Chapter 1

Introduction
Humans come from a long line of meat eaters. For much of the past two million years, our hominid forebears have been evolving from scavenging to systemic hunting. This trend was intimately coupled with the evolution of the human brain, which now is much larger and more complex than was the brain of our mostly vegetarian Australopithecine ancestors. In many hunter-gatherer communities, meat became a major, even the majority, source of dietary energy. The ethics and aesthetics of carnivory aside, meat is a high grade source of nutrients, a universally called food and an important source of high-value animal protein that contributes significant amount of bio-available iron and zinc as well as Vitamin A, E and the B-vitamins to the diet (Valsta et al., 2005).

Since time immemorial, meat had been an integral part of human diet. It had been associated with the male adult bravery and as such recognized with high status. We, the omnivorous humans, are never destined to be the pure vegetarians. Our dentition, gut structure, enzymatic range, adaptability and our dependence on both plant and animal sources for essential nutrients are all supportive evidence for our omnivorous status. As babies in uterus, we receive most of the nutrients of animal origin. It is also important to note that the modern diseases such as obesity, cancer, diabetes and coronary heart diseases were absent in Paleolithic men. They had a high reliance on animal foods rather than on plant foods. Studies have shown that the Australian aborigines have low blood cholesterol level when they have their traditional high reliance on animal foods. Inspite of all controversies, meat has been accepted as a high protein diet having several micro-nutrients, minerals and vitamins. Furthermore, across many cultures and stages of economic development, meat (specially red meat) is regarded as desirable food and an increase in meat consumption therefore figures prominently in the ‘nutrition transition’.

In the second half of 20th century, meat production increased roughly fivefold and meat consumption has soared in countries that are undergoing rapid industrialization. Apart from those who for ethnic, racial or religious reasons do not eat any meat (mostly in Asia), most of the worlds’ population are meat consumers (Harrington, 1994). Still, it ia estimated that although only 1-2% of the world population suffers from severe
malnutrition, nutritional stress occurs to a greater or lesser extent in all societies, social and economic status groups and is expressed in different pathological conditions (Casey, 1992). Worldwide per capita consumption of meat has increased from 41.3 kg in 2009 to 41.9 kg in 2010. People in the developing world eat 32 kg of meat a year on an average compared to 80 kg per person in industrial world (State of the world 2011: Innovations that nourish the planet @ www.worldwatch.org). The annual meat production is projected to increase from 218 million tonnes in 1997-99 to 376 million tonnes by 2030 (FAOSTAT, 2009). Urbanization is a major driving force influencing global demand for livestock products, because it stimulates improvements in infrastructures including cold chains which permit trade in perishable goods.

Goat meat, i.e. chevon, constitutes approximately 63% of all red meat consumed worldwide. The world goat population has been on the increase during the last three decades and currently stands at almost 840 million, as compared to 140 million cattle and 110 million sheep (FAOSTAT, 2009). There are about 570 breeds and types of goat in the world (Galal, 2005). Globally, goats that are slaughtered for meat production constitute about 45% of the recorded world goat population (FAOSTAT, 2009) and 268 million tons of meat totally produced in 2005 globally, 1.7% of this was chevon. India accounts for 20% of the worlds’ goat population with annual growth rate of 1.6% (Department of Animal Husbandry and Dairying, 2005).

In general, the global demand for goat meat is growing (Gipson, 1998). In India, it is the most popular meat and is accepted to all communities irrespective of any caste or creed. Chevon has been established as a lean meat with favourable nutritional qualities. It is a high quality protein source which is lower in calorie, total fat, saturated fat and cholesterol than other red meats. Despite the low lipid content in chevon compared to meat from other ruminants, chevon has a high proportion of unsaturated fatty acids in addition to being a source of conjugated linoleic acid (Webb et al., 2005) which acts as anti-inflammatory, anti-thrombotic and atherosclerotic preventatives (Givens et al., 2006). It is also having higher levels of iron and potassium content with lower sodium levels. India possesses 126.01 million goats and produced 478800 tonnes of chevon in 2008 (FAOSTAT, 2009). Still, very little is known on meat quality specially nutritional quality of goat meat raised by utilizing available feed resources in semi-arid region and it’s
products at International level (Sen et al., 2004).

A recent report by the Foreign Agricultural Service (FAS) of USDA states that for the second year in a row in 2013, India will be the world’s largest beef exporter. The total global meat trade is projected at 27 million metric tones (MMT) up 2.4% from 2012 with beef at 9 MMT, 33.2% of total trade (Korves, 2012). The domestic consumption has been growing 1-2% per year and that is not expected to change in the years immediately ahead.

Calorie-for-calorie, beef is one of the most naturally nutrient-rich foods. On average, a 3oz serving of lean beef is about 150 calories and also an excellent source of six nutrients, i.e. protein, zinc, vit. B12, vit. B6, niacin and selenium and also phosphorous, choline, iron and riboflavin (USDA, 2008). The U.S dietary survey data shows that fresh beef is the number one source of protein, vit. B12 and zinc in an American’s diet (Cotton et al., 2004). Evidence from clinical trials indicates that lean beef is equally as effective as lean white meat at lowering LDL cholesterol when included as a part of well-balanced, low-saturated fat diet (McNeil et al., 2012). It can lower LDL cholesterol by up to 10% as much as any other recommended heart-healthy diet (Roussell et al., 2012). Beef also contains sodium and potassium in good amount and some amount of calcium and manganese as well.

