

# COMPARISON OF SELECTED QUALITATIVE PARAMETERS OF FOOD PRODUCTS "SMOKED DUCK BREASTS CHILLED" AND "SMOKED DUCK BREASTS FROZEN"

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## SUMMARY

The aim of the project was to assess the influence of processes of preservation (chilling and freezing) on quality parameters of the thermally treated poultry meat products. Duck breasts were first defrosted, and then cooked and preserved by chilling and deep-freezing. In the next phase, the individual sensory, physical and chemical, and microbiological parameters were compared. Observation of their influence on qualitative properties of both products followed.

Comparison of quality of smoked duck breasts preserved by freezing and chilling proved that both ways of preservation did not affect the original properties of products. Even some of the examined individual sensory parameters (taste, flavor, and tenderness) showed higher values in pair test. Microbiological quality of both products was in accordance with requirements of the Codex alimentarius of the Slovak Republic.

**Key words:** duck, chilled breast, frozen breast, sensory evaluation

## INTRODUCTION

### Consumption of poultry meat in SR

Meat has had an important role in the human nutrition for many centuries. In recent years, poultry meat has become increasingly popular owing to its dietetic properties, lower fat content, and fast and easy culinary dressing, but also favourable prices. Poultry meat, in comparison with beef meat, is among the most consumed meats in the world. Success is primarily due to its low price in comparison with other types of meats, wide use all over the

world, a relative health safety, and the fact that it has been accepted by most cultures and religions. In 2004 in the Slovak Republic, poultry meat took the second place after pork meat (Table 1).

According to results in the field of animal production (Statistic bureau of SR) recorded in 2003 and compared with the last-year results, the average rate of poultry production was increased by 3.8 % and average rate of laying hens by 3.6%. Total production of live poultry reached 126.1 thousand tons, i.e. it was decreased by 0.9 % (1.1 thousand tons). The slaughtered poultry market amounted to approximately 108.0 thousand tons, in opposition to the same period of the last year when it was reduced by 0.9 % (946 tons). Market increase was recorded only in broiler chickens (1.8 %). Sales of turkeys decreased by 46.8 %, hens 2.9 %, and ducks 21.6 %, respectively.

Development of the poultry situation indicated that

▼ **Table 1.** Consumption of meat in the Slovak Republic from 1999 to 2004

▼ **Tablica 1.** Potrošnja mesa u Republici Slovačkoj od 1999.-2004.

	1999	2000	2001	2002	2003	2004
Poultry Meso peradi	17.4	17.1	18.5	20.1	20.3	20.7
Beef Govedina	10.4	9.3	7.0	6.8	6.8	6.8
Pork Svinjetina	35.9	33.1	31.8	31.3	31.2	31.2

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in 2004, in comparison with 2003, it was reasonably to expect by 2.4% reduced production of live poultry for slaughter. Reduced production can be explained by moderate rate of consumption of poultry meat per capita and year.

Poultry production is one of stable branches of agriculture in the SR stable. Its representation in the total meat consumption among the Slovak population shows a constant upward trend. Increase in the consumption of poultry meat is not only due to acceptable price, in the situation when poultry meat is considered social meat, but also to the possibility of multiple uses in the preparation of healthy and dietetic meals. Poultry meat has become a world-spread commodity. In the most developed countries, there is an increased demand for white meat and reduced demand for red meat.

In contrast with 2003, the increased import of all types of poultry meat (chickens, turkeys, and ducks) was recorded in 2004. Reported facts are consistent with structure of purchased poultry from domestic producers, primarily as regards the purchase of chickens on the account of other kinds of live poultry. Out of the total volume of imported meat, meat of gallinacean birds (hens, broilers) amounted to 65.9%, meat of turkeys to 20.3% and meat of water

poultry (geeses, ducks) to 13.9% respectively. Duck meat has a nutritional value and it represents enrichment of menu, in spite of a higher portion of fat.

#### Chemical composition of poultry meat

Chemical composition of meat is type-related, but it also depends on technological processes in the production and processing of meat (Table 2).

