

## STORAGE AND PRESERVATION CONDITIONS USED FOR ANIMAL ORIGIN FOOD PRODUCTS (PORK MEAT)

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### Abstract

*The identification of biochemical indices of proteic degradation in order to establish their limit values for different freshness degrees was the aim of our paper. The total nitrogen, ammine nitrogen, ammonia nitrogen, the value of the proteolysis indices ( $N-NH_2 \cdot 100/\text{total N}$  and  $N-NH_3 \cdot 100/\text{total N}$ ) and amino acids content were studied and analyzed in correlation with the organoleptic alteration, function of storage duration, intensity of the proteolytic alteration preservation processes of meat. The study performed on pork meat emphasized values of 2.70% for the total nitrogen after 8 days of keeping at 0°C...4°C, total nitrogen 2.70%, ammine nitrogen 170 mg %, ammonia nitrogen increases up to 35.2 mg %, ad total amino acids content was between 75 - 80 mg %.*

**Keywords:** proteic degradation, pork meat, storage

### Introduction

The food stored products must maintain during storage their main food value as close as possible to fresh products. The organoleptic and physico-chemical freshness alterations vary function of the storage conditions (temperature, duration and moisture). In freeze food, the intensity of the organoleptic and physico-chemical alterations is much diminished compared to food kept at refrigeration temperature (Man, 2004; Ștețca, 2003a).

The methods used for the preservation of the food products must be of economical, practice and commercial interest. The preservation methods must be simple and efficient. The analyzed of the degradation products of proteins and fats from preserved food products can

represent objective biochemical tests of appreciation the hygienic quality of pork meat (CEE directives, nr.89/397, 99/12/CEE, 94/43/CEE and 93/99). Besides usual tests and methods, some indices of proteic degradation function storage duration and temperature were used (Stănescu, 1993; Şteţca, 2003b). The identification of biochemical indices of proteic degradation in order to establish their limit values for different freshness degrees was the aim of our paper.

### **Experimental**

During of years 2002, 2003 and 2004, 180 pork meat samples harvested from different muscle groups were organoleptic and biochemical examined. The study was performed in three slaughter houses A, B and C. The study was performed at 6 hours after meat sampling, and during storage at 0 - 4°C, 14 - 16°C and 20°C. The following parameters were studied: total nitrogen, ammine nitrogen, ammonia nitrogen, the value of the proteolysis indices ( $\text{N-NH}_2 \cdot 100/\text{total N}$  and  $\text{N-NH}_3 \cdot 100/\text{total N}$ ) and amino acids content.

### **Results and Discussions**

The total nitrogen determined in meat at 8 hours after slaughtering had values between 2.92 - 3.0g percent. During meat storage, the total nitrogen decreased in all analyzed samples. The decrease velocity was proportional with the temperature and storage duration. At 0°C...4°C, after 8 days storage, the total nitrogen was of 2.70 % (table 1). After 8 hours from slaughter, the ammine nitrogen had values between 41-60 mg %. In continues to increase with the temperature and storage duration. In the end of the storage, at 0°C...4°C, values of 170 mg % were recorded for the ammine nitrogen (table 1). These values show organoleptic changes, which demonstrate the total alteration.

The ammonia nitrogen, at 8 hours after slaughter, varies between 15 – 18.05 mg percent. During meat storage at 0°C...4°C, it increases up to 35.2 mg %. The organoleptic changes appeared when it is over 35 mg % (table 2). When meat is stored a higher temperatures, the organoleptic changes appear at lower ammonia values, 25-30 mg %

(Laslo, 1997; Stănescu, 1998). The indices of proteolysis revealed by the N-NH<sub>2</sub>/100/N total and N-NH<sub>3</sub>/100/N total ratios recorded variation function of the meat freshness, hygienic conditions of storage. They also reflect the proteolytic activity of the muscular fiber (Laslo, 1997; Stănescu, 1998). The N-NH<sub>2</sub>/N total has values of 2.5 in fresh meat; 2.5-5.0 in relatively fresh meat and over 5 in altered meat (table 2).

