

QUALITATIVE ASPECTS CONCERNING CERTAIN MINCED MEAT PRODUCTS FROM ROMANIAN MARKET

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Abstract

*The paper aimed to analyze the quality of some minced meat assortments, namely: pork minced meat, beef minced meat, pork-beef minced meat mixture and traditional sausages paste, which are often sold on the Romanian market. Moisture (%), fat (%), easily hydrolysable nitrogen (NH₃), total nitrogen (% protein), collagen content (%) and the C/P (collagen/protein) ratio were analyzed during experiments. Differences with varying degrees of significance were identified between quality parameters of minced meat assortments (Student test). Significant differences were found between the samples of minced meat and traditional sausages paste, regarding humidity (%), fat (%), easily hydrolysable nitrogen (NH₃) and total nitrogen (protein%). Traditional sausages paste has significantly elevated values of fat (%) and easily hydrolysable nitrogen (%) when compared with pork minced meat (3.369**, 16.010***), beef minced meat (9.255***, 16.979***), and pork-beef minced meat mixture (7.277***, 17.364***); instead, it has the lowest protein content when compared with pork minced meat (6.677***), beef minced meat (13.174***), and pork-beef minced meat mixture (5.983***). We find that all the formed significant correlations have particularized minced meat assortments, because of the fact that some of the assortments did not show significant correlations between the same quality parameters, for example in the pork – beef minced meat mixture, where fat correlated to collagen ($r = -0.621^*$) and to C/P ratio ($r = 0.731^{**}$), easily hydrolyzable nitrogen (NH₃) correlated to C/P ratio ($r = 0.538^*$) and also protein correlated to collagen ($r = 0.604^*$). All observed correlations, with varying degrees of significance, constituted peculiarities of minced meat assortments taken for analysis.*

Key words: quality parameters, minced meat, statistical evaluation, traditional sausages paste

INTRODUCTION

Meat is one of the most important sources of proteins with high biological value of human nutrition.

At the same time it is the basis of one of the most dynamic sectors of the Romanian bioeconomy, the place where traditional consumption elements collide with research and top innovation.

Meat intake in Romania was estimated in 2015 to about 54 kg/capita/year, below the European average of 90 kilograms. In the structure of meat intake, poultry prevail, followed by pork and far away by beef or mutton. It is estimated that a Romanian consumer eats about 6 times less beef than an European consumer. [1] Underlying this

behavior are both traditional elements and constraints related to purchasing power. Much of the meat sold on the Romanian market are imported, the import volume of meat in 2015 is estimated at 408,000 tonnes, corresponding to a trade deficit of about 280 million euros [4, 5].

The quality of meat eaten by the Romanian consumer is the subject of many disputes. There is a reticence of consumers regarding the informations available on the product's label because manufacturers hesitate to clearly inform on relevant issues of products quality, namely: water addition, the amount of meat in products, the use of mechanically deboned meat or of some disputed substitutes or additives. At the same time, meat quality is influenced by a great number of factors:

species, breed, fattening, anatomic region, feeding, type and size of animal shelters, movement, age at slaughtering, health, stress before slaughtering etc. [2,3].

In this context, the objective of our research was to analyse some meat assortments on the Romanian market, in order to differentiate their quality profile and the variability of some quality parameters.

MATERIALS AND METHODS

There were analyzed four minced meat assortments coming from a local producers, as follows: pork minced meat, beef minced meat, pork – beef minced meat mixture (1:1) and traditional sausages paste (pork – beef mixture, 1:1). Of each assortment were taken a variable number of repetitions as seen in table 1. For each assortment were analyzed the main quality parameters, according to the methods described in Table 1.

Table 1. Quality parameters and methods used to analyze different assortments of minced meat

Parameter	Analysis method
Moisture (%)	STAS 756/3-85
Fat (%)	SR-EN ISO 659:2009
Easily hydrolyzable nitrogen (NH ₃)	SR 9065-7:2007
Total nitrogen (protein %)	SR ISO 937/2007
Collagen (%)	SR ISO 3496/A1:1999
Collagen/Protein	Calculation

Results were statistically interpreted using the IBM SPSS Statistics 20 computer program.

RESULTS AND DISCUSSIONS

Table 2 shows the descriptive statistics of the quality parameters for the 3 assortments of minced meat and traditional sausages paste.

