DETERMINATION OF SOME PHYSICAL-CHEMICAL AND MICROBIOLOGICAL QUALITY PARAMETERS FOR TRADITIONAL PORK MEAT PRODUCTS WITHOUT MEMBRANE

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Abstract

Nowadays, from the total meat production, almost 75% it is used as such and the rest of 25% is destined for industrial processing, being transformed in various food products. From this category, the highest rate is held by meat products, over 70% from total (Banu, et al., 2002) (Banu, et al., 1980)*; having in view this aspect, by the current paper we aimed to highlight the quality of some assortments of traditional pork meat products without membrane, "Ceafă de porc tradiţională/Traditional pork scruff", "Şunculiţă ţărănească/Country ham" and "Pastramă porc tradiţională/Traditional pork pastrami", through some physical-chemical and microbiological quality indicators. The determined analyses for assortment "Ceafă de porc tradiţională/Traditional pork scruff" highlight mean values for studied parameters (NaCl-%, nitrites-mg/100g, easy hydrolysable nitrogen-mg/100g, water-%, D.M.-%) of 1.75±0.74, 1.55±1.04, 11.95±2.12, 32.28±1.36, respectively 67.72±1.12, values in conformance with firm's standards. For assortment "Pastramă de porc tradiţională/Traditional pork pastrami", the obtained values were also between the limits imposed by standard, being of 1.69±0.46% NaCl, 2.15±0.38 mg/100g nitrites, 10.13±1.56 mg/100g easy hydrolysable nitrogen, 26.16±0.95% water and 73.84±1.17 D.M. Analysing assortment "Şunculiţă ţărănească/Country ham" we observed the fact that mean values were 1.87±0.73% NaCl, 2.36±0.86 mg/100g nitrites, 11.54±1.93 mg/100g easy hydrolysable nitrogen, 28.38±0.73% water and 71.62±0.81% D.M. Salmonella spp., Escherichia coli and Listeria monocytogenes were absent on all those 15 studied samples, and Bacillus cereus, Coagulase-positive staphylococcus was between the normal limits. The obtained and presented results are from a more extensive series of research and aimed to enlarge the knowledge area regarding the quality of some traditional products.*

Key words: *traditional products, quality, physical-chemical indicators, microbiological indicators*

INTRODUCTION

Nowadays from the total meat production, around 75% it is used as such and the rest of 25% is destined to industrial processing being transformed in various food products. From this category the highest rate is held by meat products, with over 70% from total (Banu, et al., 2002) (Banu, et al., 1980).

Having in view this aspect, through the current paper, we aimed to highlight the quality of some assortments of meat products without membrane, "Ceafă de porc tradiţională/Traditional pork scruff", "Şunculiţă ţărănească/Country ham" and "Pastramă porc tradiţională/Traditional pork pastrami", through some physical-chemical and microbiological quality indicators.

MATERIAL AND METHOD

Effectuation of physical-chemical examination involved determination of the values for: sodium chloride (%), sodium nitrites (mg/100g), easy hydrolysable nitrogen (mg/100g), percent in water and DM.

1. Sodium chloride represent an important compound which could be founded in meat products. The main reagents utilised for determination were silver nitrate ($AgNO_3$) 0.1n

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and potassium chromate (K_2CrO_4) saturated aqueous solution, as indicator (Vacaru Opriș, 1974).

Working technique: into a titration beaker are introduced 10 ml filtered, over which are added 3-5 potassium chromate drops as indicator. Subsequent it is titrated with silver nitrate, solution 0.1n. Operation is realised drop by drop, under a continuous stirring till the initial colour (yellow) goes into a persistent brick colour.

Calculus of sodium chloride is in according with the following formula:

$$g\ NaCl\% = \frac{V*0.00585*V1}{V2*g} * 100, \text{ in which:}$$

V = ml $AgNO_3$ sol. 0.1n, used for titration;
0.00585 = equivalent in g NaCl of 1 ml $AgNO_3$ 0.1n;
V_1 = total volume of extract (in ml);
V_2 = volume of analysed extract (in ml);
g = mass of analysed sample (in grams).

2. Determination of nitrates Effectuation of determination implies: preparation of etalon solution, preparation of aqueous extract and comparison of control sample with etalon scale (Oțel, 1974) (Popovici, et al, 1967).

To prepare the etalon scale are taken 12 colourless test tubes, with the same diameter and volume, uniform calibrated and are numbered.

In each test tube is introduced a volume (in ml) from etalon solution, in according with its number, is added 1 ml Griess reagent and is completed up to 13 ml (content is homogenised).

Into a similar test tube with the ones of etalon scale are introduced: 1 ml extract, 1 ml Griess reagent and 11 ml distilled water. It homogenizes and after that it is left to rest for 20 minutes; in this interval the mix gain a rose reddish colour, proportional with the contained nitrates quantity.

