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Effects of Nutrition and Heat Treatment Methods on Sensory Traits of Chicken Meat

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Abstract: In order to meet the needs of world market it is necessary to enlarge quantity and improve quality of chicken meat. Positive effects of dietary supplementation of pronutritive materials – probiotics in chicken feed resulted in better feed conversion and faster body weight gain. The influences of probiotics inclusion in feed and different cooking treatment on sensory attributes and cooking loss, as main quality characteristics of chicken breast meat, were investigated in this paper. The results showed that supplemented probiotics decrease cooking loss and effect formation of characteristic sensory attributes of thermally treated chicken meat. Sensory attributes of experimental group were assigned somewhat lower grades than control group, whereas combination of dry and water cooking- stewing, was used as the most appropriate method for processing chicken meat from trial group.

Key words: sensory analysis, cooking loss, cooking treatments, probiotics.

Introduction

Poultry meat processing and production has been in continuous rise in developed countries in recent years (Popov-Raljac et al., 2002). New trends in

the world market require fulfillment of high quality standards, with due regard to environmental considerations, ethical concerns and issues related to human treatment of animals during meat production (Andersen et al., 2005). The term "meat quality" means the totality of features and characteristics of a meat product that bears on its ability to satisfy stated or implied needs concerning its consumption, processing or storage and sale. The key features from the meat safety point of view include nutritive value, aroma, texture, water binding capacity, colour, composition and fat content, stability and uniformity (Andersen et al., 2005). Due to a number of chemical and physical reactions causing formation of specific aroma and texture of the product, heat treatment is considered a very important factor of processing affecting meat quality. Increased temperatures destroy microorganisms and guarantee product safety (Cheng et al., 2004). Appearance, aroma, juiciness, tenderness and other sensory attributes of heat treated meat depend on applied heat treatment processing and temperature (Sharifudin et al., 2006). Sensory characteristics, i.e. quality attributes that consumers use to determine the acceptability of poultry meat depend mainly on applied processing method and production conditions (Barbanti i Pasquini., in press). Production conditions include husbandry and management techniques, breeding, genotypes, nutrition strategies, pre-slaughter treatment, cooling and storage conditions (Andersen et al., 2005).

In order to increase quantity and improve quality of meat, chicken diets are supplemented with various additives yielding positive effects according to available literature data (Popov-Raljić et al., 2002). Dietary supplemented probiotics have been reported to positively effect weight gain increase and improve feed conversion (Savković, 2005).

Finally, quality is considered as a complex multi-variate meat characteristic, depending on numerous processing factors and production conditions.

The objective of this study was to examine effects of different heat treatments (roasting and stewing) on sensory quality (colour, texture, tenderness, juiciness, flavour and taste) as one of the most important acceptability features of meat from chickens fed probiotics-supplemented diets.

Materials and methods

Preparation of samples

The university trial involved one-day old fattening chicks of Hybro hybrid line from meat industry "Topiko" from Backa Topola.). The first three weeks chicks were fed starter diets and then finisher diets until the end of the trial. The main difference between starter and finisher diets was in protein level and energy : protein ratio.

Trial diets were supplemented with probiotic «Probios» produced by the company OHR Hansen Bio System from Denmark with the inclusion rate of 1%. Preparation "Probios" contains isolated lactic acid bacteria *Enterococcus* (*Streptococcus*) *faecium*, *Lactobacillus acidophilus*, *Lactobacillus casei* and *Lactobacillus plantarum*.

Table 1. Composition of "starter" and "finisher" diets

Diet	"Starter" diet		"Finisher" diet	
	Control	Probiotic	Control	Probiotic
Corn	57,9	57,9	65,95	65,95
Soybean meal	30	30	27	27
Fish meal	6	6	2	2
Oil	2,85	2,85	1,8	1,8
Dicalciumphosphate	1	1	1	1
Limestone	0,95	0,95	0,95	0,95
Salt	0,3	0,3	0,3	0,3
Premix	1	1	1	1
Total	100	100	100	100

The trial lasted for 42 days and after that the birds were slaughtered in the experimental laboratory at the Faculty of Technology. Samples from average breast muscles were selected and subjected to heat treatment and sensory analyses at day 1 post mortem.

Heat treatment

Heat treatment processing was carried out in two ways:

- Roasting – halves of breast meat were packed in alu foils and roasted in oven at 175°C, until reaching 72°C in the middle of the sample.
- Stewing (combined method) – three halves of breast meat were firstly treated in 200 ml oil heated at 175°C, and then 200ml water was added and treatment was continued under same heating regime for 7 minutes, until reaching 72°C in the middle of the sample. Upon completed treatment, samples were strained by gravity.

All treated samples were cooled at ambient temperature before sensory evaluation.

Determination of body mass loss

Samples were weighed before and after heat treatment and following cooling, and loss of body mass during heat treatment was determined as a difference between the initial and final mass. Body mass loss was expressed as a percent in relation to the initial body mass.

Sensory evaluation

Sensory quality evaluation was performed using modified scoring system (Reuter, 1974). Colour, texture, tenderness, juiciness, flavour and aroma (smell) were scored based on the system shown in Table 2 (Popov-Raljić, 1999).

