

## THE AMOUNT OF PROTEIN AND INFLUENCE OF VARIOUS ACID SOLUTION AND WATER IN MICROBIOLOGY OF FRESH AND FROZEN PORK SKINS

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### ABSTRACT

The aim of this exam was to determine the amount of protein in fresh and frozen pork skins, as well as, the acid influence on their microbiology. A total of 120 kg pork skins were taken (selected randomly), divided in two groups – 60 kg fresh and 60 kg frozen, immersed in three different combinations of acid solution (acetic, lactic, tartaric, citric) and water. Six groups were obtained for further analysis: fresh skins immersed in solutions A, B, C and frozen skins immersed in A, B, C solutions. Samples from all groups were taken before and after immersion, for chemical and microbiological analysis. Samples were homogenized and analyzed for amount of water, fats, ash and proteins. Pork skins were putted in solution for 72 hours, then washed and well drained. Water content varied from 52.01 to 62.8 %, while the content of proteins was from 10.7 to 13.83 %. Microbiological analysis showed that in pork skins immersed in acid solutions were not found species of bacteria *Clostridium*, *Staphylococcus*, *Proteus*, *Escherichia*. Total bacteria (*Bacillus*) number is reduced in all groups immersed in acid solutions compared to the fresh ones. Reduction in the total number of bacteria before and after immersion was determined in solution A.

**Keywords:** pork skins, proteins, chemical and microbiological analysis.

### INTRODUCTION

During the life of the animal, the skin is in permanent direct contact with the sources of contamination and an excellent place for the development of numerous surface microbial contamination (eg. fissures, follicles) (Kim et al., 1996). Pork skin represents an excellent source of protein and serves as a supplement to a number of boiled meat products. The skins are quite solid by nature and undergo softening using various combinations of acids (acetic, lactic, tartaric, citric) and water. Simultaneously, immersion in these solutions serves as a good bacteriological protection. Different bacteria species (*clostridium*, *staphylococcus*, *proteus*, *escherichia*, *salmonella*, *listeria*) are analyzed at the fresh pork and chicken skins by various authors (Pipek et al. 2006; Trivedi et al. 2008; Lecompte et al. 2009; Morild et al. 2011; Chaine et al. 2013).

The aim of this exam was to determine the amount of proteins in fresh and frozen skins, before and after immersion in different solutions of acids and water. Also, our goal was to see microbiological difference between fresh and frozen pork skins before and after immersion in different solutions of acids and water.

### MATERIAL AND METHODS

A total of 120 kg pork skins were taken (selected randomly), divided in two groups - 60 kg fresh and 60 kg frozen, immersed in three different combinations of acid solution (acetic, lactic, tartaric, citric) and water. Six groups were obtained - fresh (3 x 20 kg) and frozen (3 x 20 kg) skins immersed in:

- A - solution (15 g acetic acid, 200 g lactic acid, 100 g tartaric acid, 100 g citric acid, 18,5 l water),
- B - solution (200 g lactic acid, 100 g tartaric acid, 19,7 l water),

- C - solution (50 g acetic acid, 200 g lactic acid, 19,7 l water).

Pork skins are separated from the bacon using a special machine called DERINDER. This machine is composed of a base, electric motor, grinning roller and sharp knife. The bacon and the skin are putted on the drum DERINDER - with the skin downward, the roller takes the pieces and move them right to the blade which peels off the skin of bacon. Samples from all groups were taken before and after immersion, for chemical and microbiological analysis. Earlier samples were cutted ground and well homogenized in a small mixer for home use. Pork skins were putted in solution for 72 hours, then washed and well drained.

#### *Chemical analyses*

Total nitrogen (TN) was determined according to the Kjeldahl method. Moisture content was determined by drying at  $(103 \pm 2)$  °C to constant mass. The intramuscular fat content was determined according to AOAC International method, with petroleum ether as solvent. Minerals were determined by burning and combustion (4 – 5 h) at 525 – 550 °C.

#### *Microbial analysis*

Following bacteria were determined: Total bacteria (*Bacillus*) number - ISO 4833 / 2003. Sown on nutrient agar to 37 °C during 24 hours. *Staphylococcus* ISO 6888 - 1 / 1999. Sown on ETGP agar (barit parker agar) after thermostating on 37 °C during 24 hours. *Enterobacteriaceae* ISO 21528 - 1 / 2004; ISO 21528 - 2 / 2009. *Escherichia coli* are sown on lactoza bujon and brilian green, thermostated on 37 °C during 24 - 48 hours. *Clostridium* sown on sulfiten agar, thermostated on 37 °C during 24 - 48 hours.

Data were transformed into  $\log_{10}$  CFU/g before comparison of means.

The results were statistically processed using mathematical program EXEL ANOVA 2007 / 2010, T – test.

