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Muhammad Umair Sajid
Institute of Food and Nutritional Sciences, PMAS Arid Agriculture University, Rawalpindi, Pakistan

Corresponding Author:
Muhammad Umair Sajid
Institute of Food and Nutritional Sciences, PMAS Arid Agriculture University, Rawalpindi, Pakistan

Contamination in meat: A review

Muhammad Umair Sajid

Abstract
Meat is an flesh of animal that's eaten as a food. Meat has an unprecedented source of energy. Human eat meat of different animals like camels, goats, cow, chicken, fish etc. Meat has some major parts including water, carbohydrates, proteins fats and minor components like vitamins.
(Vitamin A and B) and minerals (Iron, Zinc, selenium). Selenium is a mineral that's play a vital role in metabolism and thyroid function of the body. All of these things are required for human body growth. Due to increases in population of this world, requirement of meat increases day by day. Many factors involve in the contamination of meat. So, contamination of the meat is also increasing, and this factor may be intentionally or unintentionally. Chemical contamination like aflatoxin, pesticides (Transfer through forage) and heavy metals (Transfer through water, environment, and forage) etc. These types of contamination may can unfit the meat for human body and will cause serious infection. Microbial activity is also a major issue in meat. This activity may can deteriorate the meat. Physical contamination is also a major problem and that may have done during slaughtering, transportation, and storage etc. All these factors have adverse effect on the meat quality. And when these material transfer in human body through meat then they can cause constipation, diarrhea, and many other diseases. This article will help people to getting info about different ways through meat can contaminate.

Keywords: Meat, contaminants, contamination, shelf-life, food safety

Introduction
Meat is the edible skeletal muscle of an animal which is used as a food after the slaughtering (CFDAR, 1990) [8]. Meat consists of four primary ingredients, including antioxidants, carbohydrates, pigments and flavorings, including water, protein, lipid, starch and many other minor components (Lambert *et al*., 1991) [21].
Meat is nutritious, highly perishable protein food with minimal shelf-life without using preservative processes. Holding and preservation of meat quality are influenced by a variety of interrelated factors, including conservation of temperatures which may contribute to dangerous changes in the quality of meat. (Olaoye and Onilude, 2010) [29].
All of these contributions have a special structure, shape, flavor, colour and nutritious benefit for meat in their proportions. However, meat is rapidly rotting from the moment of slaughter to consumption because of its unique biological and chemical nature (Lambert *et al*., 1991) [21].
The composition of the meat can be approximately 75 percent water, 19 percent protein, 3.5 percent soluble, non-protein, substances and 2.5 percent fat, following rigor mortis but prior to post-mortem degrading adjustments. Muscle proteins can be narrowly classified into those that are soluble in water or diluted salt solutions (sarcoplasmic proteins), those that are soluble in concentrated salt solutions (myofibrillar proteins) and those that are insoluble in the latter, at least at low temperatures – connective tissue proteins and other formed structures (Lawrie and Ledward, 2006) [22].
A combination of several hundred genetic species constitutes the sarcoplasmic protein. Beef proteins consist of significant amino acids such as leucine, isoleucine, lysine, methionine, cystine, phenylalanine, threonine, tryptophan, valine, arginine and histidine; the latter two are considered essential for infants. Some sarcoplasmic proteins are glycolytic pathway enzymes and can be found in more than one form (isozymes). For the preservation and repair of human body tissues, amino acids are essential. (Lawrie and Ledward, 2006) [22].
Meat is a highly effective source for various micronutrients, with 100 g of meat and liver daily intakes up to 50% of the indicated daily intake of iron, zinc, selenium, vitamins B1, B2, B6, B12 and 100% of vitamin A. (Biesalski and Nohr, 2009) [4].

The importance of meat as a main source for certain micronutrients is either due to its sole source or to the fact that it is more bioavailable. Vitamin A and B12 are mostly found in foods. Plant-derived provitamins can hardly be substituted (Biesalski, 2005) [3].

Fe is more bioavailable for meat than plants as its folic acid, particularly for liver or eggs, is almost 10 times higher compared to vegetables (Biesalski, 2005) [3]. For the growth and development of various cells and tissues, vitamin A, one of the micronutrients in the meat, is essential. The Retinoic Acid's active type controls natural differentiation as a ligand for RA receptors and helps integrate cell structure, i.e. gap junction. (Kurokawa *et al*., 1994).

Moderate vitamin A deficiency increases the incidence of lung diseases, and regular breathing disorders can be managed with mild vitamin A supplementation. (Biesalski, 2005) [3]. Vitamin A is also responsible for the growth and maturation of the lungs and the development of other tissues, and regulation of these processes appears to depend on the expression of RA receptors. While the liver is the best available source of vitamin A, it has a 'poor reputation' due to other possible constituents of the body, such as heavy metals, hormones or xenobiotics (Biesalski, 2005) [3].