Chicken meat, popularly known as ‘white meat’, is distinguished from other meats such as beef, chevon etc by its lower iron content (0.7mg compared with 2mg/100gm). The fat content of cooked chicken varies depending on whether it is cooked with skin or not, the portion of the bird, the bird’s diet and breed. The breast meat of chicken contains less than 3gm fat/100gm. About 50% of the fat from chicken is made up of desirable mono-saturated fats. Therefore, it is considered as a healthy meat. It does not contain the trans-fat that contribute to coronary heart diseases (Farrell, 2009). It is an important source of essential poly-unsaturated fatty acids (PUFA) especially omega-(n)-3 fatty acids. The scavenging chicken are particularly good source because of their varied diet. The recommended dietary intake of niacin can be met with 100 gm of chicken meat per day for adults and 50 gm for infants. It is also a rich source of selenium which often
plays a significant role in prevention of some forms of cancer. That’s why the world poultry meat consumption is of significant economic importance in more than 50 countries worldwide and will undoubtedly continue in an upward trend (Roenigk, 1999). In India, there is a sharp increase in poultry meat production, i.e. 175% over the 1995 to 2005 as per FAO and 120% as per USDA data (Mehta and Nambiar, 2007). Here the poultry industry has grown at the rate of around 14% per annum while the agricultural production has been rising at the rate of 2% per annum over the past two or three decades (FAO/OECD, 2006). In 2006, there was an annual turnover of US$7500 million in poultry Industry in India (FAOSTAT, 2006).

Apart from these glorious perspectives of meat, the ‘darker’ side depicts that tissue heavy metal concentrations in animals are closely related to heavy metal levels in feedstuffs, the dose of heavy metal and the duration of heavy metal load, other tissues that could be injured include liver, reproductive tract, the immune and nervous system and blood of human being (Maracek et al., 1998). The continuous consumption of food stuffs contaminated with heavy metals that exceed the safe permissible limits may result in a serious health problem through progressive irreversible accumulation in human body (Goyer, 1997). Pollutants from industrial waste enter into the livestock production system and then into the food chain (Rajaganapathy et al., 2011). Heavy metal toxicity is one of the major current environmental health problems and is potentially dangerous because of bio-accumulation through food chain (Aycicek et al., 2008) and this can cause hazardous effects on livestock and human health (Aschner, 2002). High levels of heavy metals have been reported in soil, water and animals in different parts of India. Ingestion of these contaminants by animals causes deposition of residues in meat. When these residue levels go beyond the prescribed standards, they cause deleterious effects on human health, especially when consumed continuously (Santhi et al., 2008).

Similarly, the organochlorine pesticides which are characterized by low water solubility and high lipid solubility, are used widely in agriculture sector to control pests, leading to their bio-accumulation in fatty tissues. Therefore, they can also accumulate in human body fats posing threat to the human being (Ejobi et al., 1996). Pesticide
contamination of chicken and meat resulting from feeding a diet containing low-concentration of pesticides is a well-established fact (Noble, 1990; Aulakh et al., 2006). A study conducted in China revealed that inhalation and dermal contact contributed to only 5.1% and 13.5% of total intakes of DDT and HCHs by adults while ingestion through diet was responsible for 94.9% and 85.5% of the total respectively (Guo, 2004).

In this way, the healthy image of meat, a nutrient dense and versatile food providing valuable amounts of protein, fatty acids, vitamins and many other macro and micro-nutrients, has got tarnished during the past few years on account of several factors including the lipid hypothesis, contribution of saturated fats, emerging diseases associated with meat, obesity, toxicity etc. These lead to a silent transformation of consumers from ‘bulk-consumers’ to ‘selective-consumers’ and they expect that the product they purchase are of high quality and positive to their health (Thulasi, 2006).

They also believe to the concept of ‘food today for medicines tomorrow’. These ‘concerned consumers’ prefer meat cuts with high lean meat yield (LMY%) to carcass with higher proportion of fat (Johnson et al., 2005). Choosing a particular meat cut of a specific fatness level, prior to cooking and consuming it without added high energy condiments as well as trimming on the plate, can make significant contribution to decrease energy intake from a total diet perspective (Schönfeldt and Gibson, 2008). Knowledge of the carcass composition is necessary to provide the preferred cut to the consumer as such or by further trimming of the cut to the consumer’s preference (Hopkins et al., 1995). Accurate nutrient composition data are essential in communicating nutrition information to consumers (Cobiac et al., 2003).

Therefore, it is a high time for the scientists and researchers to face the need effectively and make nutritional maps of carcasses and their cut-up parts along with an image of deposition of different heavy metals and chemical residues in different wholesale cuts of various zoologically identified species reared for the meat production and lead the consumers in the right direction so that they can justify their choice logically and scientifically with the expense behind that.
On this above context, the present programme of research have been postulated to make a study on nutritional mapping of meat arising out from some principal wholesale cuts (both raw and cooked) of Beef, Chevon and poultry. Chemical residues in the raw meat in those species meat will be estimated. The physico-chemical parameters of meat quality will also be evaluated in the present study.