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Total phosphorus content in technologically unprocessed meat

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Abstract

The total phosphorus content was measured in raw, technologically unprocessed meats. Our results show that total phosphorus content in different raw meats varies substantially (from 1.41 g/kg to 4.22 ± 0.93 g/kg). Based on the results, manufacturers of meat products are advised that before production of any meat product, the precise amount of total phosphorus in raw meat starting material has to be known. Based on this, the content of added synthetic phosphates and polyphosphates together with the content of natural phosphorus in the meat would be within the prescribed values stated in the Regulation, which are 8 g/kg.

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Keywords: total phosphorus content; technologically unprocessed meat

1. Introduction

In modern food technology, the most important purpose of every manufacturing formula is to produce a product with desired appearance, texture, smell and taste, but which is also safe and healthy1. Food safety is an imperative for modern society and that is the reason why most food additives, besides other measures applied, and if used in a proper way, can significantly help in achieving the objective of food safety. On the contrary, excessive and unprofessional use of additives, or not declaring the true content, can have negative effects on the quality of product

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and also on health of consumers[2]. Phosphorus can be found in the bodies of all living creatures, mostly as organically bound polyphosphoric acid , and is a precondition for every life process, being the actual energy center [3]. Phosphorus is an essential macroelement, the absorption of which in the human body depends on the presence of calcium, vitamin D and also on the activity of parathyroid hormone which regulates the absorption of calcium and phosphorus. In the human body, phosphorus is a component of bones and teeth (over 85% of the total quantity in the body). It is also a constituent of DNA, RNA and compounds with high energy (adenosine triphosphate, creatine phosphate), a regulator of acid-base balance, etc. Symptoms of phosphorus deficiency in human nutrition are not known, but excess of phosphorus in the body influences the excretion of calcium[4].

Phosphates and polyphosphates have four important features on which their use is based and those features are: emulsifying properties, they act as sequestrants, great power of dispersion and high capacity for water retention[5].It is also known that higher quantities of phosphorus in meat products do not contribute to better product qualities or safety , but can only have a consequential pro-oxidative effect and cause the product to have a not really pleasant astringent taste[6,7].

Synthetic phosphate additives are permitted in a large number of food products. The influence of phosphorus chemistry is not completely clarified even today, but it is known that phosphates interact with proteins like casein, act as emulsifying agents and affect the separation of fat from water in cheese. Besides this role in the technology of fat, water and protein emulsification, phosphates also encourage the binding of water in meat products. This water binding can be technologically justified, but excessive amounts of phosphorus in a meat product can negatively influence product safety[3]. Phosphorus uptake influences the resorption of calcium or even more directly, causes calcium from bones to be released, which leads to health problems in developing individuals and also in middle aged women.

Regulations restrict the total quantity of phosphates and polyphosphates for different products (expressed as P_2O_5) but do not take into account the analytical procedures for accurate determination of added and natural phosphorus in a product. That is why it is essential, before usage of any kind of meat in the preparation of meat products, to know the quantity of phosphorus in the meat or meat mass, so that added synthetic phosphates and polyphosphates will not exceed the allowable limit[3].

Due to these facts mentioned above, the aim of this paper was to measure the total phosphorus content in raw, technologically unprocessed meat. With such data, manufacturers would know the quantity of phosphorus based additives that can be added into a meat product so that the total final quantity of phosphorus does not exceed the limit of 8 g/kg in the product, as given in the Regulation[5].

2. Materials and methods

Materials for the study were samples of raw pork and poultry meat. In total, 24 samples were analyzed. The samples were divided into seven groups: pork ham, pork neck, mechanically separated poultry meat (MSM), back bacon, pork shoulder, turkey fillet and turkey drumsticks.

Total content of phosphorus, expressed as P_2O_5 (g/kg) was determined by spectrophotometry, by a standard method SRPS ISO (13730/1999)[8]. According to the method, 5 g of each sample was weighed in a ceramic plate. The plate was heated in a muffle furnace. The next step was acid hydrolysis of ash, with ammonium heptamolybdate and ammonium monovanadate reactions afterwards. A yellow colored complex of vanadomolybdophosphoric acid was created, the intensity of which was then measured by spectrophotometry at wavelength of 430 nm. The total content of phosphorus determined by this method represented the natural phosphorus from meat plus phosphorus from added phosphates, if there was any.

