

REVIEW ARTICLE

Meat: Prestigious or Indecorous?

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Abstract

Meat has been a key component of the human diet since the earliest times of humanity. However, consumption of meat is controversial because it favors high incidence of metabolic and chronic diseases including diabetes type II or cardiovascular diseases, cancer, and food borne diseases. Does the human diet require meat? In our view, meat is a good and prestigious food fundamental to a well-balanced diet (100 gram/day/person) is respected. The notice of the Swiss physician Paracelsus (b.1493-d.1541) "*sola dosis facit venenum*" seems appropriate here.

Keywords: Meat Consumption, Human health, Chemical residues, Foodborne diseases.

1. Introduction

Food supply has played a decisive role in the process of humanization. Consensually, worldwide, and in all languages, we assume: "we are what we eat". In particular, consumption of meat is part of our evolutionary heritage (Smil, 2002) it is consensual the acceptance of it's role on the definition of the contours of elegance and wit of modern man, basically due to the biological high quality of proteins, richness in vitamins and minerals and high concentration of energy (Higgs, 2000; Biesalski, 2005; Wójcik *et al.*, 2010; Pereira and Vicente, 2013; Leroy and Praet, 2015; Rohrmann and Linseisen, 2015).

Meat consumption has been accepted as a good indicator of economic and social well-being; it is a prestigious food and its consumption has increased in recent years, especially in developing countries (FAO, 2015). However, meat, like other foods, does not exclusively provide nutrients and energy. Also microorganisms, chemical residues, allergens (Taylor and Latham, 2001; OMS/FAO, 2003; WHO, 2016) and *imaginarium*, can be incorporated during a meat meal. In the present opinion article, we emphasize controversial aspects related with meat consumption: i) over consumption and chronic diseases; ii) chemical

residues and cancer; iii) microorganisms and food safety.

The symbolic value of meat is out of reference in this manuscript. Recently, abundant literature data describe new chemical waste molecules in the meat subsequent to current conservation processes (drying, freezing, canning, smoking, salting etc.) (Baiano, 2014; Chaves-López *et al.*, 2015; Santarelli *et al.*, 2009), and cooking (grilled, baked etc.), (Seb-Choudhury *et al.*, 2014; Rohrmann and Linseisen, 2015). The consonance of this knowledge is reason enough to take into account the advice warned of Paracelsus: "*sola dosis facit venenum*".

According to this ancient scholar, all things are poison and nothing is without poison, only the dosage makes the thing not poison (Paracelsus, 1965). Thus, in addition to all the controversy (to eat or not to eat meat - respectable if taken responsibly), meat consumption should comply with two fundamental pillars: the sufficient amount (following nutritional recommendations) (USDA, 2015) and hygiene enough to minimize risk of microbiological contamination (EFSA, 2015).

2. Meat Consumption, a Balance between Good and Bad

2.1 Over Consumption and Chronic Diseases

In this work, we assume meat definition in accordance with European Regulation (EC) N° 853/2004, (EC, 2004). The meat consumption *per capita* had an annual increased absolutely uncommon (Bruinsma, 2003). In undeveloped countries, according to FAO, a 2.9% meat consumption growth rate is predicted between 2005/2007-2030 (FAO, 2012). In developed countries, 0.6% meat consumption growth rate is expected during this interval (FAO, 2012). Despite of the recommended annual meat consumption of \approx 33.0 kg/*per capita* (\approx 100g/day), in 2014 alone were consumed 76.1 kg/year/*per capita* in developed countries and 33.7 kg/year *per capita* in undeveloped countries (FAO, 2015; USDA, 2015). These data highlight the urgency of reducing meat consumption in developed countries. This average figure masks a more worrying situation affecting the undeveloped countries population presenting a large portion of their population dying of hunger or suffering from poverty with subsequent nutritional inadequacies. According to WHO (2015), metabolic disorders and cardiovascular diseases are exclusively related to the increased of the meat over consumption (OMS/FAO, 2003; Kouvari *et al.*, 2015; WHO, 2015).

2.2 Chemical Residues and Cancer

According to IARC, processed meat is meat that suffered alteration procedures like salting, curing, fermentation, smoking, or other processes to increase flavor or improve preservation (IARC, 2015). Recently, new molecules favoring cancer risk have been described in meat and particularly in meat products. Recent studies point out the specific role of meat components like haem iron, nitrosamines, and heterocyclic aromatic amines identified as cancer responsible (Jakszyn, 2011; IARC, 2016; Bingham, 2002; Mirvish, 1995). In addition, chemical compounds termed heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs) were identified which are formed when muscle meat is cooked using high-temperature as takes place during pan frying or grilling directly over an open flame (Cross and Sinha, 2004; Santarelli *et al.*, 2009; Hamidi *et al.*, 2016; Rohrmann and Linseisen, 2015; Lee *et al.*, 2016). These metabolites play an important role in carcinogenesis.

2.3 Microorganisms and Food Safety

According to USA official data, in the period between 1998 and 2008, meat consumption was

responsible for 41.1% of bacterial, 10.8% of viral, 8.9% of chemical and 0.1% of parasitic annual domestically acquired food borne illnesses. More than 40% of bacterial food borne detected diseases was due to the ingestion of contaminated meat and poultry (Painter *et al.*, 2013). In EU, in 2013, a total of 5196 food borne outbreaks were described affecting globally 43183 human cases with 5946 hospitalizations and 11 deaths (EFSA, 2015). The main route of zoonosis transmission is diet (Harrison *et al.*, 2013). Remarkable efforts have been undertaken in European Union in order to limit the extent of foodborne infections, with the implementation of improved hygiene standards in pre and post harvest meat chain. However, the number of infections originated in ingestion of contaminated meat remains high (Rohde *et al.*, 2015; Garrido *et al.*, 2013; Dhama *et al.*, 2013).

In order to minimize the role of meat as vector of microorganisms it seems imperative: i) to implement in farms animal welfare rules with education of farmers and enforcement of existing legislation; ii) to promote a conscientious fulfilment of the Hazard Analysis and Critical Control Point (HACCP) and Good Manufacturing Practices (GMP) and an efficient training among meat handlers (Gomes-Neves *et al.*, 2012); iii) efficient and rapid detection and tracing microorganisms in food chain by using sensitive, specific and economic tests based on DNA amplification (Fisher *et al.*, 2007). Finally, consumer education is crucial in common and practical aspects of food safety and nutritional requirements in order to ensure informed choices about food and meat choices, how to use the kitchen for cooking, the appropriate food handling and storage methods.

3. Conclusion

Eating meat may be a healthy and pleasant social and bio-cultural act. Consumer education in order to respect the recommended nutritional intake of meat in tandem with food safety practices can be expected to minimize risks related with cancer, chronic diseases and food borne illness.

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