

## EVALUATION OF TOTAL PROTEIN AND MOISTURE CONTENT IN PROCESSED MEAT (SAUSAGES) OF TIRANA MARKETS

Mariola Kodra<sup>1\*</sup>, Ariola Devolli<sup>1</sup>, Dhurata Feta<sup>1</sup>, Merita Stafasani<sup>1</sup>, Edlira Shahinasi<sup>1</sup>

<sup>1</sup>Chemistry Department, Faculty of Biotechnology and Food, Agricultural University of Tirana,  
Pajsi Vodica - Kodër-Kamëz, 1029 Tirana, Albania

\*e-mail: mkodra@ubt.edu.al

### Abstract

Such as other developing countries, Albania has also a high daily amount of meat consumption and of course of sausages, that are even cheaper compared to meat. Proteins are one of the main constituents of meat, playing a central role in creating new tissues in meat and serving as an energy source for meat consumers. Moisture content is an important parameter of processed meat quality. This study aims to determine total protein content as total nitrogen, and to evaluate moisture content in Albanian manufactured fresh sausages of Tirana markets in accordance with total protein and moisture content of products labels.

Sausages samples were collected at some of biggest markets in Tirana and total protein and moisture content were determinate by standard methods. Analyses were conducted with 3 replication and collected data were evaluated by statistical data analyses.

The results show that analyzed parameters (total protein and moisture content) did not meet standard levels of Food and Agriculture Organization (FAO). Most of the samples presented high levels of total protein content (20 to 25%) compared to standards (13 to 18%). Moisture content in all samples resulted lower than 50%. Total protein and moisture content was not in accordance with the label information.

Based on results and references, we conclude that these processed meat products contain more processing adjunct than allowed norms.

**Key words:** Total protein, Moisture, Processed meat sausage, Evaluation.

### 1. Introduction

Meat and processed meat are an important food with high biological values that serve as an important source of proteins. They also contain minerals and other food constituents like: water, carbohydrates, fats, vitamins, etc. A sausage is a prepared food, usually made from ground meat animal fat [1]. Sausage manufacturing consists of grinding, mincing or chopping the muscle tissue and other organs and blending them with: fat, salts, seasonings (herbs and spices) and, when necessary, with binders or extenders [2]. Then the sausage mix or dough is then stuffed into cylindrical synthetic or cellulose casings or tubing's of traditional sausage shape, such as hog or sheep intestines or the hog's bun (for liver sausage) are used. They are sold as raw, pre-cooked or cooked, and/or smoked sausages.

Beside the main meat components and animal fat, processed meat also contain substance of non-meat origin, used as ingredients, such as substances of chemical, plant and animal origin. These substances are called additives and play functional role in assuring safe for consumers and in improving processing technology and some sensory quality, as instance for improving: taste, flavor, color, water binding capacity, texture, etc. Ingredients of plant origin like spices are mainly used to improve taste and flavor of meat products. Ingredients of chemical origin, like: nitrites, salts, antioxidants, preservatives, etc., are mainly used in small limited amounts to improve product's structure, water binding, shelf-life and sometimes even flavor and color. Ingredients of animal origin are mainly used to improve water binding and to avoid fat split during heat treatment.

In the point of view of nutritional value, proteins are important because of the amino acids constituting them. Some amino acids, like leucine, isoleucine, lysine and sulphur containing amino acids, are essential for human diet, because they cannot be synthesized by simple molecules of human body, and so they need to be up taken by food. Main protein sources for humans are meat and vegetables. Almost all of the proteins from meat and meat processed products are 95 - 100% digestible compared to vegetables proteins that are 65 - 75% digestible [3]. Sausages are classified in 5 main groups: of fresh sausage, uncooked smoked sausage, cooked smoked sausage, cooked sausage, dry and semi-dry sausages [4].

Moisture is also another important parameter reflecting quality of processed meat products. Generally speaking moisture content varies between different types of meat and processed meat products, and is closely related to fat content, being higher in processed meat products than in fresh meat because of fatty tissues used during treatment [5, 6].

In most countries, meat consumption increases as economic development improves [3]. As other developing countries, even our country has high meat consumption and because of lower prices meat processed products are mostly preferred rather than fresh meat. The composition of some ham and sausage products is presented in Table 1 [2].