The obtained colour is compared with etalon scale. Nitrates quantity from analysed sample, expressed in mg for 100 g product, is equal with the label number of correspondent test tube from etalon scale.

3. Determination of easy hydrolysable nitrogen from meat

Working technique: from homogenised sample are weighted 10 g and are placed with 300 ml of distilled water into distillation flask. In collecting flask are introduced 10-15 ml sulphuric acid 0.1n and 2-3 drops of indicator. Distillation unit is assembled in a way in which the extremity of refrigerant extension tube to be immersed into sulphuric acid solution from collecting flask bled (Oțel, 1974).

In distillation vessel are introduced 1-2 g magnesium oxide and paraffin (antifoam), is covered with the cap, is homogenised by some circular moves of flask and the flame is actioned. Distillation must take place for 30 minutes from the moment in which liquid reached the boiling point.

At the end of distillation, when are collected around 125-150 ml distillate, the collecting flask is lowered so that refrigerant extension to remain above distillate; the distillation end is checked out with litmus paper.

Using a pipette, the extremity of refrigerant extension tube is washed (around 5 ml distilled water), washing liquid being collected over distillate.

The sulphuric acid excess is titrated with sodium hydroxide solution 0.1n, till the obtaining of indicator colour.

Calculus is in according with the formula:

$$\text{Easy hydrolysable nitrogen} = \frac{0.0017\ (v1-v2)}{m} * 100\ g\ NH_3/100\ g\ product$$

in which:
0.0017 – ammonia quantity, in g, correspondent to 1ml sulphuric acid 0.1n;
v_1 – volume of sulphuric acid 0.1n, in ml, introduced in collecting flask;
v_2 – volume of sodium hydroxide 0.1n, used for titration of sulphuric acid excess (in ml);
m – mass of the analysed sample (g).

Microbiological examinations aimed to observe the presence of *Salmonella spp*., of coliform bacteria and *Escherichia coli*, *Bacillus cereus*, *Coagulase-positive staphylococcus* and *Listeria monocytogenes*.

1. Identification of Salmonella

Identification of bacteria belonging to *Salmonella* type was realised by inseminations on selenite-cystine enriched broth, which was incubated at 37°C, for 24-48 hours. To identify the cultural characters, were effectuated inseminations on a selective Istrati-Meitert agar

in Petri dishes and after an incubation of 24 hours at temperature of 37ºC, was examined the presence and aspect of colonies (Savu, 2008) (Georgescu, Banu, 2000).

2. Determination of coliform bacteria and Escherichia coli presence in solid selective culture environments (without enrichments)

Working technique: from homogenised product and from each dilution are inseminated 1 ml into 2 Petri dishes (diameter 10 cm) over which is poured around 15 ml agar with deoxycholate and lactose chilled at about 45ºC. Inoculum is homogenised with the broth and is placed for solidification. Plates are incubating at 37ºC, 24-48 hours. Are counted the specific colonies from those 2 plates of each dilution. Are considered the plates in which were developed 10-300 colonies. Is made a mean of the colonies from those 2 plates, which multiplied with dilution factor generate the number of coliform bacteria/g product (Bondoc, Şindilar, 2002).

3. Quantitative determination of Bacillus cereus.

To determine only the sporulation forms, the first dilution is inactivated at 80ºC, for 15 minutes. The inactivated sample is suddenly chilled and from this one are realised successive decimal dilutions (Banu, et al., 1985) (Bondoc, Şindilar, 2002).

From each dilution are inseminated by partition 2 Petri dishes, one with MYP broth and the other one with agar-blood. Are incubated 24-48 hours at 30-37ºC, and after that the colonies are counted. From each plate in which were developed 15-150 colonies characteristic for *Bacillus cereus*, are taken 5 colonies which are subjected to biochemical tests.

4. Determination of Listeria monocytogenes

Primary enrichment, are taken 25 g from analysed product and after homogenization are introduced into a flask with 225 ml enrichment broth (LEB_1); are incubated for 24 hours at 30ºC (Vacaru Opriș, 1974).

Secondary enrichment, from LEB_1 is transferred 1 ml into a tube with 4.5 ml solution of potassium hydroxide 0.25% and is streaked on FSIS gelose. Plates are incubated 24-48 hours at 30ºC.

In parallel from incubated LEB_1 is transferred 0.1 ml into a test tube with 10 ml LEB_2 and it is incubated. Then is transferred 1 ml suspension into a tube with 4.5 ml potassium hydroxide 0.25%. Is streaked and after that is buffered on FSIS gelose.