Proteins are the most important components of meat, primarily from the nutritional and technological point of view. Protein content in pure muscles is 18 – 22 %. Lipids represent a group of lipophilic, chemically different substances, like free fatty acids, composite fats, fat-soluble hydrocarbons, and vitamins. In the food and analytical practice, total fat content is considered as qualitative and quantitative parameter (Příbela, 1991). Fat is important for taste and tenderness of meat and plays an essential role from sensory point of view, because it is a carrier of aromatic and flavour substances (Pipek, 1995).

#### Sensory properties of poultry meat

Sensory properties of meat (taste and flavour, colour and texture, proportion of muscle and collagen tissues, structure, tenderness and juiciness) influence its quality. These properties are of utmost

▼ **Table 2.** Chemical composition of selected types of meat

▼ **Tablica 2.** Kemijski sastav nekih vrsta mesa

Chemical components (g/100 g) Kemijski sastav	Type of meat Vrsta mesa			
	Duck Pačje meso	Chicken Pileće meso	Pork Svinjetina	Beef Govedina
Energy (KJ) Energija	970	475	1295	705
Saccharides Saharidi	0.1	0.3	0.3	0.3
Proteins Bjelančevine	11	13.5	12.9	13.4
Fat Mast	20.8	6.4	28.6	12.6
Calcium Kalcij	10.7	16	10.6	7.6
Vitamin A	0.084	0.005	0.007	0.01
Vitamin B <sub>1</sub>	0.119	0.077	0.567	0.065
Vitamin C	5.9	0.7	1.8	0

importance for end consumers. Consumers make their decision according to total appearance, including colour of meat, cleanness, dressing, presence and ratio of connective tissues, and relationship between fat, muscle and bone tissues (Ingr, 1995).

#### Chilling and freezing of poultry products

In general, microorganisms present biological risk of poultry products. Various ways of preservation are used for prevention or elimination of this risk, including chilling and freezing. Following chilling media used in practice are: air, dry ice (solid carbon oxide), and liquid nitrogen.

Thermally treated poultry products are chilled in accordance with hygiene requirements in a way that the temperature of 4 °C is reached as soon as possible after cooking.

Chilling with cold air is one of the currently acceptable procedures. Mostly, contamination by mutual contact is avoided. Negative accompanying factors might be sludge and lower meat yield.

#### Freezing of poultry products

Deep frozen products are foodstuffs intended for human consumption, but also for preparation of meals. These products must be frozen as fast as possible, i.e. when the phase of maximal production of ice crystals corresponds to type of food. In the final phase, when the temperature of -18 °C, and lower, is reached and stable, this temperature must be maintained without fluctuations.

Frozen products, indicated in the relevant chapter of Codex alimentarius, are foodstuffs intended for human consumption, but also for preparation of meals. These products must be frozen as fast as possible, i.e. when the phase of maximal production of ice crystals corresponds to type of food. In the final phase, when the temperature of -12 °C is reached and stable, these products must be put on the market in the same conditions (Codex alimentarius of the Slovak Republic No. 2986/2003-100).

Freezing must be done without delay, using equipment in the manner to avoid unfavourable chemical, biochemical, and microbiological changes. The following freezing media are used for direct freezing:

a) Liquid air, b) Liquid nitrogen, c) Liquid carbon oxide (Codex alimentarius No. 2986/2003-100).

Rapid freezing shortens the stay of food in dangerous temperature zone, when large crystals are produced. These crystals deteriorate cell walls. On the other hand, if freezing is rapid, the cell tissues remain almost undamaged. Determinant factor is optimum timing of the freezing process in compliance with ideal temperature interval during the entire process, primarily without temperature fluctuation. Moreover, during storage of food under chilling conditions, numerous biological and chemical changes occur. Similar changes can not be expected in case of deep frozen food, and deep frozen food products are foodstuffs of high quality and safety. In spite of possible sensory deviations, mostly because of fat oxidation, some flavour properties of frozen meat are significantly better than in fresh meat (juiciness, tenderness) (Komes, 2002).

