

## Lectures

Mode of delivery: Lectures and round tables at the end of the day.

June, 4 - MEAT PRODUCTION AND IMPACT

### **Giuseppe Bee - "Livestock production: global future perspectives"**

The global livestock sector is highly dynamic. However, this dynamic differs depending on the demand for livestock product, which historically has been driven by the population growth, the income growth, the urbanization and the advances in science and technology. In developing countries, livestock sector is evolving rapidly due to the increasing demand for such products whereas in developed countries the demand stagnates or even decreases. Consequently, many production systems in developing countries focus on improving efficiency and environmental sustainability (carbon-constrained economy) due to the mid- to long-term view, competing for natural resources, particularly land and water, thus competition between food and feed will increase in the future. Developments in breeding, nutrition and animal health/welfare, as well as the associated improved analysis and monitoring techniques, will further contribute to increase the efficiency and genetic gains. This lecture will discuss how future livestock production will be affected by these factors.

### **Phillip Strydom - "Impact of meat production from intensive farming system"**

The world population is expected to grow from 6.9 billion in 2010 to 9.3 billion in 2050 with an expected growth of 73% in meat consumption. Due limited arable land, intensification of meat production is necessary buffer the higher demand of meat. Due to the perceived negative impact of intensive meat production on natural resources such as vegetation, air, soil, water and biodiversity, steps need to be taken to sustain these resources. The impact of feeding, genetics, fitness (longevity and reproduction) and growth manipulation are tools to improve efficiency but could affect product quality and consumer attitude towards products as well. Breeding and managing animals that are better reproducers, consume feed more efficiently and produce less harmful gasses such as CH<sub>4</sub>, lower the environmental impact. Growth manipulators such as hormone implants and beta-agonists increase yield and efficiency in addition to better genetics and feed formulation, but often have negative effects on quality and perceptions of food safety.

### **Hervé Rémignon - "Impact of the production of the *foie gras*"**

The production of *foie gras*, issued from the force-feeding of ducks, is typical of the French poultry industry. Even if it is a very old practice, and a luxurious food emblematic from the French gastronomy, it is also often a source of public debates regarding the welfare of the birds. In this lecture, general information about technical and economical parameters of the production of *foie gras* will be introduced as well as the associated physiological and biochemical aspects due to the rapid development of this hepatic steatosis. New approaches for the production of *foie gras* will be also rapidly presented.

### **Louwrens Hoffman - "Meat consumption in developing Countries: Africa"**

This presentation visits the demand for animal protein and the role that it lays within the different cultures in Africa. These demands cannot only be met by the consumption of the traditionally farmed species (beef, lamb, pork and poultry) and therefore other species are also consumed. The talk briefly touches on the potential production (which is unknown) of meat produced by the informal market. The controversy (mainly taboos) around the consumption of different species

such as Dog, horses/equids, marine mammals, non-human primates, rodents and reptiles, from an African perspective are discussed relative to the Western World's perspective.

#### **Attawit Kovitvadi - "Meat consumption in developing Countries: Asia"**

Meat consumption is continuously and rapidly rising in developing countries including Asia, comparing to the developed countries. The major factors should be a higher income of population and a lower price of meat products. Therefore, Asian people have a greater chance to consume higher amount of animal protein sources. Price has been the main factor which influences on consumer's decision. However, the buying behaviour and consumption attitude changed, whereas the product quality, safety, functional properties, animal welfare and environmental friendly production systems are other impact factors to consider. Therefore, animal and food production industries should adapt to serve the trends.

### June, 5 - INSECTS AS FEED INGREDIENT IN MEAT PRODUCING ANIMALS

#### **Marco Cullere - "Insects as protein source in meat animals' diets: world regulation"**

Worldwide population is expected to reach the 9 billion people by 2050. Consequently, the demand of meat is expected to increase by 58% compared to 2010 which will require an augmented livestock and conventional feedstuffs production, ultimately increasing the pressure on the already overexploited natural resources. In the imperative search for different and sustainable feedstuffs for farmed animals, insects are a promising alternative candidate to the conventional protein feed sources. In this session, I will provide an overview of the worldwide legislation on the use of insects in animal feeding, which is very heterogeneous and determines a global scenario in which some countries are already significant producers of insects for a multitude of products, whereas in some other countries, like some western countries, a clear legislation and standards for the use of insects as feed is lacking, which hampers the industrial development of this emerging sector.