In order to obtain the recommended 1 mg of retinol per day from vegetables, 500 mg of mixed and β-carotene rich vegetables must be consumed daily, whereas 100 g of liver twice a month is adequate and is neither toxic nor teratogenic (Biesalski, 2005 [3]; Nohr and Biesalski, 2007).

In a significant number of human diets meat, including meat products, is one of the main food grades. Its frequent/regular usage means a high protein consumption, a broad range of essential micronutrients (Fe, Zn, B12, etc.) and a large energy intake.

However, the comparatively large amounts of meat currently eaten by some population groups in many countries have been blamed for leading to a rise in the prevalence of some chronic diseases, including cancer (De Smet and Vossen, 2016; Hammerling *et al*., 2016) [14]. This increased occurrence, and in particular that of certain cancers (colorectal cancer, CRC), is more linked to red meat than to white meat. Specifically on cancer, the International Agency for Cancer Research (IARC, 2015) [15] released a press release on the latest assessment of the carcinogenicity of red and processed meat consumption on 26 October 2015. Until that decision of the IARC, it was believed that eating moderate quantities of lean red meat as part of a healthy diet would make a valuable contribution to the intake of essential nutrients and probably also to the intake of long chain PUFAs and conjugated linoleic acid would not raise the risk of cardiovascular disease and CRC.

Contamination in meat

As the recipient population rises, the need for cheap, abundant, nutritious and safe food goods has never been louder or more urgent. (Tilman *et al*. 2002; OECD-FAO 2009). Exposure to chemical compounds, such as organic toxins, pesticides and antibiotics, in farming ecosystems and their possible existence as residues in food products are one concern that has drawn the public's interest in particular. (Bruhn 1999 [5]; NRC 1999; Resurreccion and Galvez 1999 [37]; Willis 2000 [44]; Verbeke *et al*. 2007). This concern has led consumers to consider (erroneously) that exposure to chemicals in foods is one of the top ten causes of death (Nicholls *et al*. 1994) [28]. Similarly, in the fall of 2005, the Eurobarometer survey showed that European consumers rank the presence of chemicals, pesticides and toxic substances in food second after food poisoning as an issue that consumers worry about when assessing risks associated with food in general (European Commission 2006) [11] and particularly with animal food products (Becker 2000). Poultry products represent approximately one-third of the protein food consumed in the world (Johnson 2010) [17]. Yet, health associated risks from consuming these products are a growing concern for consumers (Yeung and Morris 2001) [45], followed closely by concerns regarding animal welfare in this production system (Van Horne and Achterbosch 2008) [43].

Chemical Contamination

Even though most consumers are mainly concerned about the presence of residues of pesticides and veterinary drugs in their food, in reality there are many more potential sources of contaminants normally present in the environment. Many of these unintentional sources of contaminants can be just as harmful for consumers, including mycotoxins, heavy metals, pesticides and environmental contaminants (e.g. dioxins; Botsoglou and Fletouris 2000; Peshin *et al*. 2002) [47].

Contamination by aflatoxin B1 (the most toxic of all mycotoxins) and its metabolites has been found in eggs and poultry tissues after the consumption of diets tainted with aflatoxins (Pandey and Chauhan 2007 [32]; Denli *et al*. 2009) [10]. These metabolites may cause significant direct toxic effects on the birds (e.g. decreased feed intake and growth rate, reduced egg production, impaired immunity, and mortality). Elements such as cadmium, lead, mercury and thallium can be stored in several different organs in the animal. They are generally characterized by a slow rate of elimination, accumulating in tissues and even being able to undergo transformations that increase their toxicity (Montoro and Velez 2004) [26]. They have the potential, at high enough concentrations, to have harmful effects on consumers, such as disruption of several metabolic processes and disorders in the gastrointestinal, urinary and nervous systems (e.g. cadmium, lead, arsenic; Tollefson and Cordle 1986 [41]; Gochfeld 1997 [13]; NRC 1999).

Antibiotics

A wide variety of veterinary antimicrobial chemicals, natural synthetic or semi-synthetic, are used to control pathogens (Phillips *et al*., 2004) [35] or as feed additives (SGP) for different sectors such as poultry, agriculture or agricultural activity as synthetic growth promoters (SGPs). (Aust *et al*., 2008 [23]; Gao, *et al*., 2012; Zuccato, Castiglioni, Bagnati, Melis, & Fanelli, 2010) [46].

(Cunha and Burnside (1949) [9], has found that adding chlortetracycline residues into pig feed increased its development by adding dry mycelia in aerobic cultures of Streptomyces-auerofaciens (previously referred to as Aureomycin), (Castilian, 2007). The use of antibiotics in the 1940's and 1930s as growth promoters was part of an original solution to animal feed supplementation called "animal protein factor".

