

# Beneficial Effects of Poultry Meat Consumption on Cardiovascular Health and the Prevention of Childhood Obesity

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## ABSTRACT

Poultry meat is an animal product important in human nutrition. A variable, and moderate energy content, highly digestible proteins of good nutritional quality, unsaturated lipids, fat-soluble and B-complex vitamins as well as minerals make poultry meat a valuable food.

Poultry meat is one of the recommended constituents of Dietary Approaches to Stop Hypertension Diet as well as the Mediterranean Diet. The substitution of red meat with poultry as well as fish, nuts and legumes decreases the risk of developing type 2 and gestational diabetes mellitus, improves glycemic control and cardiovascular risk factors. Low-fat diets supported by fruits, grains, nuts, fish and poultry instead of red meat yields cardiovascular health benefits. Anti-inflammatory and antioxidative diet enriched with high-quality foods reduces pro-inflammatory cytokines. This favors anti-inflammatory milieu which in turn improves insulin sensitivity and endothelial function and ultimately act as a barrier to obesity, metabolic syndrome, type 2 diabetes mellitus and development of atherosclerosis.

The nutritive value of poultry meat depends on different factors such as age, feeding, keeping, hybrids, carcass parts and type of meat. Preventive measures against risky aspects of the matter should be developed. Since the use of antibiotics leads to the development of antibiotic resistant pathogens, antibiotics must be replaced by herbs and spices with growth promoting effects, antimicrobial properties, and other health related benefits to solve the problem. Enrichment and fortification with nutrients may cause poultry meat to gain even more functional food character.

**Keywords:** Poultry meat; Obesity; Childhood



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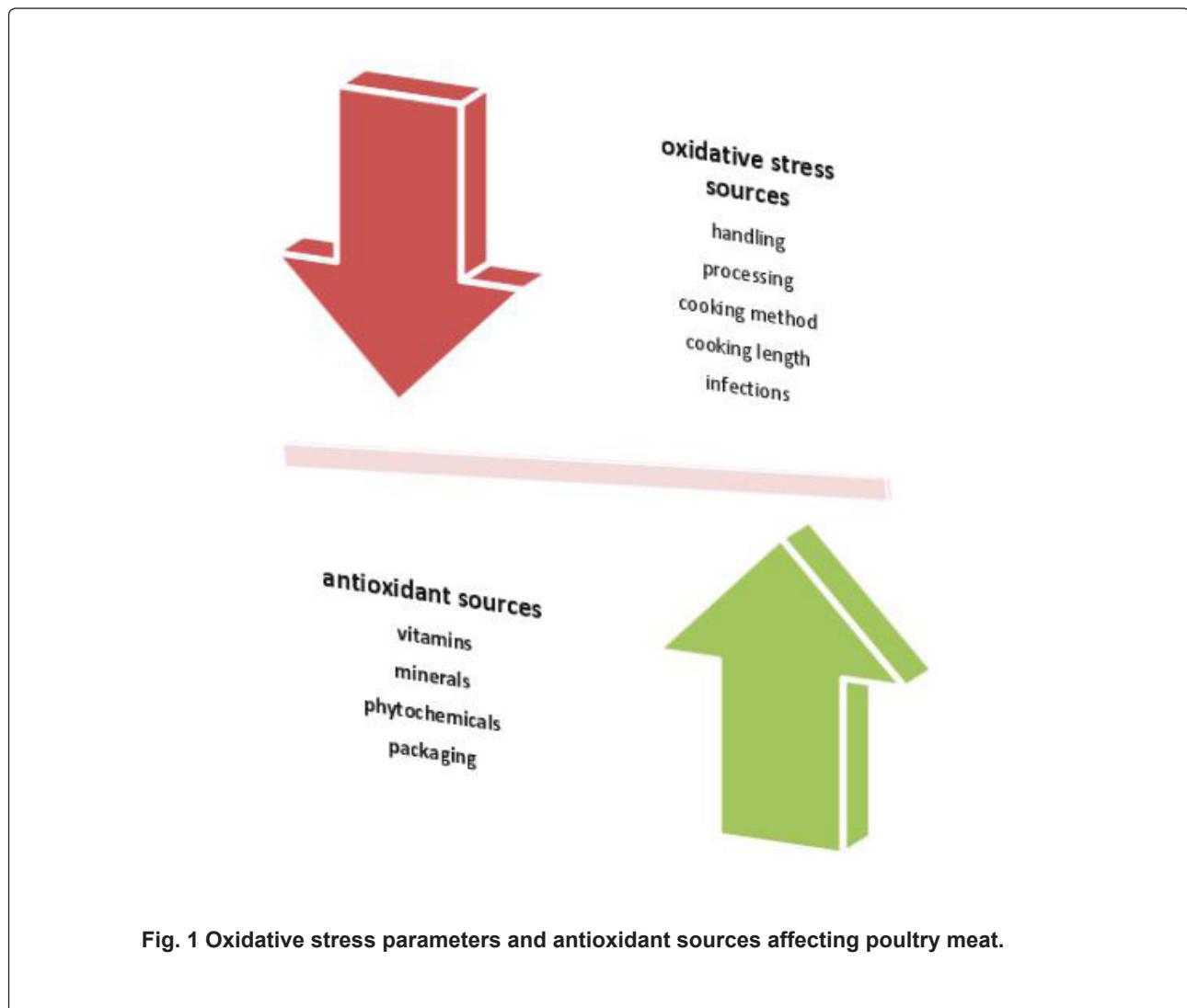
## 1 INTRODUCTION