It can be observed that fat content of pork minced meat greatly varied, the variation coefficient being very high (33.10%). The protein content also varied more than the other parameters, but within reasonable limits (10.38%).

Fat content of beef minced meat had the highest variation coefficient value (13.76%) compared to the other parameters, but in the normal limits (<14%).

Table 2. Descriptive statistics of the quality parameters

Parameter	Assortments of meat	n	X±s	CV %
Moisture (%)	pork minced meat	11	67.88 ± 2.31	3.40
	beef minced meat	15	69.93 ± 2.62	3.75
	pork – beef minced meat mixture	10	68.64 ± 0.94	1,37
	traditional sausages paste	15	65.22 ± 2.05	3.14
Fat (%)	pork minced meat	14	12.54 ± 4.15	33.10
	beef minced meat	15	9.72 ± 1.34	13.76
	pork – beef minced meat mixture	15	11.18 ± 2.22	19.85
	traditional sausages paste	15	16.88 ± 2.68	15.89
Easily hydrolyzable nitrogen (NH ₃)	pork minced meat	14	17.06 ± 0.23	1.33
	beef minced meat	15	17.01 ± 0.21	1.25
	pork – beef minced meat mixture	14	17.00 ± 0.00	0
	traditional sausages paste	14	19.97 ± 0.64	3.23
Total nitrogen (protein %)	pork minced meat	14	19.06 ± 1.98	10.38
	beef minced meat	15	20.42 ± 1.21	5.92
	pork – beef minced meat mixture	15	19,14 ± 2,27	11.85
	traditional sausages paste	4	12.18 ± 0.41	3.38
Collagen (%)	pork minced meat	14	1532.57 ± 97.75	6.38
	beef minced meat	15	1597.26 ± 68.57	4.29
	pork – beef minced meat mixture	15	1541,60 ± 90,50	5.87
	traditional sausages paste	3	1671 ± 182.518	10.92
Collagen/Protein	pork minced meat	14	8.09 ± 0.58	7.27
	beef minced meat	15	7.84 ± 0.46	5.84
	pork – beef minced meat mixture	15	8,13 ± 0,857	10.53
	traditional sausages paste	3	13.92 ± 1.41	10.16

For pork – beef minced meat mixture, higher variation coefficients were recorded for fat (19.85%), protein (11.85%) and the C/P ratio (10.53%), without exceeding the normal limits. Considering that this sample is a mixture, it is normal to register higher variation coefficients, because the intervals between the minimum and maximum values increase.

Although the traditional sausages paste is more intensely processed, spiced and with addition of bone soup, garlic, eventually ammonium bicarbonate, it is interesting to compare it with pork – beef minced meat mixture. It can be observed that also for traditional sausages paste, higher variation coefficients were recorded for the following parameters: fat (15.89%), collagen (10.92%) and C/P ratio (10.16%). By comparison, fat content is eloquent on dietary properties of minced meat.

Easily hydrolysable nitrogen or free ammonia is an indicator of meat freshness.

It can be observed that traditional sausages paste had an increased amount of free ammonia, as compared to other types of minced meat. The reason for this might be the addition of a certain amount of ammonium bicarbonate in the traditional sausages paste, which releases ammonia, or that the traditional sausages paste was not fresh enough. The other three assortments of minced meat had comparable values of easily hydrolysable nitrogen.

Regarding the protein content, the traditional sausages paste had the lowest value, probably due to additions of bone soup, spices, garlic. The highest content of total nitrogen was recorded in beef minced meat.

Also, beef minced meat had a higher content of collagen, compared to the minced meat mixture and the pork minced meat. The traditional sausages paste had a much higher content of collagen, which can be explained by further additions of connective tissues in the meat (cartilage, tendons, ligaments, skin and blood vessels). In general, collagenous tissues should not prevail in minced meat, because they are difficult to digest and decrease quality parameters of meat.

