



## Availability, price, tradition, religion, income, social, development and economic influences on meat consumption

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### Abstract

The Muslims slaughtered the AL-Odhia of sheep, goat, cattle, buffaloe and camel in Eid Al-Adha every year and eat their meat. The Muslims eat the meat of all animals except pig all over the year. The Christians not eat meat and other foods of animal origin in certain periods of the year. The meat consumption is based largely on the availability, price and tradition. The meat production is a very complex operation depending not only on the demand which is usually based up on the price and the income, but up on the many social and economic influences such as the official policy, the price support mechanisms, and the interrelations such as the interaction between beef and milk production, the availability of animal feedstuffs and the competition for the food between the man and the animals. It is difficult to make accurate comparisons of the meat consumption between the countries in the world because the different methods are used to estimate the consumption. The figures may be derived from the total supplies available at wholesale level, or from the records of the household purchases, with or without estimates of what is consumed away from the home; the estimate of waste, both in the preparation of the food and by the individual adds to the uncertainty. Some national estimates fail to include the imports, and some surveys include the weight of non-meat components of the products, for example the amount of the meat in a product can range between hundred percentage in some types of the burger to ten percentage in some types of the pizza. The food Balance Sheets are prepared from the figures for the production, the imports, the stock changes and the exports with allowances for the feed, the processing and "The other uses" and the same methods are applied to all the regions. The amount of the meat consumed in different countries in the world varies enormously with social, economic and political influences, religious beliefs and geographical differences.

**Keywords:** The Muslims, The Christians, meat consumption, religion, diets, development, imports, meat production.

## INTRODUCTION

Up to a certain level of the income, the amount of meat eaten varies with the income, in the relatively affluent the western world where the proportion of available income spent on the food has been steadily falling over the past generation, there is now a little if any difference between the amounts of the meat eaten by the different income groups. This contrasts with the Third World countries in the world (1,2,3,4,5 and 6). The meat consumption is very large in the meat-producing areas such as Uruguay, Argentina, Australia and New Zealand, at three hundred grams per head per the day compared with an average of ten grams in India, Indonesia and Sri Lanka, the contrast between the total meat supplies in developed and developing countries in the world, allowing for exports, imports and stock changes, and the production per capita in the former is five times as much as in the developing countries in the world. These tables also show the relative size of production of the different types of animals involved. The role of the meat in the diet of undeveloped and developing countries in the world. The meat is held in high esteem in most communities. It has prestige value, it is often regarded as the central food round which meals are planned, various types of meat are sometimes made the basis of festive and celebratory occasions, and from the popular as well as the scientific point of view, it is regarded

as a food of high nutritive value (7,8,9,10,11 and 12). While it is clear that meat is not essential in the diet, as witness the large number of vegetarians who have a nutritionally adequate diet, the inclusion of animal products makes it easier to ensure a good diet. There is a marked difference at the present time in attitudes towards the meat between the people of the developing and the industrialized communities in the former where meat is in short supply it can be taken as a measure of the nutritional quality of the diet as a whole. Where a typical diet is heavily dependent on one type of the cereal or the root crop, the meat, even in the small amounts, complements the staple food. The meat provides a relatively rich source of well absorbed iron and also improves the absorption of iron from other foods, its amino acid composition complements that of many plant foods, and it is a concentrated source of B vitamins, including vitamin B12 which is absent from plant foods. Consequently, there is pressure to increase the availability of meat products (13,14,15,16,17 and 18).