Obesity is a chronic low-grade inflammatory disease. In recent years, it has become a major health problem particularly in children. The prevention of this disease particularly during childhood will inhibit the development of obesity in adulthood as well as obesity-associated diseases such as cardiovascular diseases, atherosclerosis, diabetes mellitus, non alcoholic fatty liver disease, hypertension and cancer. Overweight children are potentially at risk of early atherosclerosis as much as obese children<sup>[1]</sup>. Overweight children are also susceptible to the development of heart failure<sup>[2]</sup>. T cell immunity plays important roles in chronic inflammatory diseases such as obesity. Decreased regulatory T cells status

is noted in obese children<sup>[3]</sup>.

The major concern is the reduction in the energy intake of individuals, prevention of foods with high fat and carbohydrate content. Poultry meat is an animal product important in human nutrition. A variable, and moderate energy content, highly digestible proteins of good nutritional quality, unsaturated lipids, fat-soluble and B-complex vitamins as well as minerals make poultry meat a valuable food<sup>[4, 5]</sup>.

Poultry meat is under the threat of oxidative stress parameters, which impair the quality of it. However, successful antioxidative strategies may fight against oxidative damage produced and supported by the harmful effects of reactive oxygen species including those of free radicals (Fig. 1).



Recent studies have shown that the magnitude of changes in meat/poultry/fish consumption varied between children and adults, and also, by meat source as well as by gender. Also, compared with 1995, more people consuming poultry, mostly as chicken, in 2011-2012 were reported<sup>[6]</sup>. Associations of meat consumption during childhood with measures of body composition during adolescence have been investigated<sup>[7]</sup>.

Consumption of poultry meat along with vegetables and fruits is associated with a risk reduction of developing overweight and obesity, cardiovascular diseases, type 2 diabetes mellitus, cancer. The United Nations Food and Agricultural Organization consider poultry meat widely available, relatively inexpensive food to be particularly useful in developing countries. Poultry meat consumption due to its essential nutrients gains importance particularly in pediatric and geriatric age groups and during some physiological conditions such as pregnancy and breast feeding periods<sup>[4]</sup>.

## 2 MATERIALS AND METHODS

### 2.1 The Nutritive Value of Poultry Meat

The nutritive value of poultry meat depends on different factors such as age, feeding, keeping, hybrids, carcass parts and type of meat. Breast meat is richer in protein and poorer in fat than meat of drumsticks and thighs. Poultry meat is a good quality protein source. The low content of collagen is another positive aspect of poultry meat, because collagen reduces the digestibility of the meat<sup>[4, 5]</sup>.