#### **Giuliana Parisi - "Meat quality of fish fed insects as feed ingredient"**

Fishmeal, the main ingredient in the aquafeeds due to its high nutritional value, represents a finite resource and will not be able to supply the aquafeed industry that further will increase its requests in the future. Finding alternative and new protein sources in aquafeed is an issue of economic and strategic importance for the sustainable development of aquaculture. The interest in using insects as new source of protein is growing, thanks to their nutritional properties. In addition, they are part of the feeding natural habits of the fish and this is a strategic point for the consumer acceptability for fish fed with aquafeed including insects. Several studies have investigated the growth performance and nutrient utilization of a variety of fish species fed with diets where fishmeal was partially/totally replaced by insect meal but very few are the studies dealing species of fish interesting for the Mediterranean aquaculture and those regarding the effects on the quality of fillets.

#### **Louwrens Hoffman - "Meat quality of poultry fed insects as feed ingredient"**

In this presentation a brief background is provided around the use of insects in South Africa. This is followed by a discussion around the four main fly species that have been researched in South Africa: Insect being researched as diets for animals: The house fly (*Musca domestica*), the green fly/blow fly (*Lucilia sericata*), blow fly (*Chrysomya chloropyga*), Black Soldier Fly (*Hermetia*

illucens). A brief overview of the challenges faced to quantify the production parameters for raising insect larvae is given, this includes the nutrition requirements of these insects. Thereafter the effect of the use of these insect larvae on poultry products (broilers and eggs) is discussed as well as a brief look at the effect of using fly larvae to feed pigs.

### **Antonella Dalle Zotte - "Meat quality of rabbits and chickens fed insects oil as energy source"**

Dietary lipid supplementation has become a widespread practice in intensive animal production, as it allows to increase energy density of diets, maximising feed conversion index. The majority of the lipid sources in poultry and rabbit diets consists of rendered fat, coming from the part of the slaughtered animal which is not used for human consumption, and crude vegetable oils. Currently, the limited supply of soybean and its high price has caused increasing interest in the search for new alternative lipid sources for animal feed. Fat from insects could represent an alternative dietary lipid supplement for broilers, laying hens, and growing rabbits. In this lecture recent research results on the dietary inclusion of insects oil to growing chickens and rabbits will be discussed, with emphasis to its impact on meat quality.

### **Attawit Kovitvadhi - "Meat quality of poultry fed insects as protein source: an Asian perspective"**

Insects represent an alternative protein source with valuable and good quality for poultry nutrition which could possibly replace soybean and fish meals. Climate in most of Asian countries, mainly South-east Asia, is appropriate for insect farming and provides therefore a great opportunity to perform a sustainability farming system. Insects are accepted as human food in Asian countries including Thailand, therefore the use of insects in poultry diets should be accepted from Asian consumers. Moreover, the increase demand of meat from local breed broilers (free-range production system and feeding insects) was reported in Thailand because the better taste than broilers in commercial production system. In conclusion, meat of poultry fed insects as protein source is accepted on their quality from Asian perspective.

June, 6 - PRODUCTION, SAFETY AND BENEFITS OF MEATS FROM UNCONVENTIONAL/ALTERNATIVE SPECIES

### **Hervé Rémignon - "Alternative poultry farming and meat quality in France"**

The *Label Rouge* (LR) official sign of quality distinguishes foods with a higher sensorial quality than standard products. The LR official sign of quality is very efficient and popular, more than the organic one for example, mainly in poultry products. The conditions of production of LR poultry are based on a list of restricted rules regarding to the genetic origin of the birds, the composition of feeds, the conditions of rearing, etc. In this lecture, we will examine the technical conditions of production of LR chickens to understand how they could positively influence the final quality of the meat.