#### MATERIAL AND METHODS

Duck breasts were processed in the company Rybárstvo Požehy, GmbH. After defrosting, they were flushed with drinking water and dipped in a salt solution. After salting followed phase of drying, smoking, and cooking to achieve 70 °C for 2 hours in the centre of the products. The last phase after cooking was chilling at 4 °C, shock freezing respectively, in a tunnel and -18 °C in the centre of products. Consequently, thus treated duck breasts (cooked and chilled or frozen) were evaluated on the basis of sensory examination, analysis of physical and chemical properties and microbiological examination in accordance with requirements of the Codex alimentarius of the Slovak Republic (1998).

Pair test is a resolution method for comparison of two products. A team of six experts did evaluation. They assessed flavour, taste, juiciness and tenderness of chilled and frozen products. Samples of chilled duck breasts (n = 6) and frozen duck breasts (n = 6) were sequenced into six pairs and marked with codes, which precluded their identification. Triangle test is in principle identical to pair test, but assessed samples are organised in triplets (two are the same and one is different). Samples were submitted in six triplets and in this order they were also evaluated (Příbela et al., 2001) by a panel of six experts.

Analyses of physical and chemical parameters

(protein content, fat content, water content, and loss of water) were done according to Standard laboratory methods – Chemistry of food (1990). The same number of samples as for sensory evaluation was analysed in parallel series. Sensory evaluation and physical and chemical analyses were performed at the Institute of meat hygiene and technology of the University of veterinary medicine in Košice.

Microbiological parameters were assessed according to the following legislative rules: total bacteria count (TBC) according to STN ISO 4833 for counting of colonies cultivated at 30 °C, coliform bacteria according to STN ISO 4832, bacteria of *Salmonella* strain according to STN EN ISO 12824, and examination of coagulase positive staphylococci according to STN EN ISO 6888-1. In our experiment, the average results of three analyses of frozen and chilled smoked duck breasts were used. Microbiological analyses were performed in the accredited laboratory of the State veterinary and food institute in Dolný Kubín.

## RESULTS AND DISCUSSION

### Sensory evaluation

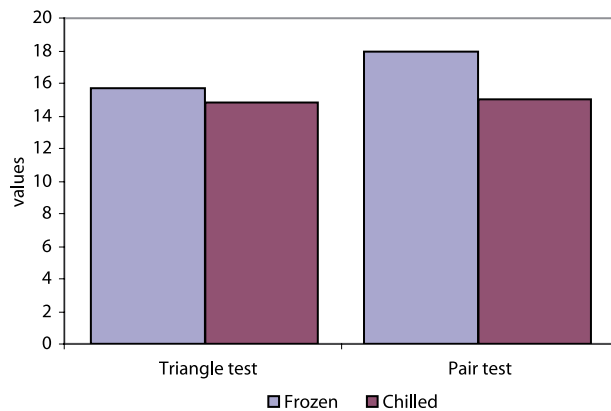
Evaluation of smoked duck breasts, chilled and frozen, revealed certain differences (Graph 1). In both used tests, the appointed team of experts allocated higher values to frozen smoked duck breasts. Moreover, at evaluation of individual sensory parameters (Graph 2) higher values were allocated to frozen breasts, primarily with respect to flavour, taste, and tenderness. Evaluation of juiciness, in both samples, gave similar results. In triangle test, a different sample (chilled smoked duck breasts) was identified only by 1 expert, and 5 of them did not discover any difference. It means that contrast between samples was not significant. Pair test gave results clearly in favour of deep frozen duck breasts.