**Table 1. Moisture, protein, fat and caloric value of some meat processed products (ham and sausages)**

| Product               | Moisture % | Protein % | Fat % | Caloric value (kJ) (kJ/100g) |
|-----------------------|------------|-----------|-------|------------------------------|
| Salami (German style) | 40         | 21        | 33    | 1,578                        |
| Cervelat sausage      | 41         | 20        | 34    | 1,598                        |
| Knackwurst            | 60         | 12        | 26    | 1,166                        |
| Bratwurst (pork)      | 57         | 12        | 29    | 1,277                        |
| Liver sausage         | 52         | 12        | 29    | 1,351                        |
| Ham, raw              | 43         | 18        | 33    | 1,527                        |
| Ham, cooked           | 70         | 23        | 4     | 539                          |

Our study aimed to determine and evaluates total protein and moisture content of five different trademarks fresh sausages that are traded in Tirana markets. Several parallel analyses were conducted for every fresh sausage trademark, including blank analyses.

## 2. Materials and Methods

### 2.1 Sample collection and preparation

Five different trading marks of fresh sausages were taken in different times at some of the biggest market of Tirana city. Prior performing physicochemical analysis, samples of the same trading mark were minced and homogenized by a lab meat blender. Sausages samples of each trading mark were analyzed for moisture and total protein content. Analyses were performed with 3 replication, for each of the trading mark sample. The collected samples were tested at both Laboratory of Chemistry Department and Laboratory of Agro-environment and Ecology, Agricultural University of Tirana.

### 2.2 Analytical techniques

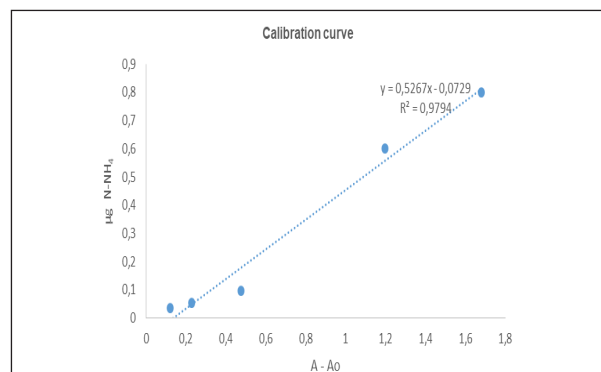
Moisture content was determined gravimetrically by drying well homogenized samples respectively at  $100 \pm 2$  °C for 24 hours till to constant weight. Percentage of moisture content of sausages samples was calculated based on weight lost.

Total protein content was performed by using Kjeldahl and spectrophotometric method. Prepared samples were dried to avoid moisture influence during analysis. 0.3 g of sausage sample was digested by Kjeldahl method using  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and  $\text{K}_2\text{SO}_4$  as catalysts. For sample digestion were used 4 mL of  $\text{H}_2\text{SO}_4$  98%. Digestion was started at low temperature, increasing it gradually up to 430 °C. In this temperature protein's nitrogen is converted in ammonium.



Nitrogen concentration was determined by using UV-Vis spectrophotometer. After digestion, the solution was put on a 100 mL balloon, filled up with distilled water, and left to rest till homogenization. From this 100 mL balloon, were took 0.25 mL and putted on a 50 mL balloon where distilled water was added till homogenization to avoid acid content influence in spectrophotometric measure.

Nitrogen concentration was assessed by using standard curve created by the data shown in Figure 1, below:



**Figure 1. Calibration curve used for determination of N-NH<sub>4</sub> concentration**

Total protein content in %, was evaluated then by multiplying  $N-NH_4$  concentration by 6.25 (equivalent of 0.16 g N for g protein).

### 2.3 Statistical analysis

A statistical analysis was conducted for the results of total protein and moisture content. Analyses of wastewaters were conducted with 3 replications and there were calculated: mean ranges, standard deviations and confidence interval from data obtained. Statistical analysis of results were performed by using the computer software SPSS. The statistical analysis of data was carried out with one-way analysis of variance (ANOVA). The significance level was 0.05. Graphs were performed by using Graph Pad Prism 6 software.

## 3. Results and Discussion

Total protein content was determined in different sausage samples, of five different trading marks, collected in different periods at some of the biggest markets of Tirana. In our country there are only few studies dealing with nutritional values, quality and safety of meat and meat processed products, so for interpreting our results we are mainly based on studies performed in other countries, regarding determination of nutritional values of different types of sausages. Total protein content of sausage samples analyzed was different for all the five trading marks taken in consideration, varying from minimal values of about 18.13% to maximal values of 25.34%. The data acquired by total protein assessment are presented in Table 2, and the results have also been statistically evaluated.

