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Fifth YEAR-Class- Meat Hygiene

Food animal and Transportation

1- Introduction to food animal

Meat is normally regarded as the edible parts (muscle and offal) of the food animals which consume mainly grass and other arable crops, namely, cattle, sheep, goats, pigs, horses, deer, reindeer, buffalo, musk oxen, moose, caribou, yak, camel, alpaca, llama, guanaco, vicuna, etc. In addition, poultry have become a major meat-producing species, while rabbits, guinea pigs, capybara and various game animals and birds provide a substantial amount of protein, particularly in localised areas. Fish and other seafood have also been an important part of man's diet since earliest times.

All the above animals, including fish, are converters, that is, they utilise green vegetable material with varying efficiency to produce protein. Even micro-organisms can be classified as converters in that they use carbohydrates from plants to make protein from simple nitrogenous compounds. Especially when an animal eats something which is inedible for man or could not easily be made into food for man, it is considered valuable as a source of food

In more recent times, efforts have been made to domesticate certain *wild animals*, although many of these have been used as food since ancient times. In Africa and Russia, elands are being domesticated, as well as antelope in the latter country. Kangaroos are being kept for meat in Australia, and in South America, the large rodent capybara, which is a semi-aquatic vegetarian, is being used as a source of meat, although it is not especially palatable. There are probably many other wild species which could be utilised in meat production and would have some advantages over the domesticated animals since they exist on less valuable land, need only rough grazing, are more disease resistant and act as a tourist attraction. Some problems, however, arise in connection with feeding, protection from predators, slaughter and meat inspection.

Buffalo meat is said to be more tender, leaner and gamier than beef, with lower levels of cholesterol. Although expensive in France, it is cheaper than beef in Canada. The name buffalo is often applied to the bison (*Bison bison*) of North America, a different species of the order Bovidae. There are several species; the Indian buffalo (*Bubalus bubalis*), sometimes called the water buffalo or arna, is the only one to be domesticated. It is found in many parts of the Old World, with significant numbers in Hungary, Italy and France.

- **The future for meat and meat products** will depend mainly on consumer demand and the prices at which they can be profitably produced. As living standards rise, so also does the consumption of meat. Factors such as the cost of production, feed conversion efficiency, land use and availability, consumer taste, price to consumers, diet, attitudes of people to meat production methods, use of protein from non-animal sources, etc. will all play a part in determining future demands. Procedures such as genetic engineering, embryo transfer, sexed semen, cross-breeding and twinning will continue to be utilised in attempts to produce more productive livestock with improved milk and meat quality. But if close attention is not paid to the vital importance of disease resistance, we may well see the development of stock susceptible to existing and novel conditions, some of which may have serious public health implications. Consumer attitudes must always be borne in mind by research workers and those engaged in the agriculture and food industries, which will only prosper in a climate of real consumer confidence in the quality and safety of food.

- **World livestock production**

In general, those countries with the highest meat consumption rates are also the major producers. Some parts of the world such as Argentina, Australia, New Zealand and Denmark are large exporters of meat and meat products, while the United States, Britain and Germany import large quantities, although the former also have a considerable export trade as have many other countries.

- **Many factors operate to determine levels of food animal populations**, economics playing the principal role, but disease outbreaks, weather conditions, overproduction, consumer preference, feed availability, etc. are also important reasons, along with trade barriers imposed by individual states, often on ill-defined, even unjustified, grounds.

- **Breeds**

In Britain's dairy herd, the Holstein/British Friesian is the dominant breed. About one-third of mature dairy cows and almost half of the dairy heifers are mated with beef bulls, mostly Limousin and Angus and a smaller proportion with Belgian Blue due to concerns regarding incidence of calving difficulties with the latter breed, in order to increase the beef potential of calves not required as dairy herd replacements.

Exotic breeds have been introduced into the United Kingdom in an attempt to improve beef production. The first of these (in 1961) was the French Charolais, which is typical of the large cattle breeds of western Europe with their mature body size, rapid growth rate and lean carcases. Charolais and Belgian Blue, are, however, liable to some difficulty in calving, often necessitating caesarean section, but this is apparently regarded as an acceptable risk by many farmers. British Charolais, through selective breeding, have easier calvings. British breeds have been exported to many other countries to improve local strains, as live animals, frozen embryos or semen. Throughout the world, there are numerous breeds of domestic cattle used for meat and milk production and also in some cases as draught animals

- **Systems of beef production**

Beef production systems vary from almost range conditions to semi-intensive and intensive units. The efficiency of animal production is the ratio of output to input: the main outputs are meat, milk, hides, fur and by-products, and the principal inputs are feed, land, labour, capital, energy and water.

- **Growth promoters**

Probiotics are benign bacteria which are administered by mouth to animals (calves, lambs and piglets) sometimes at birth and/or after disease. The introduction of a probiotic into the digestive tract is claimed to ensure more efficient feed conversion, earlier slaughter and a healthier animal. Unlike antibiotics, which often kill useful intestinal microorganisms and create undesirable residues, probiotics are said to be natural products without any side effects. Prebiotics are ingredients that stimulate the growth and/or function of beneficial intestinal micro-organisms.