- ▼ Average values of individual parameters evaluated by a panel of six experts
- ▼ Prosječne vrijednosti pojedinih parametara prema procjeni tima od šest eksperata

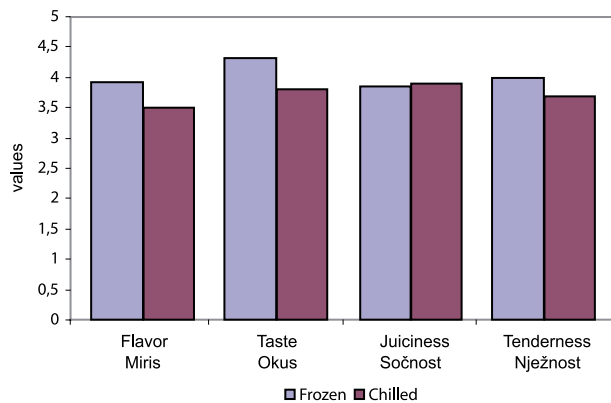
Flavour Miris		Taste Okus		Juiciness Sočnost		Tenderness Nježnost	
Frozen: Smrznuto	Chilled: Ohlađeno	Frozen: Smrznuto	Chilled: Ohlađeno	Frozen: Smrznuto	Chilled: Ohlađeno	Frozen: Smrznuto	Chilled: Ohlađeno
3.93	3.5	4.33	3.8	3.86	3.9	4.0	3.7

Average values in triangle test	Average values in pair test
Frozen: 15.7	Frozen: 18
Chilled: 14.8	Chilled: 15

- ▼ **Graph 1** Comparison of average values in sensory evaluation of frozen and chilled smoked duck breasts
- ▼ **Graf 1.** Usporedba srednjih vrijednosti kod senzorne procjene smrznutih i ohlađenih dimljenih pačjih prsiju



- ▼ **Graph 2** Comparison of average values of individual parameters in sensory evaluation
- ▼ **Graf 2.** Usporedba srednjih vrijednosti pojedinih parametara senzorne procjene



Examined physical and chemical parameters (protein content, fat content, water content, and water loss) did not show significant variability (Table 3). Slight differences were recorded only in water losses in favour of chilled duck breasts. Water and fat contents were higher in chilled duck breasts, while protein content was higher in frozen duck breasts (Graph 3).

The analysed microbiological parameters of samples of frozen and chilled duck breasts did not show significant differences. Values of selected microbiological parameters, in both examined samples, were by far below the permissible limits established by the Codex alimentarius of the Slovak Republic (Table 4).

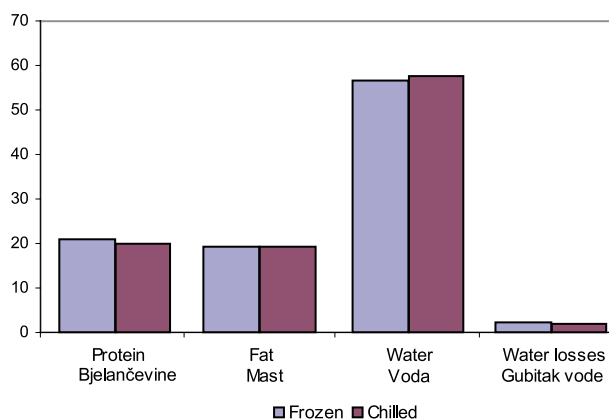
## CONCLUSION

The consequence of fast freezing is the formation of smaller ice crystals within cells. It leads to a higher quality of products, primarily in the sense of taste and texture. Extremely fast freezing maintains freshness and quality of most products in comparable sensory, physical and chemical and microbiological quality of fresh products.

Comparison of quality of smoked duck breasts

▼ **Graph 3** Comparison of physical and chemical parameters of frozen and chilled smoked duck breasts

▼ **Graf 3.** Usporedba fizikalnih i kemijskih svojstava smrznutih i ohlađenih dimljenih pačjih prsiju



preserved by freezing and chilling proved that the original properties of products could be maintained by both modes of preservation. Even some of the examined individual sensory parameters (taste, flavour and tenderness) showed higher values in pair test. Microbiological quality of both products was in accordance with requirements of the Codex alimentarius of the Slovak Republic.