The obtained data show that trade mark 1 and trade mark 2 have a low range of difference between minimum and maximum values, varying 18.13% - 21.85%, and 18.46% - 21.66% respectively. Also their total

protein mean values, respectively of 20.07% and 20.26% clearly shows that even if total protein content it will be more than 18%, the producers of these trading marks have make serious efforts to keep this parameter in its normal norms.

Total protein evaluation of trade mark 2 and 4, also show almost same minimal, maximal and mean values of total protein content. Total protein contents in these trading marks are a little bit higher that those obtained from trade mark 1 and 5, and also generally high than 18% with mean values of 21.57% and 21.03% respectively.

When evaluating trade mark 3 obtained data, we can see that even if the analyzed sausage samples have the higher mean values of 21.93%, compared to all the other trading marks, as well as the highest minimal (20.15%) and maximal (25.34%) total protein content.

The obtained results of total protein content (%) are higher than 18% that is a total protein content recommended for fresh sausages [7]. When evaluated nutritional values of different type of sausages, Quasem *et al.*, [1], found protein content of 21.1 - 14.8%, lower than the results obtained in our study. Nurul *et al.*, [8] also found lower protein content of 10.63 - 16.43%, compared to our results, when evaluating quality characteristics of some Malaysian beef sausages. Higher total protein content obtained from our results, shows that these sausage trademarks contain more meat proteins, serve as a good source of protein, than non-meat proteins (that are mainly used in big industries). Indeed, the companies producing these analyzed trading marks are small to medium producers.

Sausage samples were also analyzed for moisture content. The collected data are presented in Table 3. We can see that each trading mark had different values of moisture content. The lower moisture content are present at sausage samples of trade mark 1 and 5, varying from 28.24% to 31.25% and 27.35% to 29.51% respectively.

**Table 2. Evaluation of total protein content (%)**

| Parameter    | Min   | Max   | Range | Mean     | STDEV    | Conf. Int. |
|--------------|-------|-------|-------|----------|----------|------------|
| Trade mark 1 | 18.13 | 21.85 | 3.72  | 20.07633 | 0.94386  | 0.33775    |
| Trade mark 2 | 19.94 | 22.56 | 2.62  | 21.57133 | 0.732444 | 0.262097   |
| Trade mark 3 | 20.15 | 25.34 | 5.19  | 21.93    | 0.909464 | 0.325441   |
| Trade mark 4 | 19.32 | 22.48 | 3.16  | 21.03    | 0.828422 | 0.296442   |
| Trade mark 5 | 18.46 | 21.66 | 3.2   | 20.26433 | 0.902467 | 0.322938   |

**Table 3. Evaluation of moisture content (%)**

| Parameter    | Min   | Max   | Range | Mean     | STDEV    | Conf. Int. |
|--------------|-------|-------|-------|----------|----------|------------|
| Trade mark 1 | 28.24 | 31.25 | 3.01  | 29.52967 | 0.747435 | 0.267461   |
| Trade mark 2 | 41.25 | 43.82 | 2.57  | 42.514   | 0.624232 | 0.223375   |
| Trade mark 3 | 38.21 | 40.74 | 2.56  | 39.484   | 0.676138 | 0.241948   |
| Trade mark 4 | 42.42 | 43.9  | 1.48  | 43.16233 | 0.42076  | 0.150564   |
| Trade mark 5 | 27.35 | 29.51 | 2.16  | 28.18667 | 0.647655 | 0.231756   |