Table 3. Significance of mean difference for quality parameters

Pairs of minced meat assortments	Mean difference	t
Significance of mean difference for Moisture		
Pork - beef minced meat	-2.05	2.0694*
Pork - minced meat mixture	0.24	0.968
Pork - traditional sausages paste	2.66	3.098**
Beef - minced meat mixture	1.29	1.486
Beef - traditional sausages paste	4.71	5.482***
Minced meat mixture - traditional sausages paste	3.42	4.914***
Significance of mean difference for Fat		
Pork - beef minced meat	2.82	2.499*
Pork - minced meat mixture	1.36	1.111
Pork - traditional sausages paste	-4.34	3.369**
Beef - minced meat mixture	-1.46	2.181*
Beef - traditional sausages paste	-7.16	9.255***
Minced meat mixture - traditional sausages paste	-5.7	7.277***
Significance of mean difference for Easily hydrolyzable nitrogen (NH₃)		
Pork - beef minced meat	0.05	0.612
Pork - minced meat mixture	0.06	0.054
Pork - traditional sausages paste	-2.91	16.010***
Beef - minced meat mixture	0.01	0.178
Beef - traditional sausages paste	-2.96	16.979***
Minced meat mixture - traditional sausages paste	-2.97	17.364***
Significance of mean difference for Total nitrogen (protein)		
Pork - beef minced meat	-1.36	2.249*
Pork - minced meat mixture	-0.08	0.101
Pork - traditional sausages paste	6.88	6.677***
Beef - minced meat mixture	1.28	1.927
Beef - traditional sausages paste	8.24	13.174***
Minced meat mixture - traditional sausages paste	6.96	5.983***
Significance of mean difference for Collagen		
Pork - beef minced meat	-64.69	2.075*
Pork - minced meat mixture	-9.03	0.258
Pork - traditional sausages paste	-138.43	1.929
Beef - minced meat mixture	55.66	1.899
Beef - traditional sausages paste	-73.74	1.281
Minced meat mixture - traditional sausages paste	-129.4	1.922
Significance of mean difference for C/P ratio		
Pork - beef minced meat	0.25	1.291
Pork - minced meat mixture	-0.04	0.146
Pork - traditional sausages paste	-5.83	12.282***
Beef - minced meat mixture	-0.29	1.155
Beef - traditional sausages paste	-6.08	14.598***
Minced meat mixture - traditional sausages paste	-5.79	9.698***

* significant at the 0.05 level (significant)

** significant at the 0.01 level (distinctly significant)

*** significant at the 0.001 level (very significant)

It can be observed that C/P ratio was greatly increased in traditional sausages paste. The

result is consistent with the hypothesis that an excess of connective tissue was added to the traditional sausages paste.

The three assortments of minced meat and the analysed traditional sausages paste showed features which can be highlighted by Student's test (t), respectively the significance of mean difference for quality parameters (Table 3).

From the table above it can be extracted a number of observations that differentiate the assortments of minced meat and the traditional sausages paste. Moisture, protein content and collagen content are significantly increased in the beef minced meat as compared to pork minced meat (20.694*, 2.249*, 2.075*), while fat content is significantly increased in the pork minced meat as compared to beef minced meat (2.499*).

Pork minced meat is not significantly different from pork – beef mixture, regarding all parameters.

Remarkable differences are recorded between pork minced meat and traditional sausages paste. Thus, moisture is significantly increased in pork minced meat (3.098**). Also, the protein content is considerable increased in minced meat as compared to traditional sausages paste (6.677***). Fat content is significantly increased in traditional sausages paste (3.369**); ammonia and C/P ratio are considerable increased in traditional sausages paste (16.010***, 12.282***) as compared to pork minced meat assortment.

Between beef minced meat and pork – beef minced meat are no significant differences. The only difference is fat content that is significantly increased in the minced meat mixture (2.181*). This is normal, considering that the mixture contains pork minced meat, which is fatter.

As with pork minced meat, when comparing beef minced meat with traditional sausages paste, differences arise regarding beef minced meat. Thus, it can be observed that moisture and protein content are significantly increased in beef minced meat (5.482***, 13.174***), while fat content, ammonia, and C/P ratio are considerable increased in traditional sausages paste (9.255***, 16.979***, 14.598***).

The quality of pork – beef minced meat mixture is also significantly different from the quality of traditional sausages paste. Fat, ammonia, and C/P ratio are highly increased in traditional sausages paste (7.277***, 17.364***, 9.698***), while moisture and protein content are significantly increased in pork – beef minced meat mixture (4.914***, 5.983***).

