



Magnesium content in chicken meat — share in food intake

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ABSTRACT

The aim of this study was to determine magnesium content in two types of chicken meat samples and to calculate average intake of magnesium through chicken by adults in Serbia. Meat and meat products are important sources of many nutrients, including protein, minerals, vitamins and fats. One of the minerals necessary for the normal functioning of the human body is magnesium. Considering the price, availability and consumption, chicken meat is one of the most important foods in the human diet. A total of 81 samples were analysed using inductively coupled plasma with mass detection. The results showed that the average magnesium content in chicken meat was 297.8 mg/kg. The intake of magnesium by chicken meat per adult in Serbia was found to be 51.48 g per day, which represents 5% of the recommended daily intake. Taking into account the wide spectrum of other nutrients that we consume through chicken meat, we can conclude that chicken plays an important role in overall magnesium intake by adults in Serbia.

1. Introduction

Magnesium is alkaline earth metal that occurs in nature as a cation in water or as a mineral part of a large number of compounds. Magnesium plays an extremely important role in the body. It is part of many enzyme systems that, among other things, participate in protein synthesis and normal muscle work. In addition, it is important for maintaining normal blood pressure and functions of the central nervous system. Magnesium deficiency is becoming increasingly common today, due to refined magnesium-poor foods. Symptoms of magnesium deficiency include muscle tremors, weakness, nausea, vomiting and cramps. Magnesium deficiency is associated with the development of diseases like coronary

heart disease, malignant tumours, osteoporosis and hypertension (Ryan, 1991; Swaminathan, 2003). Stone fruits, leafy vegetables, fish, eggs and meat are the most important sources of magnesium in human diet. Daily recommended intake of magnesium ranges from 320 mg per day for woman and 420 mg per day for men (DRIs, 2011).

Adequate intake of magnesium ensures normal functioning of the nervous system and facilitates the body's reaction to stress. Lack of magnesium in the body is associated with symptoms of depression and irritability. The chemical imbalance of magnesium and other electrolytes in the cell, which is caused by exposure to stress and a magnesium-deficient diet, is responsible for disturbances in the work of the

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nervous system and various psychological manifestations. In addition, magnesium contributes to the maintenance of normal bones and teeth and has a mild laxative effect.

Humans take in about 10% of the total amount of magnesium with water. Foods rich in chlorophyll, such as green vegetables and spinach, contain high amounts of magnesium. Nuts, seeds and unprocessed grains are known as good sources of magnesium. Lower levels of magnesium are also found in legumes, fruits, fish and meat. Based on the recommendations of several relevant institutions around the world, EFSA recommends magnesium intake of 300 mg for women and 350 mg for men.

The aim of this study was to determine magnesium content in two types of chicken meat and to calculate average intake of magnesium through chicken by adults in Serbia.

2. Materials and methods

2.1. Samples

A total of 81 chicken meat cuts (red meat and breast meat) were collected in Serbian markets from January 2022 to May 2023. After collection, meats were labelled and stored in polyethylene bags and frozen at -18°C prior to analysis. Frozen samples were thawed at 4°C for a day before analysis and then homogenized. An amount, approximately 0.5 g, of each homogenized sample, was transferred into a Teflon vessel with 5 mL nitric acid (67% Trace Metal Grade, Fisher Scientific, Bishop, UK) and 1.5 mL hydrogen peroxide (30% analytical grade, Sigma-Aldrich, St. Louis, MA, USA) for microwave digestion.

2.2. Extraction

The microwave (Start D, Milestone, Sorisole, Italy) program consisted of three steps: 5 min from room temperature to 180°C , 10 min hold at 180°C , 20 min vent. After cooling, the digested sample solutions were quantitatively transferred into disposable flasks and diluted to 100 mL with deionized water produced by a water purification system (Purelab DV35, ELGA, Buckinghamshire, UK).

2.3. Quantification

Analysis of magnesium content was performed by inductively coupled plasma mass spectrometry (ICP-MS), (iCap Q mass spectrometer, Thermo Scientific, Bremen, Germany). The most abundant iso-

tope ^{24}Mg was used for quantification. Torch position, ion optics and detector settings were adjusted daily using tuning solution (Tune B, Thermo Scientific), in order to optimize mechanical and electrical parameters and minimize possible interference. Basic operating conditions of the instrument were: RF power (1550 W); cooling gas flow (14 L/min); nebulizer flow (1 L/min); collision gas flow (1 mL/min); operating mode (Kinetic Energy Discrimination — KED); dwell time (10 ms).

Standard stock solution containing 1000 mg/L of magnesium was purchased from CPChem (Bogomilovo, Bulgaria). These solutions were used to prepare standards for five-point calibration curves (including zero). Multielement internal standard (6 Li, 45Sc, 71Ga, 89Y, 209Bi) was introduced online by an additional line through the peristaltic pump, and covered a wide mass range. All solutions (standards, internal standards and samples) were prepared in 2% nitric acid. The analytical method was validated by Guidelines for Single Laboratory Validation (SLV) of Chemical Methods for Metals in Food (AOAC) and accredited according to ISO 17025. The quality of the analytical procedure was verified by analysis of the certified reference material ERM — BB384 (lyophilised pork muscle, ERM, Geel, Belgium). Reference material was prepared using an identical procedure as for the samples using microwave digestion. The measured concentration was within the range of the certified value.

3. Results and discussion

Table 1. show magnesium levels found in chicken red and breast meat. On average, a higher concentration of magnesium was detected in chicken breast (335.1 mg/kg) than in chicken red meat (279.1 mg/kg). However, using the Student's-t test, a statistically significant difference in Mg concentrations in the two investigated groups of chicken meat was not found ($P < 0.05$).

The values obtained in our study are significantly lower than the published results of *Batista et al.* (2012) who reported an average of 1182 mg/kg, while they are slightly higher compared to the study by *Zand et al.* (2012) who reported average value of 190 mg/kg of magnesium. Magnesium levels in chicken cuts in our study were similar to the levels found in broiler breast meat (223–291 mg/kg) reported by *Ahmed et al.* (2015). The levels of magnesium in the same cuts were lower than reported by *McCance and Widdowson* (2015), who found average of 240 mg/kg of mag-

Table 1. Magnesium levels in analysed samples of chicken (mg/kg)

Type of sample	Number of samples	Magnesium content (mg/kg)
Chicken red meat	54	279.1±41,2 ^a
Chicken breast meat	27	335.1±42,3 ^a

P<0.05; ^a Values in the same column followed by the same letter were not found to be significantly different

nesium. Therefore, levels of magnesium determined in our samples were in range of USDA reported data for different chicken products. According to the USDA, 4 oz (113.4 g) contains 25 mg of Mg, which corresponds to 220.5 mg/kg. (USDA, 2016). In addition, the average content of magnesium in red chicken meat according to the Technical University of Denmark database is 242 mg/kg (range 185–330 mg/kg) and in white — 250 mg/kg.

When it comes to consumption calculation, according to the EFSA total diet study (available on <https://www.efsa.europa.eu/en/microstrategy/food-ex2-level-3>), the intake of chicken meat by an average adult in Serbia is 51.48 g/day, which means that by consuming chicken meat, the average intake is

15.3 mg of magnesium, which represents 5 % of the recommended daily intake this metal.

4. Conclusion

The results of our study showed that chicken meat contains a respectable level of magnesium. With the average consumption of chicken meat, we consume about 5% of our daily magnesium needs. The results of our study indicate the importance of consuming chicken in regards to magnesium intake. It is very important to indicate that, besides magnesium, chicken meat contains other essential nutrients, which is why it represents an important part of human diet.

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