**Table 1.** Significance of differences between total and ammine nitrogen content of pork meat stored in different conditions – "t" test

Issues	df	Total nitrogen			Ammine nitrogen		
		Differences (storage conditions)		t	Differences (storage conditions)		t
At slaughter	358	A - B	-0,08 <sup>ns</sup>	0.723	A - B	-17 <sup>***</sup>	4.543
	358	A - C	-0,03 <sup>ns</sup>	0.723	A - C	-19 <sup>***</sup>	4.093
	358	B - C	0,05 <sup>ns</sup>	0.514	B - C	-2 <sup>ns</sup>	1.138
2 days	358	A - B	0,10 <sup>**</sup>	2.622	A - B	-22 <sup>***</sup>	4.523
	358	A - C	0,20 <sup>**</sup>	2.650	A - C	-40 <sup>***</sup>	6.834
	358	B - C	0,10 <sup>**</sup>	2.731	B - C	-18 <sup>***</sup>	3.893
4 days	358	A - B	0,10 <sup>**</sup>	2.527	A - B	-42 <sup>***</sup>	4.543
	358	A - C	0,20 <sup>**</sup>	2.413	A - C	-28 <sup>***</sup>	4.094
	358	B - C	0,10 <sup>**</sup>	2.621	B - C	14 <sup>***</sup>	3.745
6 days	358	A - B	0,05 <sup>ns</sup>	0.819	A - B	-71 <sup>***</sup>	6.892
	358	A - C	0,15 <sup>**</sup>	2.942	A - C	-106 <sup>***</sup>	8.925
	358	B - C	0,10 <sup>**</sup>	2.653	B - C	-35 <sup>***</sup>	4.937
8 days	358	A - B	0,05 <sup>ns</sup>	0.924	A - B	50 <sup>***</sup>	5.837
	358	A - C	0,10 <sup>**</sup>	2.944	A - C	-20 <sup>***</sup>	4.865
	358	B - C	0,05 <sup>ns</sup>	0.932	B - C	-70 <sup>***</sup>	5.654

ns- p > 0.05; \*\* - p < 0.01; \*\*\*- p < 0.001

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The N/NH<sub>3</sub>/N total index recorded values under 1.0 in fresh meat, between 1.0 – 1.5 in relatively fresh meat and over 1.5 in altered meat (table 3). When meat is stored at relative high temperatures (14°C...20°C), the organoleptic changes are observed at values over 1.0 (Laslo, 1997; Stănescu, 1998).

**Table 2.** Significance of differences between ammonia nitrogen total N-NH<sub>3</sub> 100/N content of pork meat stored in different conditions – "t" test

Issues	df	Ammonia nitrogen			Total N-NH <sub>3</sub> ×100/N		
		Differences (storage conditions)		t	Differences (storage conditions)		t
At slaughter	358	A - B	3.050**	2.821	A - B	-0.500 <sup>ns</sup>	0.897
	358	A - C	0.150 <sup>ns</sup>	0.675	A - C	-0.700 <sup>ns</sup>	0.988
	358	B - C	-2.900*	2.422	B - C	-0.200 <sup>ns</sup>	0.651
2 days	358	A - B	-4.600***	3.812	A - B	-0.800 <sup>ns</sup>	0.887
	358	A - C	-6.650***	4.334	A - C	-1.400 <sup>ns</sup>	1.112
	358	B - C	-2.050*	2.315	B - C	-0.600 <sup>ns</sup>	0.976
4 days	358	A - B	-8.200***	6.812	A - B	-1.500 <sup>ns</sup>	1.119
	358	A - C	-13.100***	8.312	A - C	-4.600***	3.672
	358	B - C	-4.900***	5.912	B - C	-3.100***	3.544
6 days	358	A - B	-9.600***	7.823	A - B	-2.600**	3.214
	358	A - C	-14.750***	8.219	A - C	-3.800***	4.312
	358	B - C	-5.150***	7.883	B - C	-1.200 <sup>ns</sup>	0.988
8 days	358	A - B	-10.000***	8.993	A - B	-0.400 <sup>ns</sup>	0.977
	358	A - C	-21.000***	8.344	A - C	-1.000 <sup>ns</sup>	0.876
	358	B - C	-11.000***	7.829	B - C	-0.600 <sup>ns</sup>	0.721

ns- p> 0.05; \*-p<0.05; \*\* - p < 0.01; \*\*\*- p <0.001

The total amino acids content vary function of meat freshness and hygienic conditions of storage. In relatively fresh meat, the alterative changes appear at over 250 mg %. When meat is stored at 14°C...20°C, the alterative changes appear at 150-200 mg % amino acids content (Laslo, 1997; Stănescu, 1998). When meat is stored at 0°C...4°C, in our study, in fresh meat, at 8 hours after slaughter, (table 3) values between 75-80 mg % amino acids were recorded. In relatively fresh meat at 2 days after slaughter, values of 185 – 215 mg % amino acids were recorded. The differences between the content in the main analyzed parameters function of the storage conditions are in majority statistically very significant ( $p < 0.001$ ).