### **Social effect on the meat consumption:**

In the industrialized countries in the world where food of all kinds is plentiful and cheap there is concern, whether or not misplaced, about the potentially harmful effects of a high intake of saturated fat from animal foods, emphasis on continuous development of regulations dealing with hygiene in slaughter houses and during subsequent handling, concern about hormones administered to cattle, what is perceived as excessive addition of water to some processed products - concerns that can scarcely be afforded in developing countries in the world when the balanced against the food supplies. With increasing the mechanization in the industrialized communities the steady fall in the human energy expenditure and consequently in per capita the food consumption poses a potential problem in achieving an adequate intake of nutrients even where there is an abundance of the food available. With the variety of the food available a diet of 8 MJ (2000 kcal) or more per day is likely to supply enough of all the nutrients, but when the intake is 6.5 to 7 MJ (1600-1800 kcal) per day the consumer needs to make an informed choice of foods to ensure an adequate intake of nutrients. In the Western Europe the daily average energy intake of women is about 6.5 MJ and that of men 8 MJ (excluding alcohol) and there are reports of biochemical signs of deficiencies of several B vitamins and iron. It is not clear whether this is accompanied by the functional defects (19, 20, 21, 22,23,24 and 25). In the industrialized countries in the world there have been slow but continuous changes over the years in the relative amounts of different types of the meat consumed depending partly on the price and influenced by the fashion, the advertising, etc. During the more recent years health aspects, the more correctly, the perceived health aspects, have become a factor. The concerns about the public health in the industrialized countries in the world where the coronary heart disease and the other "diseases of affluence. are common have led to the recommendations to the public to modify their diet, the popularized as Dietary Guidelines. These particularly recommend a reduction in the fat consumption, especially the saturated fatty acids and consequently, even if incorrectly, in the red meat. This has led in some sections of their populations to a relative increase in the consumption of the poultry and the fish at the expense of the red meat. In addition there is concern, whether or not misplaced, about the presence in the meat of pesticides, the residues of the hormones and the growth promoters used to increase the yields, and the concern about the human diseases thought to be transmitted by the beef, together with an increase, for many reasons, in the vegetarianism (26, 27, 28,29,30 and 31).

### **The meat as a source of protein for the Human Protein Requirements:**

The human requirements for protein have been thoroughly investigated over the years and are currently estimated to be fifty five grams per the day for the adult man and forty five grams for the woman. There is a higher requirement in the various disease states and the conditions of stress. These amounts refer to the protein of what is termed the good quality and the highly digestible, otherwise the amount ingested must be increased proportionately to compensate for the lower quality and the lower digestibility (32,33,34,35,36 and 37).

### **Protein Quality:**

The quality of a protein is a measure of its ability to satisfy the human requirements for the amino acids. All proteins, both the dietary and the tissue proteins, consist of two groups of amino acids - those that must be ingested ready-made, i.e. are essential in the diet, and those that can be synthesized in the body in adequate amounts from the essential amino acids. Eight of the twenty food amino acids are essential for the adults and ten for the children. The quality of the dietary protein can be measured in various ways but basically it is the ratio of the available amino acids in the food or the diet compared with the needs. In the earlier literature this was expressed on a percentage scale but with the adoption of the S.I. system of nomenclature it is expressed as a ratio. Thus, a ratio of 1.0 (100 per cent) means that the amino acids available from the dietary proteins are in the exact proportions needed to satisfy human needs; a ratio of 0.5 means that the amount of one (or more) of the essential amino acids present is only half of that required. If one essential amino acid is completely absent (a circumstance that can occur only experimentally with isolated proteins since any food, let alone a whole diet, consists of a mixture of many proteins) the protein quality would be zero. There is a popular impression, originating at one time from the nutrition textbooks, that the qualities of the proteins from the animal sources are greatly superior to those from the plant sources. This is true only to the extent that many animal sources have Net Protein Utilization, NPU, (a measure of the usefulness of the protein to the body) around 0.75 while that of many, but not all the plant foods is 0.5-0.6. However, after infancy people consume a wide variety of proteins from the different foods and a

shortfall in any essential amino acids in one food is usually made good, at least in part, by a relative surplus from another food - this is termed the complementation. As a result, the protein quality of whole diets even in developing countries in the world rarely falls below NPU of 0.7, a value that can be compared with the average of 0.8 in industrialized countries in the world. The value of the meat in this respect is that it is a relatively concentrated source of the protein, of high quality (NPU 0.75-0.8), highly digestible, about 0.95 compared with 0.8-0.9 for the many plant foods, and it supplies a relative surplus of one essential amino acid, lysine which is in relatively short supply in the most cereals (38,39,40,41,42,43 and 44).