▼ **Table 3** Comparison of physical and chemical properties of frozen and chilled smoked duck breasts

▼ **Tablica 3.** Usporedba fizikalnih i kemijskih svojstava smrznutih i ohlađenih dimljenih pačjih prsiju

Sample Uzorak	Parameters Parametri			
	Water loss Gubitak vode (%)	Water content Količina vode (%)	Protein content Količina bjelančevina (%)	Fat content Količina masti (%)
Frozen duck breasts Smrznuta pačja prsa	2.36	56.69	20.90	19.18
Chilled duck breasts Ohlađena pačja prsa	2.07	57.69	19.99	19.47

▼ **Table 4** Results of microbiological examination of frozen and chilled smoked duck breasts

▼ **Tablica 4.** Rezultati of mikrobiološke pretrage smrznutih i ohlađenih dimljenih pačjih prsiju

	TBC	Coliform bacteria	<i>Salmonella</i>	<i>Staphylococcus aureus</i>	Anaerobic spore forming bacteria
Frozen breasts Smrznuta prsa	$2.4 \times 10^2$	$< 1 \times 10^1$	negative	$< 5 \times 10^1$	0
Chilled breasts Ohlađena prsa	$4.5 \times 10^1$	$< 1 \times 10^1$	negative	$< 5 \times 10^1$	0

**SAŽETAK****USPOREDBA KAKVOĆE DIMLJENIH SMRZNUTIH I OHLADENIH PROIZVODA OD PAČJEG MESA**

Cilj ispitivanja je bila procjena utjecaja procesa konzerviranja (hlađenja i smrzavanja) na kvalitativne parametre termički obrađenih proizvoda od mesa peradi. Pačja prsa su najprije odmrznuta, a zatim kuhana i konzervirana hlađenjem ili smrzavanjem. U sljedećoj fazi, uspoređeni su pojedini senzorni, te fizikalni, kemijski i mikrobiološki parametri. Nakon toga je slijedilo praćenje njihovog utjecaja na kvalitativna svojstva oba proizvoda.

Usporedba kakvoće dimljenih pačjih prsiju, prethodno smrznutih ili ohlađenih, pokazala je da oba načina konzerviranja ne utječu na izvorna svojstva proizvoda iako su u analizi pojedinih senzornih parametara (okus, miris i nježnost) veće vrijednosti dobivene u parnim usporednim testovima. Mikrobiološka kakvoća oba proizvoda bila je sukladna zahtjevima Codex alimentarius Republike Slovačke.

**Ključne riječi:** patka, ohlađena prsa, smrznuta prsa, senzorna procjena

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# FIZIKALNO-KEMIJSKE OSOBINE SLAVONSKOG KULENA

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**SAŽETAK**

Na 100 uzoraka kulena s "Večernjakove kulenijade 2004", iz različitih područja Slavonije (Posavina, n=35; središnja i istočna Slavonija, n=32 i zapadna Slavonija, n=33) izmjerene su vrijednosti pH i aktiviteta vode ( $a_w$ ). Utvrđena je visoka homogenost uzoraka Slavenskog kulena glede analiziranih osobina (koeficijenti varijabilnosti za pH=3.5 % i  $a_w$ =4.2 %), kao i nepostojanje značajnijih razlika analiziranih pH i  $a_w$  svojstava između uzoraka iz različitih regija ( $p>0.05$ ). Uz 95%-tnu vjerojatnost, procijenjeni su intervali pouzdanosti za prosječni pH (5.42-5.49) i prosječni  $a_w$  (0.780-0.800) zrelog kulena.

**Ključne riječi:** Slavonski kulen, fizikalno-kemijske osobine, pH, aktivitet vode ( $a_w$ )

**UVOD**

Poznavanje osobina trajnih kobasica, posebice tradicionalnih specijaliteta određenog područje, predmet je sve većeg interesa. S ciljem da se opišu tipične karakteristike proizvoda, u literaturi nalazimo podatke o kemijskim, fizikalnim, mikrobiološkim i organoleptičkim (senzornim) analizama na tradicionalnim grčkim (Ambrosiadis i sur., 2004), španjolskim

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