5. Coagulase-positive staphylococcus

Determination of the staphylococcus presence and number by inoculum enrichment is realised by insemination of 1 ml from homogenised product and from each dilution into one test tube, containing enrichment environments. For solid products, to check the presence of staphylococcus in 1 g of product, from first dilution (10^{-1}) are inseminated 10 ml from all dilutions in tubes with the same simple concentrate environment (Bondoc, Şindilar, 2002).

RESULTS AND DISCUSSIONS

Physical-chemical quality indicators for meat products without membrane

Physical-chemical examinations targeted 15 samples from each assortment, from different processing batches, aiming the content in sodium chloride, quantity of sodium nitrites, easy hydrolysable nitrogen, water content and DM.

"Ceafă de porc tradiţională/ Traditional pork scruff"

The level of sodium chloride was, in mean, at 1.75±0.74%, being recorded oscillation limits between a minimum of 1.12% and a maximum of 2.36%; the determined values being aligned with the admissible standards; was established a very good homogeneity of the studied character (tab. 1).

Table 1 Physical-chemical quality indicators for assortment "Ceafă de porc tradiţională/Traditional pork scruff"

Specification	Product standard	n	Indicators			
			$\bar{X} \pm s_{\bar{x}}$	V%	Min.	Max.
Salt (%)	Max. 4%	15	1.75±0.74	6.93	1.12	2.36
Nitrites (mg/100g)	Max. 7mg/100g	15	1.55±1.04	12.32	1.08	2.14
Easy hydrolysable nitrogen (mg/100g)	Max. 14mg/100g	15	11.95±2.12	5.62	11.36	13.10
Water (%)	Max. 35%	15	32.28±1.36	3.24	31.20	32.64
DM (%)	Min. 65%	15	67.72±1.12	2.88	67.36	68.78

Quantity of nitrites, in conditions of acceptance by standard of a maximum 7 mg/100 g product, recorded inferior mean values, of 1.55±1.04 mg/100 g. The minimum obtained value was 1.08 mg/100 g, and the maximum one was 5.14 mg/100 g (tab. 1).

Quantity of easy hydrolysable nitrogen (mg/100 g) recorded a mean value of 11.95±2.12 mg/100 g, oscillating between 11.36 mg/100 g and 13.10 mg/100 g (tab. 1).

For water content was calculated a mean value of 32.28±1.36%; inferior limit being of 31.20%, and the superior one being 32.64%, in conditions in which the maximum level is 30.50% (tab. 1).

In relation with the values obtained for water content were remarked the ones for dry matter, which had a mean of 67.72±1.12%.

"Pastramă de porc tradiţională/ Traditional pork pastrami"

Calculus of sodium chloride rate highlight a mean value of 1.69±0.46%; character was homogenous, showing a coefficient of only 7.32%.

The nitrites level was between the imposed limits by standard, being in mean of 2.14±0.38 mg/100 g product; the minimum recorded value was 1.66 mg/100 g product and the maximum one was 2.53 mg/100 g product.

For mean quantity of easy hydrolysable nitrogen (mg/100 g) was obtained a value of 10.13±1.56 mg/100 g, value inferior to the admissible one which is 14 mg/100 g (tab. 2). The product moisture, expressed in percent, was situated at a mean level of 26.16±0.95%; percent in dry matter was founded at a mean level of 73.84±1.17%.

Table 2. Physical-chemical quality indicators for assortment "Pastramă de porc tradiţională/Traditional pork pastrami"

Specification	Product standard	n	$\overline{X} \pm S_{\overline{X}}$	V%	Min.	Max.
Salt (%)	Max. 3%	15	1.69±0.46	7.32	1.46	2.14
Nitrites (mg/100g)	Max. 7mg/100g	15	2.15±0.38	8.27	1.66	2.53
Easy hydrolysable nitrogen (mg/100g)	Max. 14mg/100g	15	10.13±1.56	6.45	9.37	12.06
Water (%)	Max. 35%	15	26.16±0.95	5.64	22.53	30.19
DM (%)	Min. 65%	15	73.84±1.17	5.72	69.80	77.46

"Şunculiţă ţărănească/Country ham"

Analysing the obtained results for this assortment revealed mean values of 1.87±0.73 for sodium chloride percent.

The identified values for nitrites quantity was between the admissible limits, having a minimum of 1.54 mg/100 g and a maximum of 2.77 mg/100 g, with a mean of 2.36±0.86 mg/100 g (tab. 3).