### **The Effect of Cooking on Protein Quality:**

Apart from the inherent quality of the various proteins a reduction in the quality takes place if there is damage to the amino acids when the food is cooked. At a temperature below 100°C when the proteins are coagulated, there is no change in the nutritional quality of the meat. The first changes take place when the food is heated to temperatures around 100°C in the presence of moisture and reducing sugars, present naturally or added to the food. There is a chemical reaction between part of one essential amino acid, lysine and a sugar to form a bond that cannot be broken during digestion, and so part of the lysine is rendered unavailable. When proteins are analysed in order to determine their amino acid composition the procedure involves a preliminary hydrolysis with strong acid which does break the lysinesugar bond, so chemical analysis does not reveal this type of damage and special methods are needed. At a higher temperature or with more prolonged heating, the lysine in the food protein can react with other chemical groupings within the protein itself and more becomes unavailable. In addition the sulphur amino acids (cystine which is not essential and methionine which is) are rendered partly unavailable. The lysine-sugar reaction results in a brown-coloured compound (the so-called browning or Maillard reaction) which produces an attractive flavour in the food and is the main cause of the colour of bread crust and roast meat. While such severe heating reduces the amount of lysine available in these foods the loss is nutritionally insignificant since it affects only a very small fraction of the total amount present. At the temperature needed to cook meat there is little loss of available lysine or the sulphur amino acids but there can be some loss if the meat is heated together with reducing substances, as may be present when meat is canned with the addition of starch-containing gravy or other ingredients. Overall, the damage to protein caused by cooking is of little practical significance and it can be argued that if there is meat in the diet it is likely that the quantity of protein would compensate for any shortfall in quality. The nutritional quality of the proteins of meat rich in connective tissue is low since collagen and elastin are poor in the sulphur amino acids - there is only 0.8 g of each per 100 g of total protein compared with values of 2.6 and 1.3 of each respectively in "good meat. Meat is tough to eat when it is rich in connective tissue and such meat is often used for canning since the relatively high temperature involved in the sterilisation process partly hydrolyses the collagen so making the product more palatable. However, it still results in a product with NPU as low as 0.5 compared with a value of 0.75 - 0.8 for good quality meat (45,46,47,48,49,50 and 51).

### **Adequacy of Dietary Protein:**

The protein requirement of an individual is defined as the lowest level of protein intake that will balance the loss of nitrogen from the body in persons maintaining energy balance at modest levels of physical activity. The "requirement" must allow for desirable rates of deposition of protein during growth and pregnancy. When energy intake is inadequate some of the dietary protein is diverted from tissue synthesis to supply energy for general physical activity - this occurs at times of the food shortage and also in disease states where the food is incompletely absorbed and utilized. A diet adequate in energy is almost always adequate in protein - both in quantity and quality. For example, an adult needs an amount of protein that is equivalent to 7 - 8% of the total energy intake, and since most cereals contain 8 - 12% protein even a diet composed entirely of cereal would, if enough were available and could be consumed to satisfy energy needs, satisfy protein needs at the same time. Growing children and pregnant and nursing mothers have higher protein requirements as do people suffering from infections, intestinal parasites and conditions in which protein catabolism is enhanced. During the stress that accompanies fevers, broken bones, burns and other traumas there is considerable loss of protein from the tissues which has to be restored during convalescence and so high intakes of protein are needed at this time together with an adequate intake of energy. The digestibility of the proteins of various diets varies considerably. For example, the digestibility of the typical Western diets and the Chinese diets is 0.95. That of the Indian rice diet and the Brazilian mixed diet is 0.8. Digestibility is high in the diets that include the meat and low when the maize and the beans predominate. An increase in the amount of the protein eaten beyond the requirement the figures compensate for any shortfall in the digestibility and the protein quality (52,53,54,55,56,57 and 58).

### **Meat as a source of vitamins and minerals:**

Meat and meat products are important sources of all the B-complex vitamins including thiamin, riboflavin, niacin, biotin, vitamins B6 and B12, pantothenic acid and folacin. The last two are especially abundant in liver which, together with certain other organs is rich in vitamin A and supplies appreciable amounts of vitamins D, E and K. The meat is an excellent source of some of the minerals, such as iron, copper, zinc and manganese, and play an important role in the prevention of zinc deficiency, and particularly of iron deficiency which is widespread (59, 60, 61,62,63,64,65 and 66).