**Table 3.** Significance of differences between total N-NH<sub>2</sub>100/N total and amino acids nitrogen content of porc meat stored in different conditions – ”t” test

Issues	df	Total N-NH <sub>2</sub> ×100/N			Amino acid nitrogen		
		Differences (storage conditions)		t	Differences (storage conditions)		t
At slaughter	358	A - B	0.150 <sup>***</sup>	3.457	A - B	-5.0 <sup>ns</sup>	0.893
	358	A - C	0.050 <sup>ns</sup>	0.939	A - C	-4.0 <sup>ns</sup>	0.675
	358	B - C	-0.100 <sup>**</sup>	2.871	B - C	1.0 <sup>ns</sup>	0.234
2 days	358	A - B	-0.120 <sup>**</sup>	2.988	A - B	-13.5 <sup>**</sup>	2.456
	358	A - C	-0.270 <sup>***</sup>	3.722	A - C	-29.5 <sup>**</sup>	2.667
	358	B - C	-0.150 <sup>***</sup>	3.677	B - C	-16.0 <sup>**</sup>	2.345
4 days	358	A - B	-0.300 <sup>***</sup>	4.544	A - B	-5.0 <sup>ns</sup>	0.675
	358	A - C	-0.500 <sup>***</sup>	4.823	A - C	-55.0 <sup>**</sup>	3.687
	358	B - C	-0.200 <sup>***</sup>	3.514	B - C	-50.0 <sup>**</sup>	3.778
6 days	358	A - B	-0.350 <sup>***</sup>	3.766	A - B	140.0 <sup>***</sup>	6.928
	358	A - C	-0.600 <sup>***</sup>	5.012	A - C	122.0 <sup>***</sup>	6.366
	358	B - C	-0.250 <sup>***</sup>	3.432	B - C	-18.0 <sup>**</sup>	3.014

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8 days	358	A – B	-0.300 <sup>***</sup>	3.889	A – B	78.6 <sup>***</sup>	5.834
	358	A – C	-0.800 <sup>***</sup>	7.988	A – C	167.7 <sup>***</sup>	7.099
	358	B – C	-0.500 <sup>***</sup>	4.512	B – C	89.1 <sup>***</sup>	5.981

ns -  $p > 0.05$ ; \*\* -  $p < 0.01$ ; \*\*\*-  $p < 0.001$

### Conclusions

The study performed on pork meat emphasized values of 2.70% for the total nitrogen after 8 days of keeping at 0°C...4°C, total nitrogen 2.70%, ammine nitrogen 170 mg %, ammonia nitrogen increases up to 35.2 mg %, ad total amino acids content was between 75 - 80 mg %. Within presented experimental conditions, the average values of the main biochemical indices were established. They permit the pork meat classification in:

- **Fresh category** (total nitrogen over 3 g %, ammine nitrogen under 150 mg%, ammonia nitrogen under 20 mg%, total amino acids content under 150 mg %; no organoleptic changes);
- **Relatively fresh category** (total nitrogen over 2.4 - 3 g %, ammine nitrogen under 150 - 240 mg%, ammonia nitrogen 20 - 40 mg%, total amino acids content 150 - 240 mg %, slight organoleptic changes);
- **Altered** (total nitrogen under 2.5 g %, ammine nitrogen over 200 mg%, ammonia nitrogen over 40 mg%, total amino acids content over 240 mg %, emphasized organoleptic changes).

The differences between the main analyzed parameters function of storage conditions were in majority statistically very significant ( $p < 0.001$ ).

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\*\*\*Directiva Consiliului CEE nr.89/397 din 14 iun. 1999 privind controlul oficial al alimentelor.

\*\*\*Directiva Comisiei nr. 99/12/CEE din 08 mar. 1999 privind inspecția și verificarea bunelor practici de laborator (GLP<sub>s</sub>) (J. Oficial din 23.03.1999).

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\*\*\*Directiva Consiliului CEE nr. 93/99 din 29 octombrie 1993 asupra măsurilor suplimentare privind controlul oficial al alimentelor.