## **RESULTS AND DISCUSSION**

### **Chemical composition**

The results of the chemical composition of fresh and frozen skin before and after immersion is shown in Table No. 1. Generally, the water content of fresh and frozen skin varied from 52.33 to 58.3. After the sinking of the skins in different solvents water content increases from 53.22 to 60.2. The content of fat in fresh and frozen skin before and after immersion quite varied and ranges from 26.2-38.0. The content of protein in fresh and frozen skin is fairly uniform and ranged from 10.70 to 13.83. Immersion in different solvents did not affect the chemical composition of the skins.

Table No. 1 Chemical composition of fresh and frozen pork skins before and after immersion in different acids solutions.

Before immersion			
Parameters	Fresh skin + A sol. $\bar{X} \pm Sd$	Fresh skin + B sol. $\bar{X} \pm Sd$	Fresh skin + C sol. $\bar{X} \pm Sd$
Water	55.63 ± 0.5	54.63 ± 0.25	52.33 ± 0.018
Fats	31.5 ± 1.3	31.5 ± 1.3	38.0 ± 0.025
Proteins	13.83 ± 0.37	13.42 ± 0.40	11.27 ± 0.02
Minerals	0.27 ± 0.02	0.14 ± 0.01	0.48 ± 0.01
After immersion			
Parameters	Fresh skin + A sol. $\bar{X} \pm Sd$	Fresh skin + B sol. $\bar{X} \pm Sd$	Fresh skin + C sol. $\bar{X} \pm Sd$
Water	60.2 ± 0.6	55.72 ± 1.56	53.22 ± 0.6
Fats	26.2 ± 0.7	30.15 ± 1.0	37.0 ± 2.0
Proteins	13.33 ± 0.15	13.40 ± 0.20	11.20 ± 0.30
Minerals	0.27 ± 0.02	0.12 ± 0.2	0.48 ± 0.03
Before immersion			
Parameters	Frozen skin+ A sol. $\bar{X} \pm Sd$	Frozen skin+ B sol. $\bar{X} \pm Sd$	Frozen skin+ C sol. $\bar{X} \pm Sd$
Water	58.34 ± 0.02	52.01 ± 0.81	54.83 ± 0.41
Fats	28.0 ± 1.0	37.0 ± 0.86	33.0 ± 0.1
Proteins	13.16 ± 0.12	10.79 ± 0.12	13.67 ± 0.40
Minerals	0.20 ± 0.08	0.20 ± 0.02	0.25 ± 0.03
After immersion			
Parameters	Frozen skin+ A sol. $\bar{X} \pm Sd$	Frozen skin+ B sol. $\bar{X} \pm Sd$	Frozen skin+ C sol. $\bar{X} \pm Sd$
Water	62.81 ± 0.12	53.28 ± 0.7	55.02 ± 0.02
Fats	26.82 ± 1.3	35.02 ± 1.2	32.88 ± 0.28
Proteins	13.14 ± 0.52	10.70 ± 0.7	13.40 ± 0.40
Minerals	0.29 ± 0.05	0.22 ± 0.07	0.27 ± 0.04

$\bar{X}$  = mean, Sd = standard deviation

#### Microbiological analysis

Microbiological analysis (Table No. 2) showed that in pork skins immersed in acid solutions (72 hours) were not found species of bacteria *Clostridium*, *Staphylococcus*, *Proteus*, *Escherichia*. The total number of bacteria (*Bacillus*) in frozen skin was slightly higher compared to the total number of bacteria in fresh pig skin. After immersion in various solutions of acids and water, major differences in the total number of bacteria determined in solution A, while reducing less determined the total number of bacteria in the B solution.

Table No. 2 Results of microbiological analysis of fresh and frozen pork skins before and after immersion in different solutions of acids and water.

<b>Bacteriology Before immersion</b>	<b>Bacteriology Before immersion</b>	<b>Bacteriology Before immersion</b>
Fresh skin A Total bacteria number	Fresh skin B Total bacteria number	Fresh skin C Total bacteria number
2 log CFU/g.	2.17 log CFU/g.	2.47 log CFU/g.
Frozen skin A Total bacteria number	Frozen skin B Total bacteria number	Frozen skin C Total bacteria number
2.17 log CFU/g.	2.30 log CFU/g.	2.47 log CFU/g.
<b>After immersion</b>	<b>After immersion</b>	<b>After immersion</b>
Fresh skin A Total bacteria number	Fresh skin B Total bacteria number	Fresh skin C Total bacteria number
1.31 log CFU/g.	2.0 log CFU/g.	2.39 log CFU/g.
Frozen skin A Total bacteria number	Frozen skin B Total bacteria number	Frozen skin C Total bacteria number
1.90 log CFU/g.	2.17 log CFU/g.	2.39 log CFU/g.

The statistical processing of the obtained chemical and microbiological results showed no statistically significant difference among the tested samples ( $p > 0.05$ ).

### Conclusion

The maximum content of protein in pork skins of Macedonian origin is 13.83 %. The best results and the greatest reduction of total bacteria number in fresh and frozen pork skins showed A solution.

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