## Meat Iron:

The amount of iron absorbed from the diet depends on a variety of factors including its chemical form, the simultaneous presence of the other food ingredients that can enhance or inhibit absorption, and various physiological factors of the individual including his/her iron status. Overall, in setting Recommended Daily Intakes of nutrients the proportion of iron absorbed from a mixed diet is usually taken as 10%. Half of the iron in meat is present as haeme iron (in haemoglobin). This is well absorbed, about 15-35%, a figure that can be contrasted with other forms of iron, such as that from plant foods, at 1-10%. Not only is the iron of meat well absorbed but it enhances the absorption of iron from other sources - e.g. the addition of meat to a legume/cereal diet can double the amount of the iron absorbed and so contribute significantly to the prevention of the anemia, which is so widespread in developing countries in the world. Zinc is present in all tissues of the body and is a component of more than fifty enzymes. The meat is the richest source of zinc in the diet and supplies one third to one half of the total zinc intake of meat-eaters. A dietary deficiency is uncommon but has been found in the adolescent boys in the Middle East eating a poor diet based largely on the unleavened bread. The public health concerns associated with the consumption of the meat (67,68,69,70,71,72,73,74 and 75).

## Coronary or Ischemic Heart Disease:

A major cause of death in some parts of the industrialised world is coronary heart disease (CHD) and saturated fatty acids have been implicated as an important dietary risk factor. Since about a quarter of the saturated fatty acids in the diet is supplied by meat fat, the consumption of meat itself has come under fire. The first stage of development of the disease is a narrowing of the coronary arteries by deposition of a complex fatty mixture on the walls - a process termed atherosclerosis. The fatal stage is the formation of a blood clot that blocks the narrowed artery thrombosis. Even if the thrombosis is not fatal the reduced blood flow to the heart muscle deprives it of oxygen and can lead to extensive damage - myocardial infarction. Despite many years of intensive investigation the real cause of CHD is not known but a large number of what are termed risk factors have been identified, including a family history of CHD, smoking, lack of exercise, various types of stress and certain disease states together with a number of dietary factors. The saturated fatty acids, myristic and palmitic, have been established as the most important of the dietary risk factors in coronary heart disease. There are three types of lipoproteins in the blood; low density lipoproteins (LDL) in which 46% of the molecule is cholesterol; the high density lipoproteins (HDL) which include twenty percentage as cholesterol; and very low density lipoproteins (VLDL) which have eight percentage cholesterol. The high levels of total blood cholesterol are associated with the incidence of CHD and high intakes of saturated fatty acids elevate blood cholesterol levels: hence the association between the dietary saturated fatty acids and CHD. It is the LDL that appear to be the main problem and HDL appear to be protective. This lipid hypothesis of causation of CHD has led to the adoption in many countries in the world of dietary guidelines which, among other objectives, are intended to reduce the intake of saturated fatty acids as compared with unsaturated fatty acids and so reduce blood levels of LDL (76,77,78,79,80,81 and 82).

## Types of Fatty Acids:

**Saturated Fatty Acids (SFA):** Two of the saturated fatty acids, myristic and palmitic acids, appear to be the principal dietary factors that increase the blood cholesterol and do so by increasing LDL. The other main SFA in the diet, stearic acid, does not have the same effect (apparently because it is converted to oleic acid which is monounsaturated; fatty acids of shorter chain length appear to have no effect. In order to explain the terms saturated and unsaturated fatty acids to the consumer, SFA have been equated with animal fats so meat fat is perceived as being saturated, but, in fact, this is only relative. For example, pork lard is 40% SFA, beef tallow is 43-50% SFA, depending on the part of the body from which it is derived. These figures can be compared with 20 - 25% SFA in vegetable oils which are perceived as unsaturated. Table 3-2 shows that except for lamb fat the proportion of SFA is about 40% or less. In four of the six samples of meat listed there is a higher proportion of monounsaturates than SFA. This perception of meat fat as being saturated has led to the belief that meat, particularly red meat, should be avoided. In fact, it has been shown that a reduction of total fat intake while still including in the diet 180 g of lean meat containing 8.5% fat can result in a reduction in blood cholesterol levels. The relation between diet and coronary heart disease is not only a subject of considerable misunderstanding in the minds of consumers but also a subject of some controversy among medical scientists (83,84,85,86,87,88,89 and 90).