Table 2. Methods – Sensory evaluation system of heat treated meat quality

Score (points)	EVALUATED TRAITS				
	Colour	Juiceness	Tenderness	Flavour	Overall appearance
1,0	Pale brownish-grey	Dry	Tough	Sufficiently pleasant	Sufficient
2,0	Moderate brownish-grey	Moderately dry	Moderately tough	Satisfying pleasant	Satisfactory
3,0	Dark red-pink	Moderately juicy	Moderately soft	Pleasant-good	Good
4,0	Moderately uniform dark red-pink	Juicy	Soft	Very pleasant	Very good
5,0	Optimum uniform dark red-pink	Very juicy	Very soft	Excellent	Excellent

Results and discussion

Mean values for mass loss in control and trial groups during roasting and stewing are shown in Table 3.

Table 3. Mean values for body mass loss in heat treated meat samples (%)

Group / Heat treatment	Roasting	Stewing
Control	28,26	27,37
Trial	24,65	25,36

Body mass loss is the result of protein denaturation and reduced water binding capacity as well as the changes in muscle tissue under increased temperatures (Murphy, 2000), and partial evaporation. Protein denaturation and evaporation levels depend on the raw meat quality and applied treatment method, time and temperature of treatment (Cheng, 2004). Body mass loss is lower in humid conditions because sample is surrounded with liquid and evaporation is reduced (Cheng, 2004). Body mass loss was lower in control group treated with combined heating method– stewing (27,37%) and somewhat higher during roasting (28,26%),. However, in trial group, situation was quite different. Relatively small differences in body mass loss within the samples of the same group, can be explained with close treatment temperatures, and, consequently, temperature effects on changes in proteins. Evaporation is decreased during roasting when samples are packed in alu foils, and during stewing upon formation of crust and in further contact with liquid phase.

Body mass losses were higher in control than in trial groups during both heat treatments, thus indicating that dietary supplementation of probiotics positively effects dressing percentage in chickens subjected to heat treatment. .

Mean scores for sensory traits of roasted breast meat are shown in table 4.

Table 4. Mean score for sensory traits of roasted breast meat

Evaluated trait/Group	Control	Trial
Colour	4,16	4,85
Texture	4,50	3,83
Tenderness	4,85	3,33
Juiceness	3,0	3,33
Flavour	5,0	3,5
Aroma	5,0	3,5
Total score	4,42	3,72

Trial group was assigned higher score for colour, namely 4,85, which can be described as optimum uniform dark red-pink colour, whereas control group was assigned score 4,16 (moderately uniform dark red-pink colour). For all other evaluated sensory traits (texture, tenderness, juiceness, flavour and aroma) control groups received higher scores than trial ones. Mentioned sensory traits of trial group were scored in range 3,33 – 3,83 (between good, moderately good and very good). Control group was assigned the highest possible scores for flavour and aroma, i.e. 5,0. Total score for trial group was 3,72, and control 4,42.

Mean scores for sensory traits of stewed breast meat are shown in table 5.

Table 5. Mean score for sensory traits of stewed breast meat

Evaluated trait/Group	Control	Trial
Colour	4,0	4,5
Texture	3,66	3,83
Tenderness	4,16	4,0
Juiceness	3,0	4,0
Flavour	5,0	4,5
Aroma	5,0	4,5
Total score	4,14	4,22

Trial group received better score for colour, 4,5, than control group. For texture and tenderness both groups were assigned approximately same scores (3,66 and 3,83; 4,16 and 4,0), while juiceness was somewhat lower (score 3) in control group. Control group received highest scores for flavour and aroma (5,0), while trial group received somewhat lower, but still high score 4,5. Total scores for evaluated traits are very similar for both groups, i.e. trial 4,22, and control 4,14.

Sensory traits of control groups treated by roasting and stewing are shown in Figure 1. It is obvious that colour, texture and tenderness are affected

by the applied treatment method, and roasted meat samples received higher scores. Juiciness, flavour and aroma are not affected by applied treatment method, and both control groups were assigned same scores. Meat samples are scored as moderately juicy, of excellent flavour and aroma.

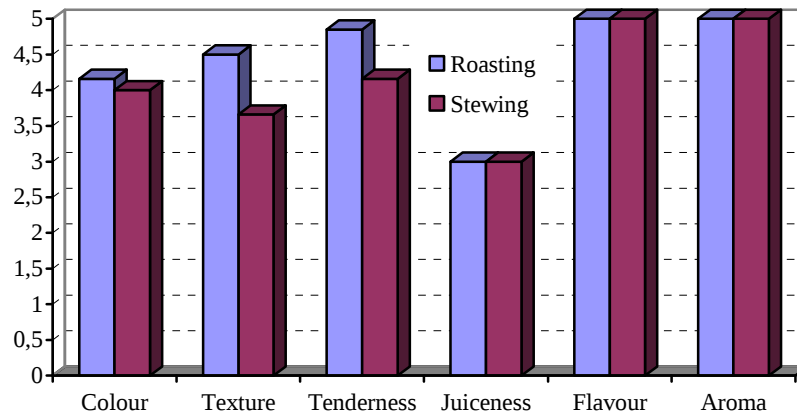


Figure 1. Average scores for treated breast meat in control groups

Sensory traits of trial groups treated by roasting and stewing are shown in Figure 2. Colour was assigned highest scores (4,85 and 4,5), and is described as optimum uniform dark red-pink. Both groups received the same score for texture 3,83. Samples of stewed breast meat were assigned higher scores for tenderness, juiciness, flavour and aroma.