Taking into account that moisture influence protein content, it can be observed that traditional sausages paste has the lowest protein content, although it has the lowest moisture content; instead, it has increased amounts of fat, free ammonia and collagen and, for this reason, is less indicated in the dietary.

There were calculated the Pearson correlation coefficients between the quality parameters of minced meat assortments and traditional sausages paste. Correlations are significant features of the respective assortment.

In the minced pork meat were established the following correlations: a distinct significant negative correlation moisture-fat ($r = -0.812$ **), a distinct significant negative correlation fat-protein ($r = -0.754$ **), a significant positive correlation fat-C/P ratio ($r = 0.634$ *), a distinct significant positive correlation protein-collagen ($r = 0.723$ **) and a distinct significant negative correlation protein-C/P ratio ($r = -0.839$ **).

The negative correlation moisture-fat was expected, given that with the increase of a sample humidity, decrease the value of other parameters.

However, as decreases a parameter, for example. fat, other parameters increase, for example protein.

The minced beef meat highlighted two significant negative correlations, namely: fat-protein ($r = -0.586$ *) and protein-C/P ratio ($r = -0.586$ *).

It is noted that these two correlations are found also in minced pork meat.

Pork-beef minced meat mixture is the assortment with most significant correlations between quality parameters. Thus, it can be observed the significant negative fat – protein correlation ($r = -0.886$ **) and the significant negative protein – C/P ratio correlation ($r = -$

0.586*), which are similar to those set out in pork minced meat and beef minced meat. At the same time, fat is significantly negative correlated with collagen ($r = -0.621^*$) and significantly positive correlated with C/P ratio, ammonia is significantly positive correlated with the C/P ratio ($r = 0.538^*$) and protein is significantly positive correlated with collagen ($r = 0.604^*$).

Astfel, grăsimea se corelează negativ semnificativ cu colagenul ($r = -0.621^*$) și pozitiv distinct semnificativ cu raportul C/P ($r = 0.731^{**}$), amoniacul se corelează pozitiv semnificativ cu raportul C/P ($r = 0.538^*$), iar proteina se corelează pozitiv semnificativ cu valoarea colagenului ($r = 0.604^*$).

Traditional sausages paste shows only one significant correlation, namely a significant negative fat – moisture correlation ($r = -0.655^{**}$).

It can be observed that all significant correlations formed customize the minced meat assortments and the traditional sausages paste, especially those correlations that are not repeated from one meat assortment to another. It matters also the significance of the correlation, which is typical for a specific assortment of minced meat.

The regression showing the higher determination coefficient for minced pork meat, was the protein-C / P ratio regression (Fig. 1).

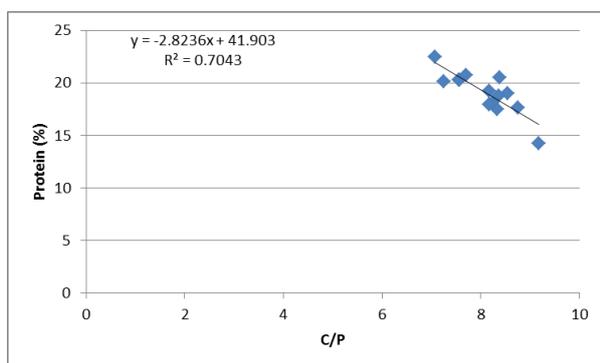


Fig. 1. Protein-C/P ratio regression

Also, the regressions: protein-fat and protein-C/P ratio in minced meat mixture showed the highest determination coefficient (Fig. 2).