**Monounsaturated Fatty Acids (MUFA):** The fatty acid of main interest is oleic acid (plentiful in olive, rape seed and higholeic safflower oils). The relatively high intake of olive oil and consequently the proportionately low intake of SFA are believed to be important dietary factors in the low incidence of CHD in Mediterranean countries in the world compared with northern Europe. It is not clear whether oleic acid confers direct protection or simply replaces SFA in the diet. Table 3-2 shows the contribution of meat fat to the intake of MUFA (91,92,93,94,95,96,97 and 98).

**Polyunsaturated Fatty Acids (PUFA):** These are fatty acids with between 2 and 6 double bonds and long carbon chains of 18 to 22 carbon atoms. Linoleic acid (18 carbon atoms and 2 double bonds) and linolenic acid (18 carbon atoms and 3 double bonds) are plentiful in many vegetable oils. The very long chain fatty acids, eicosatetraenoic (20C, 4 double bonds) and docosapentaenoic (22 C, 5 double bonds) are plentiful in fish oils and smaller amounts are present in some meat fats. These very long chain PUFA appear to offer direct protection against "heart disease", particularly against

thrombosis, but it is not clear whether the other PUFA in the diet (from vegetable oils) offer protection or simply displace SFA. Consequently, it is often recommended that vegetable oils (rich in PUFA) should not simply be added to a diet but should be used to replace other fats when there is a need for fat in formulating the food products. Linoleic and linolenic acids are essential in the diet (they were at one time termed vitamin F) and the very long chain FA are formed from them in the body. It is possible that the rate of their formation may not be adequate under all circumstances and so there may be benefit from consuming some of these very long chain PUFA ready-made in the diet (99,100,101,102,103,104,105 and 106).

**Trans Fatty Acids:** PUFA exist in nature in two structural forms, termed cis and trans forms. It is the cis forms that are used in the production of fatty products such as special margarines. The other forms, trans, are formed when oils are hydrogenated to make hard fats for some margarines, and small amounts are found in the fats of ruminants where they are formed by bacterial hydrogenation in the rumen. Experimentally trans fatty acids have been shown to have an adverse effect on both LDL and HDL and so are considered potentially harmful. When calculating the ratio of PUFA and SFA in diets, the trans fatty acids are often included with SFA (107,108,109,110 and 111).

**Cholesterol:** Cholesterol is a fatty compound involved in the transport of fat in the blood stream and is also part of the structure of cell membranes of tissues of the body. It is not a dietary essential since adequate amounts are synthesised in the body from other dietary ingredients. Confusion has arisen between the terms blood cholesterol and dietary cholesterol. For most individuals dietary cholesterol has little or no effect on blood cholesterol levels because reduced synthesis in the body compensates for increased dietary intake (112,113,114 and 115). However, there are individuals who are sensitive to dietary cholesterol and most authorities advise a general reduction in cholesterol intake for everyone. Meat supplies about one third of the dietary cholesterol in many western diets with the remainder from eggs and dairy products. Since all these foods are valuable sources of nutrients there could be some nutritional risk in restricting their intake. In addition to playing an important role in CHD dietary saturated fats have been implicated in hypertension, stroke, diabetes and certain forms of cancer, so all dietary guidelines include recommendations to reduce total fat intake and especially that of saturated fats. Some 20 national authorities have issued dietary guidelines which differ mainly in the amounts of the various foods advised. Generally, it is recommended that total fat should be reduced to 20-30% of the total energy intake, with not more than 10% from saturates, 10-15% from MUFA and with PUFA at 3% or more; this results in a P/S ratio of 1.0. Most authorities, but not all, recommend a reduction in dietary cholesterol to around 300 mg or less per day (116,117,118,119 and 120).

#### **Poultry Meat versus Red Meat:**

Dietary guidelines sometimes include advice to substitute, at least in part, chicken for red meat. Chicken meat including its skin contains about the same amount of fat as does medium-fat red meat, 20%; it is necessary to remove the skin with the adhering subcutaneous fat, to reduce the fat content to around 5% - which is no lower than the figure for lean meat. However, chicken flesh has less saturated fatty acids (33% of the total) and more PUFA (14%) than lean meat with 45% and 4% respectively. Duck flesh is very fat, containing about 10% fat - 45% when the skin and subcutaneous fat are included; only 27% of duck fat is saturated. Meat from game birds, grouse, partridge, pheasant and pigeon, contains about 5, 7, 9, and 13% fat respectively, of which about one quarter is saturated. Apart from differences in the amounts and types of fatty acids in the various kinds of meat, poultry and game their nutrient compositions are similar (31,32,33,34,35 and 36).