Aside from fat soluble vitamins B group vitamins such as niacin, pyridoxine and pantothenic acid are found in considerable amounts in poultry meat. Variable concentrations of physiologically essential trace elements (iron, zinc and copper) essential for the human body are found across different types of meat. Poultry meat is also an excellent source of selenium, another essential trace element with antioxidative and anticarcinogenic properties<sup>[4, 5]</sup>.

### 2.2 The Effect of Oxidative Stress

Protein oxidation takes place at the center of biochemical reactions, which affect the poor quality of pale, soft and exudative poultry meat. Proteins of the

breast meat are more susceptible to oxidative stress due to lower pH, an impaired activity of endogenous antioxidant enzymes such as glutathione peroxidase, catalase, superoxide dismutase<sup>[8]</sup>.

Cooking techniques as well as the length of cooking are two major contributors to the production of oxidation products, particularly the oxidation of thiols, tryptophan, alkaline amino acids and protein cross-linking, in poultry meat. Out of grilling, roasting, frying and sous-vide techniques, the last one seems to be the most advantageous cooking methods to obtain high-quality meat devoid of protein carbonylation and disulfide bond formation. Free thiol groups, Schiff base formation and hardness are impacted by the length of the cooking<sup>[9]</sup>.

### 2.3 Risky aspects, antioxidant strategy and preventive measures

The nutritive value of poultry meat is indisputable. However, hygienic conditions should also be considered. There are suggestions on improving the environmental sustainability of poultry production<sup>[10]</sup>. There are also studies trying to discuss persistent risky practices of backyard poultry<sup>[11, 12]</sup>. Preventive measures against risky aspects of the matter should be developed. Some of them may help in fighting microorganisms. Poultry products enriched with micronutrients will possess beneficial effects on human health<sup>[5]</sup>. Enrichment of feeds with some selected nutrients is quite important. Enrichment of the corn in the diet of chickens with key carotenoids maintains poultry health, increases the nutritional value of poultry products and protects them against coccidiosis<sup>[13]</sup>. Another nutrient with antioxidant properties is L-carnitine. It plays important roles in fatty acid metabolism by directing fatty acids to oxidation in mitochondria. L-carnitine also promotes growth and strengthens the immune system<sup>[14]</sup>.

Since the use of antibiotics leads to the development of antibiotic resistant pathogens, antibiotics must be replaced by botanical alternatives to antibiotics such as herbs and spices with antimicrobial properties, and other health related benefits to solve the problem<sup>[15]</sup>. Poultry meat enriched with herbs and spices containing phytochemicals possessing beneficial effects also for human health exerts various antioxidant, anti-inflammatory, antimicrobial, antihelmintic functions. Some may also act as growth promoter, immunomodulator, immunostimulant, hypoglycemic, hypolipidemic agents<sup>[16, 17]</sup> (Table 1).

**Table 1. Some herbs as well as spices and their main functions for the improvement of poultry**

HERBS	FUNCTIONS
Garlic	Growth promoter, antioxidant, immunostimulant, augment T cells
Curcumin	Growth promoter, immunomodulator, antioxidant, anti-inflammatory, antiseptic, hypoglycemic, hypolipidemic
Ginger	Growth promoter, antioxidant, effective in diarrhea, eye diseases
Onion	Antioxidant, antihelmintic, effective in diarrhea, skin infections
Echinacea	Immunostimulant, effective in upper respiratory tract infections, gut infections
Thyme	Growth promoter, antioxidant, immunomodulator, antimicrobial, antilipidemic
Rosemary	Growth promoter, antioxidant
Cinnamon	Growth promoter, antioxidant, immunomodulator, antimicrobial

Elevated methylmercury concentrations observed in muscles and organs of chickens, ducks and geese suggest that poultry meat can be an important human methylmercury exposure source in some areas of the world<sup>[18]</sup>.

Mycotoxins in foods and feeds are a major problem throughout the world. Aflatoxins, biologically active mycotoxins, constitute a great risk causing anorexia, listlessness, hepatotoxicosis, haemorrhage. Natural sodium bentonite and sepiolite, aluminum and magnesium silicates, respectively, added to poultry feed without harmful effects are capable of absorbing aflatoxins and thus, act as toxin-binding agents<sup>[19, 20]</sup>.

Phytase supplementation improves the growth performance and reduces the phosphorus levels<sup>[21]</sup>.

