



Sustainable meat production

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ABSTRACT

Nowadays, we are more aware than ever that intensive livestock and meat production and consumption have negative, sometimes detrimental effects on the environment and animal and human health. Habitats, biodiversity and soil quality have been greatly affected by the growth of agriculture. Good animal welfare and proper protection are essential for producing high-quality meat. For the past few decades, production from the poultry and pig sector expanded much faster than the bovine or ovine sector. Despite many barriers, global meat production is still a growing sector. Therefore, there is a need for a sustainable approach to the production of meat and meat products. The meat sector has to transform in such a manner as to be an industry that cares for the environment, animals and consumers.

1. Introduction

Despite many barriers, global meat production is still a growing sector. According to data given by the Food and Agricultural Organization of the United Nations, as the world population increases, consumption of meat or meat-related products is forecast to more than double by 2050 (FAO, 2017), with most products manufactured in industrial premises (Hübel & Schaltegger, 2022). World meat production is expected to be 364 million tonnes in 2023, and there is a slight increase from 2022 (FAO, 2023). For the past few decades, production from the poultry and pig sector expanded much faster than the bovine or ovine sector. Poultry meat production is predominant, and it will reach 143 million tonnes in 2023, followed by pig meat at 121,7 million tonnes, bovine meat at 76 million tonnes,

ovine meat at 17 million tonnes, and international trade of meat or meat products at 42 million tonnes in 2023.

Consumer perceptions of livestock production and meat consumption are regularly discussed by the scientific and general public and are well highlighted in many studies (Hocquette, 2023; Liu *et al.*, 2023; de Boer & Aiking, 2022); topics include impact on the environment, on human health, animal welfare, as a source of zoonotic diseases, etc. Nowadays, we are more than aware, that intensive livestock and meat production and consumption, have negative, sometimes detrimental effects on the environment, and as such, on animal and human health (Rossi & Garner, 2014). Therefore, there is a need for a sustainable approach to the production of meat and meat products, and the meat sector has to trans-

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form in such a manner to be an industry that cares for the environment, animals and consumers. To be more sustainable, the meat industry has to change and transform, which can include an ecological form of farming with high animal welfare and animal protection standards, how and how much is meat produced, alternative production e.g., cultivated meat etc. (Hübel & Schaltegger, 2022). Sustainable development will ensure food security, sufficient and nutritious food for all by sustainable agriculture with improved productivity (de Boer & Aiking, 2022; Willett et al., 2019; UN, 2015).

2. Sustainable meat production and consumption chain

Sustainable production needs to meet a present need without compromising the future, and therefore, consumers nowadays, especially the younger population, are more aware of the issue and very interested in supporting practice (Hocquette, 2023). Meat consumption is driven by various factors such as price, safety, sensory parameters, cultural diversity etc. In the developed part of the world, there is a lot of discussion about the environment, health and animal welfare, and the promotion of meat analogues. Despite that, in those countries, there is still high demand for meat. In the USA, poultry is the most consumed meat, with a decline in beef consumption, while in China, pork is the most consumed (Wang, 2022). Like the USA consumers, Chinese consumers recognised aspects of health, environment, and welfare issues in sustainable development as well. However, these concerns are not the prime interest in some parts of the world (e.g., Africa), because consumers are more concerned about food security and hunger.

The three pillars of sustainability are environmental health, economic prosperity, and social equity. To achieve sustainability, we need to use the raw materials we produce in the best way possible and coordinate our actions across the entire process from production to consumption. (Galanaakis, 2019). The meat industry aims to turn raw materials into consumer products more efficiently by enhancing welfare, cutting down energy use in meat processing, making use of co- and byproducts, and improving packaging. Habitats, biodiversity, and soil quality have been greatly affected by the growth of agriculture. Land use change is a major factor that causes biodiversity loss, e.g. when grasslands are turned into farmland, or forests

are cleared for grazing, most of the plants and the animals that depend on them for habitat disappear (Cederberg, 2014).

An important part of the food chain is animal welfare and how we protect animals in the meat sector (Broom et al., 2021). In general, welfare is in direct connection with animals, and how they cope with the environment, but an aspect of protection is in the direct responsibility of humans (e.g. farmers, transporters, operators in slaughterhouses etc). Good animal welfare and proper protection are essential for producing high-quality meat (Nenadović et al., 2021; Vicic et al., 2021; Čobanović et al., 2019; Karabasil et al., 2019), and we should be aware of this issue when we use animals to produce valuable proteins. Animal welfare guidelines (WOAH, 2019), developed by the World Organization of Animal Health are basic to follow for each sector in the meat production chain: prevent abuse and neglect, reduce suffering, and allow basic behaviour and positive emotion in relation to animal-human interactions. Principles are simple, and any conditions that deprive proper animal welfare must be eliminated (Grandin, 2019).

To protect the environment, and remove the constant pressure for more food and/or animal protein, maximum utilisation of raw materials must be obtained, with minimum waste. Animal waste can be reusable or non-reusable. While non-reusable waste has to go directly to incineration, all reusable waste materials can be treated (e. g. biological or thermal processes) and considered valuable resources (e. g. energy, nutrients, by-products) (Giroto & Cossu, 2017).

In the 21st century, food security is the goal, recognized on the global level by the United Nations, through the Sustainable Development Goals (Djekic et al., 2021; UN, 2015). Animals and the meat sector are providing highly valuable animal protein in our diet and give us better life quality, so it is upon all of us to make the best use of them by minimizing waste and taking care of the environment (Giroto & Cossu, 2017). To find new solutions and enough quantity of healthy and nutritionally valued food, there are suggestions to implement the breeding and consumption of alternative animal protein sources (e. g. insects, cultivated meat). This highlights the positive effects on natural resources due to the reduction of chemical products (e. g. fertilizers, pesticides, etc), and among others, reducing animal waste volumes as one of the main benefits of this practice (Giroto & Cossu, 2017).

3. Conclusion

For animal production and the meat industry to be sustainable, they must be proactive in changing their business practices. This includes taking into account the needs of future generations and the market, as well as the methods and technological pro-

cedures of production and the quantities produced, with minimum waste. It also involves preserving the environment and applying high standards in areas of animal welfare and protection, as well as finding and developing alternative sources of animal proteins.

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