#### **Toxic compounds formed during processing and cooking:**

While cooking is necessary to develop the desirable flavours in meat (as well as to destroy harmful organisms) the oxidation of fats, especially at frying temperatures, can give rise to compounds that decompose to aldehydes, esters, alcohols and short chain carboxylic acids with undesirable flavours. Meats are particularly susceptible because of the unsaturated lipids present which are more readily oxidised and because of catalysis by haeme and non-haeme iron. The more PUFA present the greater the likelihood of oxidation, and pork (3.6 g PUFA/100 g when grilled), duck (meat and skin, cooked, 3.5 g) and chicken (roast meat and skin, 2.5 g) are the most susceptible. Other types of meat are less susceptible, e.g. lamb (grilled cutlets, 1.5 g PUFA), turkey (meat with skin, 1.3), and beef (fried steak, 0.6 g per 100 g). The adverse effect of these oxidation products on eating quality is well recognized but more recently it has been suggested that some of them may be carcinogenic, and also may be involved in the ageing process and CHD. However, it is possible or even likely that the unpleasant flavours would cause the rejection of the food at levels below harmful ranges. Cholesterol can also be oxidized and the oxidation product has been suggested as a possible factor in CHD (43,44,45,46,47 and 48).

**Carcinogens:** A number of epidemiological studies have suggested a link between the intake of the animal protein and predisposition to cancers at the various sites - the pancreas, the breast, the colon, the prostate and the endometrium - but there are many contradictory reports. A summary of eleven case-controlled studies of the colon cancer, three of the stomach cancer and one of breast cancer concluded that the available data do not provide convincing evidence that removal of meat from the diet would substantially reduce the cancer risk. The products of pyrolysis of organic material

by the overheating and the charring, the polycyclic hydrocarbons, are believed to be carcinogenic. The most thoroughly investigated of these is 3,4-benzpyrene which is formed on the surface of barbecued and grilled and smoked meat products (including broiled fish and roasted coffee). The main source of these compounds is the flame itself, especially from charcoal, and indirect cooking where the flame is not in contact with the food greatly reduced the amount present (11,12,13,14,15,16 and 17).

**Nitrosamines:** the Nitrites, used in the curing salts can react with the amines commonly present in the food, to form the nitrosamines. These have been shown to be carcinogenic in all species of animals examined but it is not clear, despite years of the intensive research, whether the amounts present in the cured meat affect the human beings. The problem is particularly difficult because the nitrosamines have been found in the human gastric juice, the possibly formed from the nitrites and the amines naturally present in the diet. As a precaution, the legally enforced in some countries in the world, there is a tendency to reduce the amount of the nitrite used in the curing mixture and to add vitamin C which inhibits the formation of the nitrosamines. The erythorbic acid and the tocopherol are also effective in reducing the nitrosamine formation. The problem is complex since the process of the curing is designed to prevent the growth of *Clostridium botulinum* which is responsible for the botulism, and the risk of botulism is increased if the concentration of the nitrate-nitrite is reduced too far. (Moreover, cigarettes contribute far greater amounts of nitrosamines, up to one hundred times as much as the cured meat (39,40,41,42,43,44 and 45).

### Other potential problems:

**Bovine Spongiform Encephalopathies (BSE):** There is a group of diseases called prion disease, also known as spongiform encephalopathies or transmissible dementias, which include some very rare human diseases, scrapie in animals and BSE. It is not clear whether these all represent the same disease but they have in common the presence of an aberrant form of a normal cell protein called the prion protein. In some countries in the world there have been recent outbreaks of BSE in cattle with the suspicion that it might be transmitted to the human beings through affected the meat. This is difficult to prove or disprove and the risk may be remote but it has added to other popular suspicions about the meat and may be partly responsible for the reduction in beef consumption in some countries in the world (87,88,89,90,91,92 and 93).