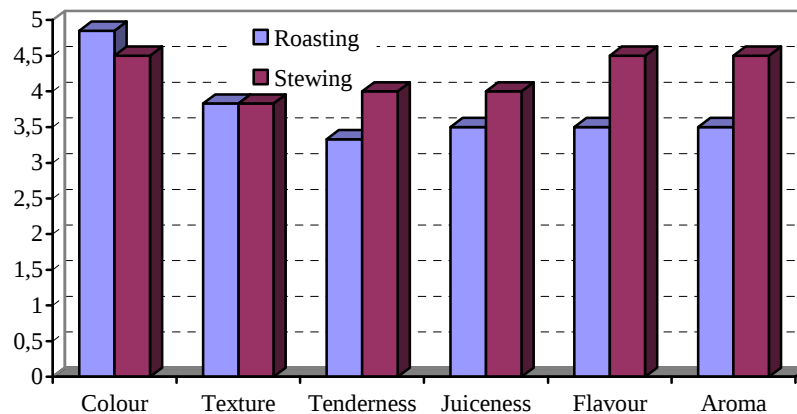


Figure 2. Average scores for treated breast meat in trial groups

Conclusion

Effect of heat treatment on body mass loss is insignificant, however, upon probiotic supplementation in concentration 1%, mass losses are reduced, and dressing percentage improved. Sensory traits for trial groups were assigned lower scores in relation to control groups. From the sensory quality standpoint, probiotic dietary supplementation appear to have better effects with combined heat treatment – i.e. stewing method.

References

- Andersen H.J., Oksbjerg N., Young J.F., Therkildsen M.(2005): Feeding and meat quality – a future approach, *Meat Science*, 70, 543-554
- Barbanti D., Pasquini M. (2005): Influence of cooking conditions on cooking loss and tenderness of raw and marinated chicken breast meat, *LWT- Food Science and Technology*, 38, 895-901
- Cheng Q., Sun D.W., Scannell A.G.M. (2005): Feasibility of water cooking for pork ham processing as compared with traditional dry and wet air cooking methods, *Journal of Food Engineering*, 67, 427-433
- Murphy R.Y. i Marks B.P. (2000): Effect of Meat Temperature on Proteins, Texture, and Cook Loss for Ground Chicken Breast Patties, *Poultry Science*, 79, 99-104
- Popov-Raljić J. (1999): Tehnologija i kvalitet gotove hrane, Univerzitet u Novom Sadu, Tehnološki fakultet
- Popov-Raljić J., Džinić N., Kelemen-Mašić Đ., Mandić A., Pavlović A., Sikimić V. (2002): Colour, Texture and Sensory Characteristics of Chicken Breasts Influenced by Citric Acid Addition to the Feed, *Roum.Biotechnol. Lett.*, Vol. 7, No. 4, 803-808.
- Reuter H. (1974): Modifiziertes Karsruher 9-Punkte Scheme für Fleischwarwn, BUFU Kulmbach
- Savković T. (2005): Probiotici u ishrani pilića, proizvodne performanse tova i uticaj na kvalitet toplotno obrađenog mesa grudi brojlera, doktorska disertacija, Univerzitet "Priština" u Kosovskoj Mitrovici, Poljoprivredni fakultet Lešak.
- Shaarani S.Md., Nott K.P, Hall L.D. (2006): Combinatio of NMR and MRI quantitation of moisture and structure changes for convection cooking of fresh chickem meat, *Meat Science*, 72, 398-403

UTICAJ ISHRANE I METODE TOPLLOTNE OBRADE NA SENZORSKA SVOJSTVA PILEĆEG MESA

- originalni naučni rad -

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Rezime

Da bi se zadovoljile potrebe tržišta za pilećim mesom potrebno je povećanje kvantiteta i unapređenje kvaliteta mesa. Pozitivan uticaj na povećanje prirasta i bolju konverziju hrane pokazalo je korišćenje pronutritivnih materija - probiotika kao dodataka ishrani pilića. U radu je ispitan uticaj probiotika u ishrani pilića i različitih metoda toplotne obrade na senzorna svojstva i gubitak mase mesa. Rezultati pokazuju da dodati probiotici smanjuju gubitak mase tokom toplotne obrade mesa i utiču na formiranje karakterističnih senzornih svojstava toplotno obrađenog mesa. Senzorne karakteristike toplotno obrađenog mesa oglednih grupa ocenjene su nešto nižim ocenama u odnosu na uzorke kontrolne grupe, a kao adekvatnija metoda za obradu mesa ogledne grupe pokazala se kombinovana metoda obrade-pirjanje.