Table 3. Physical-chemical quality indicators for assortment "Şunculiţă ţărănească/Country ham"

Specification	Product standard	n	$\overline{X} \pm S_{\overline{X}}$	V%	Min.	Max.
Salt (%)	Max. 3%	15	1.87±0.73	6.45	1.08	2.62
Nitrites (mg/100g)	Max. 7mg/100g	15	2.36±0.86	7.12	1.54	2.77
Easy hydrolysable nitrogen mg/100g)	Max. 14mg/100g	15	11.54±1.93	7.38	10.95	12.19
Water (%)	Max. 35%	15	28.38±0.73	4.32	26.14	30.13
DM (%)	Min. 65%	15	71.62±0.81	4.66	69.88	73.86

Easy hydrolysable nitrogen mean quantity was 11.54±1.93 mg/100 g product, in according with standards, with a minimum value of 10.95 mg/100 g product and a maximum one of 12.19 mg/100 g product.

Water percent recorded a mean value of 28.38±0.73%; the minimum obtained limit being 26.14%, and the maximum one being 30.13%. For dry matter was calculated a mean

value of 71.62±0.81%, with variations which oscillated between 69.88% and 73.86%.

Calculus of variation coefficients for all studied parameters, revealed a very good homogeneity inside studied batches (V%=4.32-7.38).

Table 4. Results of microbiological investigations for the studied assortments

Assortment	Standard	Determination					
		Ceafă de porc tradiţională Traditional pork scruff		Pastramă de porc tradiţională Traditional pork pastrami		Şunculiţă ţărănească Country ham	
Salmonella/25g	absent	absent	absent	absent	absent	absent	absent
Escherichia coli/g 5.	absent	absent	absent	absent	absent	absent	absent
Coliform bacteria/g	<10	<10	<10	<10	<10	<10	<10
Bacillus cereus/g	<10	<10	<10	<10	<10	<10	<10
Coagulase-positive staphylococcus/g	<10	<10	<10	<10	<10	<10	<10
Listeria monocytogenes/25g	absent	absent	absent	absent	absent	absent	absent

CONCLUSIONS

For assortment "Ceafă de porc tradiţională/Traditional pork scruff" the sodium chloride level was placed, in mean, at 1.75±0.74%, being recorded oscillation limits between a minimum of 1.12% and a maximum of 2.36%, for "Pastramă de porc tradiţională/Traditional pork pastrami" was highlighted a value of 1.69±0.46% and for assortment "Şunculiţă ţărănească/Country ham" of 1.87±0.73%. Also for the rest of studied parameters the obtained values were between the imposed limits.

At the end of determinations for *Salmonella spp*., coliform bacteria, *Escherichia coli*, *Bacillus cereus*, *Coagulase-positive staphylococcus* and *Listeria monocytogenes* was noticed that the values were in according with the standard.

REFERENCES

1. Banu, C., et al. (2002). Calitatea şi controlul calităţii produselor alimentare. Editura Agir, Bucureşti.
2. Banu, C., et al. (1985). Îndrumător în tehnologia produselor din carne. Editura Tehnică, Bucureşti.
3. Banu, C., et al. (2003). Procesarea industrială a cărnii. Ediţia a II-a, Editura Tehnică, Bucureşti.
4. Banu, C., et al. (1980). Tehnologia cărnii şi subproduselor pentru ingineri şi subingineri. Editura Didactică şi Pedagogică, Bucureşti.
5. Bondoc, I., Şindilar, E. (2002). Controlul veterinar al calităţii şi salubrităţii alimentelor - Volumul I. Editura Ion Ionescu de la Brad, Iaşi.
6. Gându, E., et al. (2002). Aspecte privind marketingul cărnii în România în contextul integrării agriculturii în Uniunea Europeană. Lucrări ştiinţifice USAMV Iaşi, vol. 46, seria Zootehnie, pag. 543.
7. Georgescu, Gh., Banu, C. (2000). Tratat de producerea, procesarea şi valorificarea cărnii. Editura Ceres, Bucureşti.
8. Mitrea, S.I., Petcu, D.C., Savu, Gh. (2003). Siguranţa alimentelor prin aplicarea sistemului HACCP. Editura Bogdana.
9. Nour, V. (2008). Tehnologia cărnii şi a produselor din carne. Editura Universitaria, Craiova.
10. Oţel, I. (1974). Tehnologia produselor din carne. Editura Tehnică, Bucureşti.
11. Popovici, D., Oţel, I., Popa, G. (1967). Controlul alimentelor de origine animală. Editura Agro-Silvică, Bucureşti.
12. Roth, I. (1996). Tehnologia fabricării preparatelor din carne de la A la Z. Editura Tipotrib, Sibiu.
13. Savu, C. (2008). Igiena şi controlul produselor de origine animală. Editura Semne, Bucureşti
14. Ţibulcă, D., Sălăgean, D. (2000). Tehnologia cărnii şi a produselor din carne. Editura RISOPRINT, Cluj-Napoca.
15. Vacaru Opriş, I. (1974). Tehnologia produselor animale. Editura Institutul Agronomic „Ion Ionescu de la Brad", Iaşi