**Excessive Amounts of Vitamin A in the Liver:** There are reports in the scientific literature of harmful effects of acute and chronic excessive intakes of vitamin A, mostly from the pharmaceutical preparations. Recently, however, concern has been expressed at unusually high levels of the vitamin A found in some, few, samples of the animal liver, which, if eaten during the early stages of the pregnancy, might possibly affect the human fetus (94,95,96,97,98,99 and 100).

**The Residues of Drugs. Pesticides:** The residues of the drugs, the pesticides and the agricultural chemicals can be found in small amounts in the meat and the meat products. The pesticides, for example, may be applied specifically to the animals to control the insects or the intestinal parasites but may also be present in the meat as a result of exposure of the animals to chemicals used on buildings, grazing areas and crops. While there is no clear evidence that these small amounts cause harm to the consumer they are perceived as a risk. For this reason there is widespread legislation to test for and control a range of chemical substances that may be present in the meat. The problem is complicated because several hundred substances are used to treat animals, to preserve animal health and to improve animal production. These include antimicrobial agents, beta-adrenoreceptor blocking agents (used to prevent sudden death in pigs due to stress during transport) anti-helminthics, tranquillizers, anti-coccidial agents, vasodilators and anaesthetics. Potential safety problems arise from the possibility of residues of these drugs and their metabolites remaining in the tissues consumed by human beings. Some tranquillizers, for example, are used in pigs in the immediate pre-slaughter period when there is no time for their removal through the normal metabolic processes. They can persist in the human body so that repeated intakes could possibly result in accumulation of the drugs. In order to protect the consumers from such risks the Codex Alimentarius Commission publishes Draft Codes of Practice for control of the use of veterinary drugs. These provide guidelines for the prescription, application, distribution and control of drugs. Where there is sufficient scientific information available about the drug in question the Codex Commission defines the following: - Acceptable Daily Intake (ADI) as a measure of the amount of a veterinary drug, expressed on a body weight basis, that can be ingested over a lifetime without appreciable health risk (the same term and definition as used for food additives. This is set at one hundredth of the maximum no-observed-effect level (NOEL) determined in experimental animals, on the assumption that human beings may be ten times as sensitive as the test animals used to determine NOEL and that there may be a tenfold range of sensitivity within the human population. When data are incomplete the safety factor may be set at a much higher multiple.

The maximum amount of residue of a drug - maximum residue limit (MRL) - is the maximum concentration per kg fresh weight of food that is recommended by the Codex Commission as being legally acceptable. This is based on the amount considered to be without any toxicological hazard to human health and takes account of other relevant public health risks as well as food technological aspects. A point is made in the 1991 report that the principal problem is not only the safety of the substances and their residues but the public perception of their safety. There is no doubt that

administration of drugs to animals (and birds) is always a potential risk to human health and so there is a need to control the use of these drugs and to measure the extent of any residues left in the food intended for human beings (77,78,79,80,81,82 and 83).

## CONCLUSION

The meat is not an essential part of the diet but without the animal products it is necessary to have some reasonable knowledge of the nutrition in order to select an adequate diet. Even the small quantities of the animal products supplement and complement a diet based on the plant food so that it is nutritionally adequate, whether or not there is informed selection of the food. Side by side with these known benefits of including the meat and the meat products in the diet are problems associated with the excessive intakes of the saturated fats, the risks of the food poisoning from the improperly processed products, the residues of the chemicals used in the agriculture and the animal production and other potentially adverse aspects. Within these concepts is the major problem of the meat production under the conditions that used to avoid the food poisoning and satisfy the economic demands of the profitability with the traditional, the cultural and the religious concerns of the community. There is a steadily increasing demand for the meat in the developing countries in the world which can be satisfied by increased the domestic consumption and the increased imports. It is thought that the major increase in the domestic production will come from the small producers rather than from creating the large production units but these lack the essential facilities for producing the safe and wholesome products. If there is to be a significant increase in the meat production it will require clear policy decisions with the necessary financial, the legislative and the technical support. There is considerable potential for the increased supplies through the better management, selection of the animals, the avoidance of the waste and making use of the indigenous species. If the exports are to be considered then the attention has to be paid to the strict hygienic and the safety requirements involved, whatever the domestic market might tolerate.

## Conflicts of Interest

The author declares no conflicts of interest

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