Animal Transportation

According to the Farm Animal Welfare Committee (FAWC), the welfare of an animal includes its physical and mental state, and the FAWC considers that good animal welfare implies both fitness and a sense of well-being. Any animal kept by man must be protected from unnecessary suffering.

The FAWC believes that an animal's welfare should be considered in terms of Five Freedoms:

1-freedom from Hunger and Thirst – by ready access to fresh water and a diet to maintain full health and vigour;

2-freedom from Discomfort – by providing an appropriate environment, including shelter and a comfortable resting area;

3-freedom from Pain, Injury or Disease – by prevention or rapid diagnosis and treatment;

4- freedom to Express Normal Behaviour – by providing sufficient space, proper facilities and company of the animal's own kind;

5- freedom from Fear and Distress – by ensuring conditions and treatment that avoid mental suffering.

- **Different farming systems**

There are many links between pre-harvest production and the safety and the quality of the food. These interactions are not yet completely understood but it is clear that farmers are contributing to food safety when producing healthy, unstressed and clean livestock for slaughter. Farming systems differ significantly between species and within each species and can be divided in several ways, for example integrated and non-integrated, intensive and extensive, indoor and outdoor, free-ranged and fenced, organic and non-organic and so on. Intensive livestock farming is the major source of the world's meat supply, and the main challenge of intensive farming is to produce food profitably whilst complying with the requirements on environment, animal welfare and food safety. It is important to understand that in all farming systems it is necessary to guarantee the acceptable level of farm animal welfare and health and to follow good practices which contribute to consumer safety and public health.

- **Good Practice at farming system**

Good Farming Practices (GFP), Good Veterinary Practices (GVP) and Good Hygiene Practices (GHP) need to be implemented to fulfil animal welfare demands and to minimize the spread of animal-specific pathogens and food safety related hazards.

The prudent use of veterinary drugs and appropriate veterinary treatments are the major components of GVP. Proper use of antimicrobials will help to prevent the development of resistance amongst microorganisms. Antimicrobials should not be used as growth promoters or for prophylactic aims. All veterinary actions should be based on making a correct diagnosis, which requires high quality clinical training and skills as well as access to diagnostic laboratory services. GVP also involve the adequate control and prevention of animal diseases.

Good hygienic practices (GHP) at the level of primary production should involve the health and hygiene of animals, biosecurity, records of treatments, feed and feed ingredients and relevant environmental factors. GHP should also include elements of own-check or internal audits. In primary production, the areas where zoonotic agents and other hazards may accumulate must be effectively cleaned and, if needed, disinfected. Chemicals must be stored in a manner such that they do not contaminate the environment or poison the animals directly or via feed and feed ingredients and water, and thereby pose a risk to food safety or human health. Additionally, primary producers should record relevant information on the health status of animals as it relates to the production of safe meat.

- **Biosecurity measures**

Primary production should be managed in a way that reduces the likelihood of introducing hazards and contributes appropriately to meat being safe and suitable for human consumption. Beside classical food safety risks, there are many foods safety risks that cannot be controlled by meat inspection because of missing clinical symptoms or pathological-anatomical lesions in the infected animal. Visual, palpatory and incision techniques are not always suitable for detecting food-borne diseases, such as campylobacteriosis, salmonellosis, yersiniosis and verotoxigenic *Escherichia coli* (VTEC/STEC) infections. Moreover, palpation and incision can contribute to cross-contamination of the carcasses with the mentioned food pathogens. Many food pathogens can be detected and controlled in the flock or herd level (pre-harvest) instead of detection at the slaughter line (harvest). Biosecurity measures are the main preventive measures for reducing food safety risks at pre-harvest.

- **Prior to transport**

Possible routes of transfer of infectious agents on farms.

1- Air (Aerosols that are produced when infected animals breathe Infected faeces, dust, feathers).
2- Animals of the same species (Infected animals being transferred into uninfected herds or flocks)
3- Dead or sick animals (Animals of other species, other species being alternative).
4- Infected or carrier hosts (Rodents and birds).
5- Feed (Feed ingredients are infected intrinsically with the disease agent, e.g. Salmonella).
6- Water (the water becomes infected from contact with infected animals such as birds, feral animals, rodents and domestic animals).
7- Waste (Contact of uninfected animals with infected wastes from an adjacent property).
8- Contaminated personnel, equipment and vehicles Movement of people, clothing, footwear, equipment and vehicles between infected and uninfected premises

- **Transport**

Farm animals are transported to the slaughterhouse most often by road but also by rail and on ship; they are seldom transported by air. The transport of livestock includes also a pre-transport period with transport-related operations. **Before the animals are loaded onto a vehicle they should be prepared for transport**. This stage consists of mustering, assembling, handling and preparation of livestock, including the feeding and watering of animals. The next stage is loading, transport and unloading of animals. Before animals are loaded onto the transport means, their fitness for the intended journey should be assessed. Additional inspections of livestock fitness for journey should be made during travelling and, especially, at staging points where animals are unloaded from the transport means.