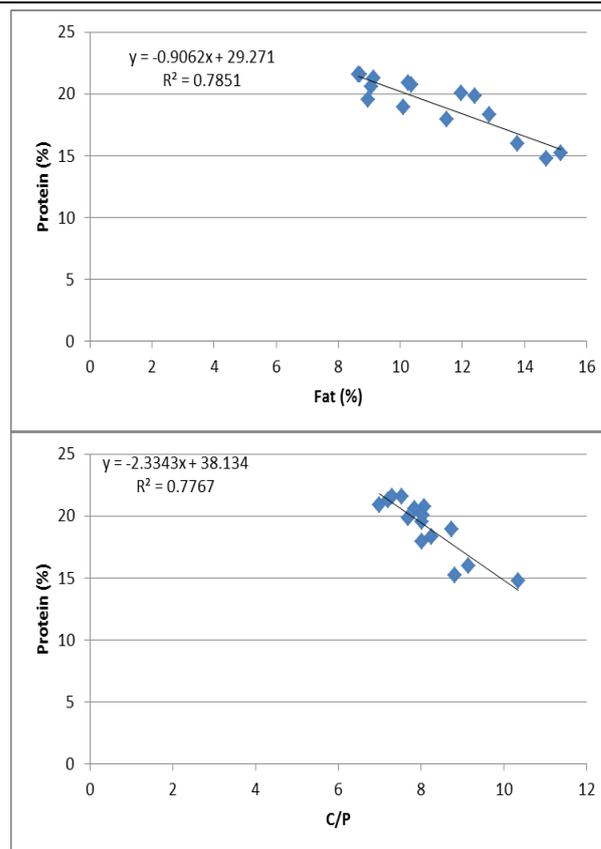


Fig. 2. Protein-fat and protein-C/P ratio regressions

The highest coefficient of determination in minced beef meat was registered by the protein-C/P ratio regression (Fig. 3).

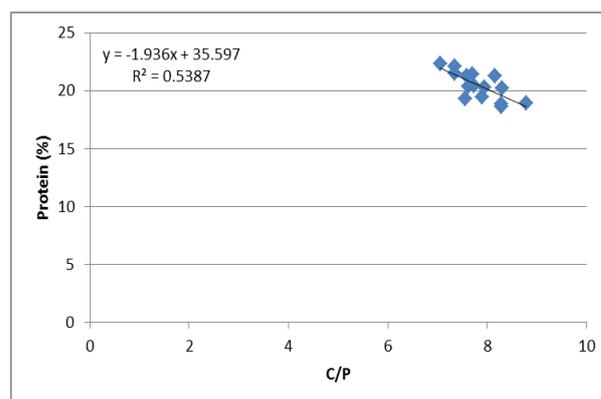


Fig. 3. Protein-C/P ratio regression

Traditional sausages paste was characterized by a moisture-fat regression with a moderate coefficient of determination (Fig. 4).

The assortments of minced pork and beef meat were individualized by the quality parameters and by the significant correlation coefficients.

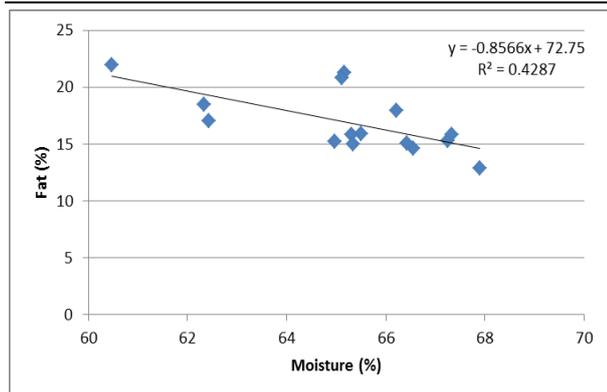


Fig. 4. Moisture-fat regression

Minced meat mixture and traditional sausages paste presented unique characteristics, not similar to pork and beef minced meat.

CONCLUSIONS

All the minced meat assortments had higher variation coefficients of Fat parameter, in particular minced pork meat and minced porc-beef mixture. The other parameters had variation coefficients in the normal range. Traditional sausages paste showed an increased moisture and fat content, to the detriment of protein content.

However, the traditional sausages paste recorded significantly higher quantities of easily hydrolyzable nitrogen (NH_3) and collagen, which indicates that either the meat was not fresh enough, either was added ammonium carbonate and connective tissues, contrary to the recipe.

The differences between the basic quality parameters (fat, protein, collagen) of analyzed minced meat assortments, recorded different degrees of significance.

Significant correlations were established between the quality parameters which characterized the assortments of minced meat and traditional sausages pasta.

The mixture of minced pork-beef meat presented a number of correlations between the quality parameters which were not found in other assortments of meat.

The degree of the correlations significance, also showed a feature of a certain assortment of minced meat.

The value of quality parameters showed that beef minced meat is more dietary and

traditional sausages paste is more indigestible, due to increased fat and collagen content.

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