### **Phillip Strydom - " The utilisation of indigenous goats as sources of meat in small scale African farming"**

Goats generally have a high tolerance to disease and heat stress, making them an ideal source of animal protein in various parts of the world exposed to these challenges. Moreover, when managed well, goats can convert low-quality plant material to meat and could be ideal in

preservation and improvement of ecosystems. Goat meat has equally good or higher nutritional value than beef mostly because carcasses are leaner. African breeds vary in size meaning that yield would be different among different types. However, carcass yield (dressing percentage) is generally low due to large guts. Meat quality of goats could vary due to factors such as poor nutrition leading to growth impairment, incorrect slaughter and processing practices, slaughter of old animals and others. Under commercial slaughter conditions the focus should be to limit stress and control chilling to optimise quality. The liking or preference of chevon (goat meat) depends much on previous experience but is also influenced by the other factors such as goat's age and nutrition.

#### **Attawit Kovitvadh - "Unconventional meats to improve food security in Thailand"**

Unconventional or exotic meat is an untraditional meat which is not commonly accepted as a food in some countries. However, the perception of consumers might have changed since the consumption of the unconventional meat has increased. In Thailand, there are several exotic meats such as buffaloes, reptiles, rodents, amphibians, insects, fresh water mussels and also wildlife animals which are accepted depending on a regional and a personal perception. The livestock production in Thailand is enough for whole country consumption, however some people cannot access depending on their incomes and living place. Therefore, they can use the exotic meat as the protein source. Food hygiene is an important factor to consideration. In conclusion, the new regulation on the exotic meat will announce from government to be sure that the meat is safe to consume.

#### **Louwrens Hoffman - "Unconventional meats to improve food security in South Africa"**

This lecture starts with a brief overview of the development of South African cuisine and the factors that have influenced this. thereafter the legal definition of meat is discussed before the lecture moves onto the consumption of alternative species. The effects of different harvesting techniques to ensure that the meat produced meets the legal requirements and enters the formal food chain are discussed. The lecture ends with a brief overview of the informal meat supply chain and discusses the challenges faced by this informal chain.

June, 7 - MEAT SAFETY

#### **Eero Puolanne - "Poultry meat emerging myopathies: aetiology"**

Increased growth rate of commercial broilers has caused myopathies in Pectoralis muscles (P. major and P. minor). Until 2010's the most common was Deep Pectoral Myopathy (DPM), when P. minor muscle does not have enough space to develop and the oxygen supply is suppressed. Muscles necrotic, deep red, turns green and yellow. Histologically there are necrotic changes, which may reflect also to P. major. The incidence is <1%. In early 2010's there was a sudden increase of a necrotic syndrome in P. major, called Wooden Breast (WB), often coexisting with White Striping (WS). The muscles are macroscopically hard, outbulging, pale, and often accompanied with WS, histologically exhibiting moderate to severe polyphasic myodegeneration with regeneration and variable amounts of interstitial connective tissue accumulation. The incidence is up to tens of percentages. The etiology of this myodegenerative lesion remains yet open, but may be the high growth rate and reduced vascularization/oxidative capacity.

#### **Eero Puolanne - "Poultry meat emerging myopathies: is the meat safe and healthy?"**

The Wooden Breast syndrome (WB, or in American literature Woody Breast) causes a decrease in sensory and technological quality and in severe cases confiscation of the WB breast muscles. The surface of raw WB breast muscle is hard, but the core may be soft at lesion site which can be focal or diffuse covering the whole muscle. After heating the texture of the muscle is more uniformly soft. The connective tissue content of is higher and total protein content lower than in WB breast than in normal breasts. The drip losses and cook losses are higher in WB than in normal breasts, exposing a slight decrease in nutritive value. In severe cases the WB breast are not suitable for human consumption. All evidence tells that the syndrome is of physiological origin, and therefore it does not cause any risks for human health. The animal welfare of the WB birds, however, may be compromised.