As research has shown, transport of livestock is very stressful and livestock are prone to injuries. Stress factors such as a new environment, contact with unfamiliar animals and humans, unusual feed and different watering equipment are some examples that cause stress during transport. The influence of certain stress factors caused by transport can be reduced if animals are fit for transport and have been prepared for transport. When calculating the duration of the journey, it should be born in mind that the influence of the journey time on the animal is

dependent on the animal species, animal condition and, especially, on animal age. Poorly executed transport can lead to poor animal welfare but can also have a negative influence on meat quality.

- **Means of transport**

The means of transport should be designed and maintained such that the basic needs of animals for safety, thermal comfort and adequate movement can be met. Vehicles should not cause injury and suffering and should ensure the safety of the animals.

1- Animals are unable to move independently without pain or to walk unassisted.

2- Animals have a severe open wound or prolapse.

3- Pregnant females for whom 90% or more of the expected gestation period has already passed, or females who have given birth in the previous week

4- Should not have any sharp edges or projections

5- Should provide loading and unloading equipment that is adequately designed and constructed for animal species

6- Should be constructed of non-toxic material

7- Should prevent animals from escaping

8- Should provide a suitable non-slip floor

9- Should be easily cleaned and disinfected and should be cleaned and disinfected before each animal transport

10- Should be leak proof

11- Should ensure air quality and temperature is appropriate to the species and number of animals being transported

- **Transport practices**

Transport can have serious effects on animal welfare and can lead to significant loss of meat quality and production if it not carried out properly. If unfamiliar animals are loaded into a transport vehicle it can lead to fighting between animals, causing bruising and serious injuries.

1- The stress factors that the animals are exposed to during transport may lead to poor animal welfare and increase the risk of infection and disease. Changes in the environment are a source of stress for transported animals.

2- Animal species vary in their responses to loading and therefore each species requires different handling procedures. For example, during the loading and unloading of animals the sheep have physiological responses rather than behavioural and these are associated with the novel situation encountered in the vehicle rather than the loading procedure.

3- Careful driving of the animal transport vehicle is important. During transport animals should be able to cope with different movements of vehicle. Up and down movements and side to side movements can be avoided by choosing good quality roads for driving.

4- The length of transport time and resting period should be appropriate to animal species.

5- The amount of space allowed for animals during transport is important for several reasons. Space allowances have two factors that need attention. The first factor is the floor area available for the animal to stand or lie down in and the second is the compartment height.

6- Depending on animal species, there are differences of common behaviour during transport. When calves or cattle are transported, they either remain standing or adopt a position of sternal recumbence. Cattle are more likely to lie down if the surface of the floor is covered with straw.

7- Compartment height should be appropriate to the animal species being transported and to each transported animal. Species-specific differences should be taken into consideration when assessing the proper height of the compartment. Animal compartment height for cattle transport should be at least 20cm above the wither's height of the tallest animal.

Lairage

The place where the animals spend time in the slaughterhouse before being slaughtered is called lairage. Certain facilities are required for *ante-mortem* inspection of animals arriving at the slaughterhouse. Therefore, a proper light intensity, an adequate number of well-designed pens and a competent staff are needed. It is well known that the cleanliness of animals has a major influence on the level of microbiological cross-contamination of the carcass and other edible parts during slaughter and dressing. Proper lairage is not only important for animal welfare but also for meat safety. The avoidance of stress is important for economic reasons as well as for meat quality and animal welfare. To maintain animal welfare, the lairage period should be kept to a minimum and there should be sufficient time allowed to recover from the

stress of the transport. Associated personnel should be trained to recognize problems and to move animals calmly and quietly.

Excessive noise can be very stressful for slaughter animals and has to be minimized by trained handling and the proper design of the slaughterhouse. Lairage constructions should be designed carefully taking into consideration all aspects related to hygienic conditions and animal welfare. The time spent in lairage influences the animal welfare and meat quality. This can be seen in higher number of bruises in animals.

Food chain information

Information shared between farms and slaughterhouses is known as food chain information (FCI). This information plays an important role in identifying animal health and welfare as well as meat quality and safety issues. If zoonotic agents are introduced into the food chain, there is a health risk for humans.

FCI no less than 24 hours before the arrival of animals at the slaughterhouse. The FCI has to cover particularly:

- the status of the farm or the regional animal health status;
- the animal's health status;
- veterinary medicinal products or other treatments administered to the animals within a relevant period and with a withdrawal period greater than zero, together with their dates of administration and withdrawal periods;
- the occurrence of diseases that may affect the safety of meat;
- the results, if they are relevant to the protection of public health, of any

  analysis carried out on samples taken from the animals or other samples taken to diagnose diseases that may affect the safety of meat, including samples taken in the framework of the monitoring and control of zoonoses and residues;
- relevant reports about previous *ante*- and *post-mortem* inspections of animals from the same farm, including reports from the official veterinarian;
- production data, when this might indicate the presence of disease;
- the name and address of the private veterinarian normally giving veterinary service in related farm.