). Though it is considered that Northeastern region of India is relatively pollution free as compared to the rest of the country because of slow industrial development, the rapid growth in urbanization has been found to be associated with environmental pollution. The impact of pollution may well be expressed in the concentrations of heavy metals etc. in our food chain which is why the present study is relevant.

Fourth aspect of the study deals with the quantification of some essential elements viz., cobalt, chromium, copper, iron, manganese, selenium and zinc in some non-conventional edibles or food of limited popularity (mainly vegetables and fruits) and several Khasi traditional vegetables and fruits. By the term 'non-conventional food' or 'food of limited popularity' it is meant that these foods, mainly of plant origin are consumed only by some, either due to its limited availability or due to its limited preference. As for example, Solanum tuberosum (potato), Allium cepa (onion), Brassica oleracia (cauliflower), Brassica capitala (cabbage), Daucus corota (carrot), Lycopersicum esculentum (tomato) etc. are more or less available in the markets of cities or towns throughout the country, whereas, some food products like Centella asiatica
(Indian pennywort), *Musa paradisiaca* (banana flower), *Deplizium esculentum* (edible fern), *Colocasia esculenta* roots (arum roots), *Curcuma longa* roots (turmeric roots), *Trigonelia foenumgraecum* leaves (fenugreek leaves), *Musa paradisiaca* stems (banana stems), *Artocarpus heterophyllus* seeds (Jackfruit seeds), tender *Sacchium edule* leaves (squash leaves) etc. are either not available throughout the country's markets or not as popular as commonly consumable vegetables or fruits. Although these foods of limited popularity are not universally consumed, their popularity is indisputable for the common people of Northeast India. Similarly, Khasi traditional food is believed to be important as far as certain nutrient supply is concerned. It was therefore thought that assessment of certain nutrients, especially the inorganic components may be important, because minerals are known to be significant protective component of food.

The last or the fifth aspect of the present study deals with the detection of different types of microbes such as fungi and bacteria in some improperly kept or stored food staffs. Several food staffs like fruits and some vegetables are eaten raw. As for example vegetables like cucumber, tomato, carrot, salad leaf, onion etc. are used to make different types of 'salads' which are usually eaten raw which may contain various types of microbes which are detrimental to health. This may lead to food-borne illnesses to people. In some cases it was found that different types of fungus and bacteria grow in stored food like in cereals and legumes whose penetration, colonization etc. can be studied with the help of scanning electron microscopy. Different food items e.g., fish, meat, various types of vegetables etc. pass through several stages like preservation, storage display etc. between procurement and consumption. During this, improper handling and prolonged shelf life etc. the edibles can get contaminated with various kinds of parasites and pathogens. In warmer climatic conditions cut pieces of fruits are sold openly which are more likely to get infected by contaminants, pollutants, pathogens
etc. In this regard the present study is relevant, because, food-borne illnesses have become a major public health problem, not only in this country but globally. Both developed and developing countries suffer the consequences of food-borne illnesses, though in varying degree which makes it important to study this aspect of food science (Orlandi et al., 2002).

Among all the hierarchal needs of human beings, food occupies the first position. Remains of food plants found at archeological sites as charred grains and chaff, and as pollen and seeds indicate that in the prehistoric period cereal food was the mainstay of human. Semi-domesticated foods (fruits etc.) and a wide range of fruit plants were also important at that time. Scientific research on many aspects of food production and consumption has not received the needed action in spite of the prominent position of food in day-to-day life. However, in recent decades there have been considerable progresses in introducing science and technology in all aspect of food production and consumption chain. In India and many other developing countries, consequently the production potential of major cereals has been increased considerably. Knowledge concerning food and nutrition is still inadequate among the general public and even among professionals. The science of food is yet to become an essential component of the curriculum of the agricultural and general universities (Swaminathan 2002).

The present study appears to be the first step in understanding the different aspects of food quality as far as the Northeast India is concerned.