## 2.4 Allergy to Poultry Meat and Hen's Egg

Allergy to poultry meat and hen's egg are important risks associated with the higher worldwide consumption of these foods. Allergy to poultry meat is rare, but affects both children and adults. Primary poultry meat allergy is mainly seen in adolescents and young adults however, hypersensitivity may start at an earlier age. Oral allergy syndrome, gastrointestinal complaints, urticaria and angioedema

are typical symptoms<sup>[22]</sup>.

Hen's egg is an important and inexpensive source of high-quality proteins in the human diet. It is a key ingredient in many food products due to its nutritional value and unique functional properties. However, egg is also known for its allergenic potential. Hen's egg allergy mainly affects young children worldwide and may be potentially life-threatening<sup>[23]</sup>. It is the second most common food allergy particularly in children, next to cow's milk allergy<sup>[24, 25]</sup>. Hen's egg allergy is mainly caused by hypersensitivity to four allergens (ovomuroid, ovalbumin, ovotransferrin and lysozyme) found in the egg white. Alpha-livetin appears to be the main allergen in egg yolk<sup>[25, 26]</sup>.

In children with hen's egg allergy, these allergens may cause itching, atopic dermatitis, bronchial asthma, vomiting, rhinitis, conjunctivitis, laryngeal edema, chronic urticaria and anaphylaxis<sup>[25, 27]</sup>. Elimination of eggs and products containing eggs from the diet is the most effective way of avoiding future hypersensitivity reactions. Oral immunotherapy is promising as a tolerance induction protocol. Induction of Treg cells has been reported after oral immunotherapy<sup>[25, 26, 28]</sup>.

## 3 RESULTS

Poultry meat is one of the recommended constituents of Dietary Approaches to Stop Hypertension Diet as well as the Mediterranean Diet<sup>[29-31]</sup>. The substitution of red meat with poultry as well as fish, nuts and legumes decreases the risk of developing type 2 and gestational diabetes mellitus, improves glycemic control and cardiovascular risk factors. Low-fat diets supported by fruits, grains, nuts, fish and poultry instead of red meat yields cardiovascular health benefits. Anti-inflammatory and antioxidative diet enriched with high-quality foods reduces pro-inflammatory cytokines. This favors anti-inflammatory milieu which in turn improves insulin sensitivity and endothelial function and ultimately act as a barrier to obesity, metabolic syndrome, type 2 diabetes mellitus and development of atherosclerosis<sup>[32-34]</sup>.

Introduction of some meat including poultry to children in later ages is detected in populations with low nutritional status compared to populations with middle and good nutritional status<sup>[35]</sup>.

Adequate consumption of poultry meat can facilitate the control of body weight due to its high protein content and help to counteract against the development of obesity, cardiovascular diseases, diabetes mellitus and cancer<sup>[4]</sup>.

Poultry is one of the most common dietary sources of L-arginine, the precursor amino acid for nitric oxide synthesis. L-arginine supplementation may be a novel therapy for obesity and metabolic syndrome<sup>[36]</sup>.

Supplementation or fortification with selenium contributes to the matter with its anti-inflammatory and antioxidative properties. Selenium is also considered for the treatment of obesity<sup>[37]</sup>.

## 4 CONCLUSION

Poultry meat is particularly susceptible to oxidative damage. Lipid oxidation is a major threat to the quality of processed poultry meat. Low feed intakes, poor performance, diseases, rancidity, formation of toxic compounds are some of the impacts of oxidation<sup>[38]</sup>. Protein oxidation plays important roles in the impaired quality poultry meat. Therefore, it will contribute to the productivity in this field to avoid from applications, which may lead to oxidative damage.

Fortification and enrichment of poultry meat with nutrients such as vitamins, trace elements, phytochemicals and omega-3 fatty acids may result in gaining even more functional food character

because they promote optimal health and help to reduce the risk of diseases.

Poultry meat prepared in optimum conditions will favor the healthy growth and development of children. The replacement of high-calorie foods, commonly consumed at present by the young population, with this valuable protein source will help children to avoid obesity and obesity-associated chronic diseases both during childhood and also their adulthood.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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