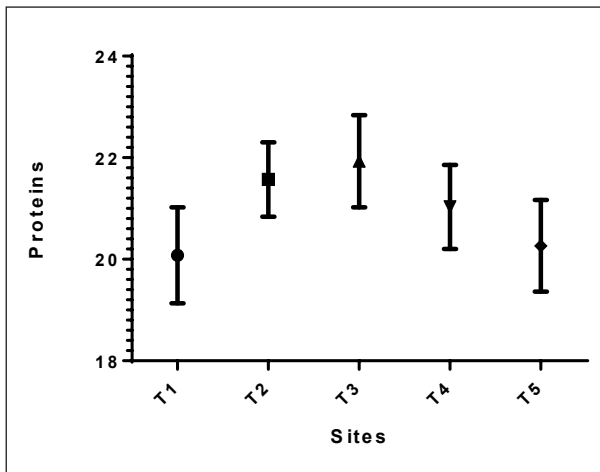


Figure 2. Total protein content (%) in analyzed samples

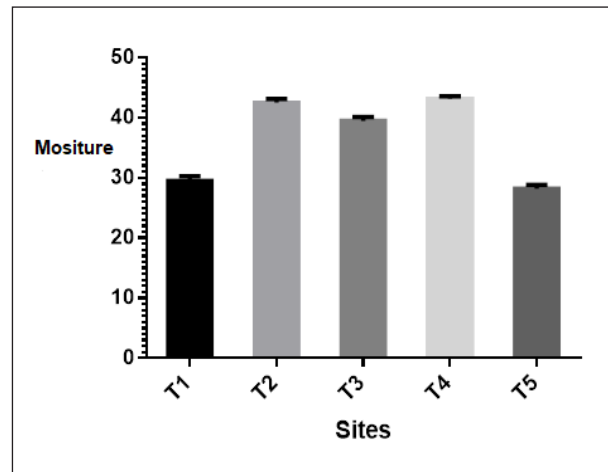


Figure 3. Moisture content (%) in analyzed samples

Table 4. Information included on products labels

| Trade mark 1  | Trade mark 2                                    | Trade mark 3                                    | Trade mark 4                                   | Trade mark 5                             |
|---|---|---|--|--|
| <b>Protein content in products labels</b>   |   |   |  |  |
| 18%   | -   | -   | -  | 14 g/ 100g                               |
| <b>Measured Protein content (%) in mean values</b>  |   |   |  |  |
| 20.07633 %  | 21.57133 %                                      | 21.93 %   | 21.03 %  | 20.26433 %                               |
| <b>Other important notes included in products labels</b>  |   |   |  |  |
| <b>Contain:</b> beef and prok meat, salts natural spices, antioxidants, stabilizant and conservant. | <b>Contain:</b> beef and prok meat, grass salt. | <b>Contain:</b> beef and prok meat, grass salt. | <b>Contain:</b> beef and prok meat, grass salt | <b>Contain:</b> chicken meat, grass salt |
| Production and expire date  | Production and expire date                      | Production and expire date                      | Production and expire date                     | Production and expire date               |

Trade mark 3 sausage's samples had a moisture content of 38.21% up to 40.74%. Highest values of moisture content were present in trade mark 2 and 4, varying respectively 41.25% - 43.82% and 42.42% - 43.9%.

Moisture content of analyzed sausage samples, varied from 27.35% (minimum value) to 43.9% (maximum value). Indeed, fresh sausages generally contain higher moisture content of 50 - 68% [2, 5]. Quasem *et. al.*, [1] found higher values of moisture content in their studies, of 59.5 - 66.9% and Nurul *et. al.*, [8] also found a higher moisture content of 63 - 73.9%. Our results showed that between total protein and moisture content was a negative correlation and this is in accordance with the results of Lorenzo *et. al.*, [9].

Another objective of our study was comparing total protein and moisture content of analyzed sausage samples with those presented on their labels. In Table 4 are presented information given at labels of all the sausage samples collected. In this table is show the information on product label about protein content.

We can see that only two from the five trading marks include on their labels regarding protein content. All the products labels included information about ingredients, production and expire date.

Only two from the five chosen trademarks had the total protein content written on their labels, three of them didn't have any data about total protein content. The labels of all the selected trading marks contained information about ingredients, production and expiring date. It is very important that the consummator get all the necessary information from products labels, not only production and expire date, but also about ingredients used to prepare a meat processed product, protein, fat and caloric value of that product.

#### 4. Conclusions

- Overall protein content of analyzed sausages trading marks was about 20 - 21%, showing that these sausages offer a good source of protein.

- Meat consumption in developing countries has been continuously increasing from a modest average annual per capita consumption of 10 kg in the 1960s to 26 kg in 2000 and will reach 37 kg around the year 2030 according to FAO projections [7].

- So, from this point of view, in our country must be carry out more studies dealing with determination and evaluation of nutritional values (protein, moisture, ash, fat content) of meat and meat processed products.

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