3. Results and discussion

The results of quantification of total phosphorus content in raw meat are shown in Table 1 and Fig. 1.

Table 1. Total phosphorus content in raw meat.

Total phosphorous content in raw meat g/kg ± SD						
Pork ham	Pork neck	MSM	Back bacon	Pork shoulder	Turkey fillet	Turkey drumsticks
4.22 ± 0.93	2.89 ± 1.58	2.84 ± 0.97	1.71	1.65 ± 0.7	1.89	1.41

SD – standard deviation

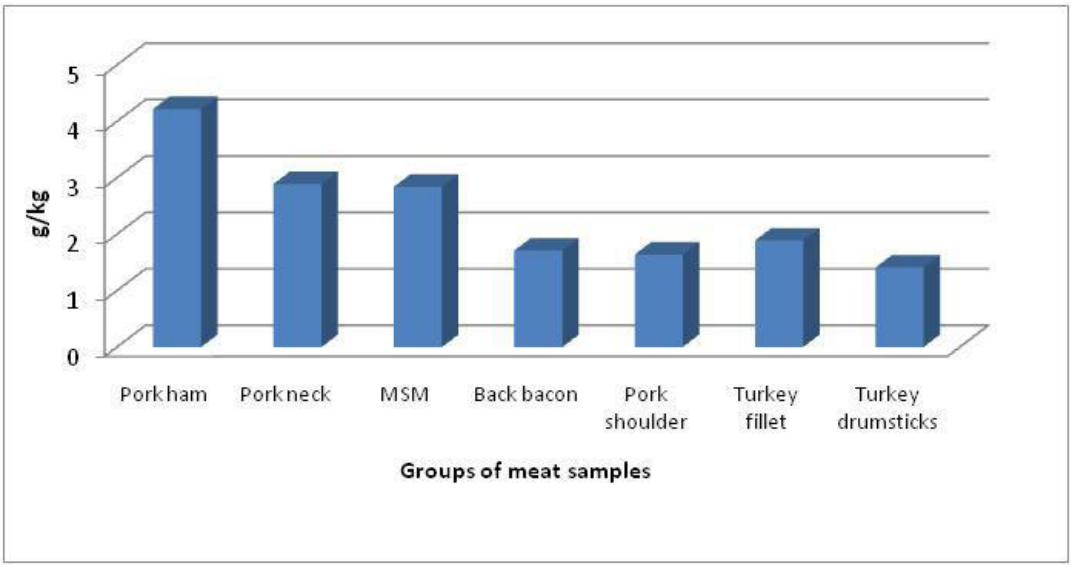

Fig. 1. Total phosphorus content in raw meat.

The highest value of total phosphorus content (expressed as P_2O_5) was found in pork ham 4.22 ± 0.93 g/kg, and the lowest total phosphorus content was found in turkey drumsticks 1.41 g/kg, which is a lower value than the one published by Serdar and Katalenić[3] (0.4711% P_2O_5).

Total phosphorus content (expressed as P_2O_5) found in pork neck was 2.89 ± 1.58 g/kg, and a very similar value is found in MSM (2.84 ± 0.97 g/kg). Lower total phosphorus content was found in back bacon meat (1.71 g/kg), pork shoulder (1.65 ± 0.7 g/kg) and turkey fillet (1.89 g/kg).

4. Conclusion

A basic principle of usage of additives in production of meat products is that they are allowed if the added quantity is technologically justified. Also, with the addition of additives, the consumer must not be misled about the real nature of the components or nutritional value of the product[3].

Our results obtained showed the total phosphorus content in different samples of raw, technologically unprocessed meat, and they also revealed a wide range in total phosphorus content (from 1.41 g/kg to 4.22 ± 0.93 g/kg).

Based on the obtained results, our recommendation to the manufacturers of meat products is that before producing any kind of meat product, the total phosphorus content must be known in the raw meat starting material.

With this knowledge, it would be easier to calculate the amount of synthetic phosphates and polyphosphates which will be added as additive for the better feature of meat product. Therefore, the aggregate value of added and natural phosphorus would always be within the limit of the value prescribed by law (8 g/kg).

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