**Antonio Frangipane di Regalbono - "Parasites in meat and meat products: is there any risk?"**

In a food safety perspective, parasites do not often receive the same level of attention as other food-borne chemical and biological hazards, and may be referred to as “neglected diseases”. Several meat-borne parasites are still endemic, and cause a high burden of disease in humans, particularly in developing country. This lecture will highlight aspects concerning biology, epidemiology, prevention and control of the risks associated with some of the major meat-borne parasites, e.g. *Toxoplasma gondii*, *Trichinella* spp., and *Taenia* spp. Despite the activities of national and international food safety authorities working for correct surveillance, management, prevention, and control, the perception of the transmission risk in meat consumers is often exacerbated by incorrect information or even fake news given from media and “public sciences”, leading to a great confusion between the truth and the fiction. These topics will be also discussed during the lecture and the following round table on meat safety.

June, 8 - MEAT CONSUMPTION AND HEALTH

**Valerio Giaccone - "Scientific progress underpinning meat safety"**

Today we can produce much safer meat than in the past thanks to advances in science. Thanks to the development of even more accurate laboratory diagnostic techniques we can identify healthy carriers of viruses and pathogenic bacteria among reared animals, creating germ-free farms, and we can better monitor the hygiene of production processes in the food factories. We know better the population dynamics of pathogenic bacteria by studying their behaviour in biofilms and we have natural antimicrobial compounds produced by lactic bacteria or extracted from plants, to stop the growth of pathogens in meat under control. The growth of pathogenic bacteria in meat can be better kept under control thanks to new meat packaging strategies, in *vacuum* or in a protective atmosphere using active packaging.

**Valerio Giaccone - "Effect of *Carnobacterium maltaromaticum* against food pathogens"**

*Carnobacterium* spp are very important Lactic Acid Bacteria (LAB) presenting different ecological niches. For some years we have known that *Carnobacterium maltaromaticum* can act as an excellent starter strain in the production of ripened meat products because it is able to produce bacteriocins that are very effective in blocking the growth of pathogenic bacteria such as *Listeria monocytogenes*. Its use has been studied more thoroughly in dairy and fish products, whereas its use as a microbial starter in meat products is still being tested. With this review an update of current knowledge in this regard will be provided.

### **Stefaan De Smet - "Improving the content of essential nutrients in meat: a nice story"**

Meat is an important source of high biological value protein, energy and important micronutrients. Whereas the composition of meat is in general quite stable, the content of several nutrients is amenable to modification. E.g. the intramuscular fat content and fatty acid composition of meat is highly variable and dependent on the dietary fatty acid composition among several other factors. This lecture addresses primary production strategies (with emphasis on animal feeding) to improve the content of essential nutrients in meat, i.e. long chain n-3 polyunsaturated fatty acids and several trace elements. The potential of these approaches to contribute to an increased human intake of these nutrients and impacts on human health as well as the limitations will be addressed.

### **Stefaan De Smet - "Red and processed meat consumption and human health: a difficult story"**

Meat is an integral part of the diet of many people and meat consumption has tremendously contributed to human evolution. Nevertheless, over the last decades a considerable number of epidemiological studies have reported positive associations between high red meat and especially processed meat consumption and all-cause mortality and several chronic diseases, whereas these associations are not found with white meat (poultry) consumption. The largest body of evidence is available for colorectal cancer, however it should be realized that the associations are weak. This lecture aims at 1/ explaining how to interpret these epidemiological data, 2/ giving an overview of the nature, formation and potential role of the compounds and processes considered at present most involved, and 3/ addressing possible mitigation strategies. It is advocated that meats consumed as part of balanced diets do not pose a health risk.

### **Francesco Francini - "Lack of meat consumption and nutrients deficiency"**

To better understand the importance of meat in human nutrition and the consequences of its lack, we briefly describe the role of this food in the evolution of man. Meat became part of the hominin diet since 4,4 million years ago and its consumption increased considerably from 1.9 million years ago, after the man began to use the fire to cook food. The increase in the consumption of meat was associated with that of the brain size and some metabolic changes. Meat provides calories, high quality proteins, minerals, vitamins, like most foods of animal origin. The meat helps to prevent iron and vitamin B12 deficiencies due to a diet rich in foods of plant origin. B12 deficiency is a particularly harmful condition because it can cause neurological damages, such as the spinal cord degeneration, which is irreversible if not treated promptly.