The antibiotics which is used as pharmaceutical are not absorbed properly (Thiele-Bruhn, 2003) their higher concentration is usually excreted out via feces urine (Ostermanna *et al*., 2013) [30], or sweating, eggs (Idowu *et al*., 2010) [16] and milk (Arikan, Mulbry, & Rice, 2009;

HallingSorensen, Jensen, Tjornelund, & Montforts, 2001) its non-excretable residues remains deposited in tissues (Kim & Schrenk, 2012; Kwon *et al*., 2011).

The addition of these antibiotics in meat causes the resistance against antibiotics. (Butaye, Devriese, & Haesebrouck, 2003) and usually regarded as major contributor of allergies. Not only are antibiotics applied by cattle producers to animal feed. Excessive use of these antibiotics caused the resistance and ed towards the failure in applied therapy which results to use more adverse and costly drugs due to resistance (McEwen, 2006) problem increases when the duration and infection,s severity persist. (Barza, 2002).

In industrial meat processing, anabolic steroids and b-agonists have been commonly used to enhance the integration of available nutrients and animal efficiency in sheep (Mondragon *et al*. 2010) [25] beef cattle (Vasconcelos *et al*., 2008) via endocrine system it will meet the standard meat which is recommended.

Heavy metals

Domestic and industrial discharge from their source imparts the most adverse effect on the human health (Gulf Research Center). These residual discharge from factories contains the high level of heavy metals and further these contaminates become part of food chains. (Alloway and Ayres, 1997) [1].

As far as the environmental pollution the accumulation of the heavy metals in the meat products is a big concern for food safety. These heavy metals are deposited in liver and kidney and cause failure of organ's. One of the most dangerous metals is known to be cadmium. Moreover, elevated blood pressure (Perry *et al*., 1979) [33], Prostate cancer, abnormalities, showing and fetal (embryonic) death (Pitot and Dragan, 1996) [36] were involved. In certain enzymes, some elements, such as copper, zinc, manganese and iron, are co-factors and play an important role in many human and animal physiological functions. Absence of these essential metals results the malfunction (Koh and Judson, 1986 [19]; Schuhmacher *et al*., 1991) but their excessive concentration caused toxicity.

Veterinary drugs

Most of vestiary drugs which is administrated for treatment of animals or for the enhancement of milk. The most of the compounds present in the drugs given to animals in feed. Both drugs and feed also contain contaminants (McEvoy, 2002) [24].

Mycotoxins

The most dangerous contaminant which is present in the feed is fungi/mycotoxin's and result in by causing mycotoxicosis is usually present in the plant based feed such as cereals and oil seed crops used as forage. The severity of these mycotoxins leads towards the production of carcinogenic compounds but animals usually detoxify these toxins (Stoloff, 1979) [40]. But these residues become part of meat/tissues. Aflatoxins are the highest potential as carcinogenic with the properties of heat resistance and stability.

Pesticides

There are more than hundred types of pesticides but it might not be possible to find in a single stuff. It varies from food to food. Major contribution of these pesticides are used in agriculture sector and comprises about 67.5% and about 16.5% in industrial and commercial and 9% in domestic level and about 6-8/% in govt application. (Cantoni and Comi, 1997) [6].

More than 100 pesticides are known, but it is unlikely to find all of them in one foodstuff. They are mainly used in agriculture (68%), commercial and industrial activities (17%), domestic settings (8%) and in governmental applications (7%), (Khadim *et al*. 2016). Pesticides are used in crops in order to make pest free crop but these residues and pesticides became part of animals body via feed. (MacLachlan and Bhula, 2008) [23]. Mostly the animal become victim of pesticide residue due to grazing and feeding. Animals which bears less exposure to residues may due to improper disposal of waste and grazing or locomotion in the affected areas or accidental spills (Robertson *et al*., 1990) [38].

Conclusion

Meat is considered as the most superior meal. It contains the number of the Carbohydrates, proteins, mineral's, vitamins and all essential components required for metabolism. The environment is suffering from pollution which have the various factors, some factors are natural and some factors are induced by Human activities. The Contaminants are the most hazardous factors which is involved in the deterioration of meat. Pesticide residues are the mostly adversely effects the quality of meat. These contaminants becomes the part of the meat when animals grazed in the pesticide infected land. These contaminants became the part of meat. Same case with Fungus which is engulfed with the food and further contaminates such as Aflatoxin becomes the part of meat. Anti-biotics are used as the purpose of treatment but these resides become part of the meat. Veterinary drugs are given usually to the milch animals in order to meet the requirements of the milk and other characteristics necessary for the animal contaminants from these drugs cause the hormonal imbalance and health issues. So that these contaminants factors which is in the approach of human beings are avoided to reduce the concern of food safety.

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