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INVESTIGATION OF COLOUR, TEXTURE AND ORGANOLEPTIC PROPERTIES OF RETAILED CONVENTIONAL AND ORGANIC CHICKEN BREAST IN HUNGARY

Anita ALMÁSI [1, 2], Gabriella BAKA-ANDRÁSSY [1], Zoltán BUDAI [3], Olga PŐCZE-KUSTOS [1], Tamás FÜLÖP [1], Zoltán SÜTŐ [1]

ABSTRACT

The large price variation paid for chicken meat originated from organic and conventional systems require up-to-date knowledge of physical and sensory properties of the mentioned products. Our aim was to find differences between intensively vs. organically reared chicken breasts as they are currently presented to consumers in Hungary. A total of 30 broiler breast fillets (n = 10 per group) were purchased from 2 retail stores and a processor. Experimental groups were intensively reared (INT1 and INT2) and organically reared (ORG). In this case no attempt was made to collect information on genotype, feed or growing conditions of the birds. We measured meat colour (L*, a*, b*), shear force, texture and sensory traits of cooked samples. L* and b* values were lower in INT1 and INT2 groups ($P < 0.001$), however no differences were found in redness (a*) among the 3 groups. Shear force was highest in ORG samples, which panelists also found drier and tougher. An overall preference was observed for juiciness, tenderness, initial smell and taste in INT1 group. However, panelists did not recognize significant differences between INT2 and ORG samples in most traits, except juiciness. Profile and Bi-plot diagrams were created to demonstrate sensory traits and coherences. Although, samples of organically reared birds were less popular among our panelists, its contribution to healthy, traditional dishes is undeniable.

Key words: poultry/meat quality/ sensory properties / consumer preference / Hungary

1 INTRODUCTION

Today an increasing number of health-conscious costumer demanding a healthy, tasty and ethically produced poultry meat and therefore favour products from organic farming to fulfil their requirements. It is also in close correlation with higher standard of living and income. Generally, birds in organic farming are kept longer, free from antibiotics and have access to outdoors and grass. High welfare standards are also required to meet as well as certified feed produced in organic production system. For buyers, colour, texture, smell, overall outlook are the initial preference criteria when purchasing a raw chicken product (Castellini *et al*., 2008). Furthermore, fattiness, nutritive value, cost and effective labelling are also important; however we have not examined these traits in this study. There are increasing numbers of literatures that have compared meat quality of chickens reared in organic, free range or conventional keeping systems (Castellini *et al*., 2002, Fanatico *et al.,* 2005). These studies were concentrated on environmental and genotypic effects and did not access meat quality traits of samples taken from retailed chicken products. Where genotype is similar in different systems, production environment is likely to be an important contributor to significant differences. Increased physical activity can also alter muscle fat and colour (Castellini *et al.,* 2002). Corn-fed chicken are highly popular in Hungary and in many other countries, where its appearance and texture add to its popularity and can be easily distinguished (Kishowar *et al.,* 2005). Age and rearing system also affects the colour, texture and sensory quality of chicken

1 Fac. of Animal Science, Kaposvár Univ., H-7400, Guba S. str. 40., Kaposvár, Hungary
2 **Corresponding author**: almasi.anita@ke.hu
3 Bábolna TETRA Ltd., Uraiújfalu, Hungary

meat, therefore in our study we were determined to find out if there was any differences between intensively vs. organically reared chicken breasts as they are currently presented to consumers in Hungary. The large price variation paid for chicken meat originated from organic and conventional systems requires up-to-date knowledge on the physical and sensory properties of the mentioned chicken meat samples. Although genetics, sex, feed, season and production methods shown to influence meat quality of chickens, this paper is not a comparison of the above mentioned influencing factors but rather a survey of broilers currently marketed in Hungary.

2 MATERIAL AND METHODS

For the experiment 10 chicken breast fillets per group were purchased from 2 retail stores and a processor to provide samples of what is available to consumers in Hungary. Experimental groups were intensively reared broiler (INT1), intensively reared broiler slaughtered at 70 days of age (INT2) and organically reared (ORG), which traditionally harvested at 84 days of age. In this case no attempt was made to collect information on genotype, feed or growing conditions of the birds. Samples were only selected on the basis of how they are presented to consumers on the market. In the case of direct purchasing from processors (INT2), sales partners were larger companies and hypermarkets. No target weight range was set for the breast as we used only a proportion of its size for investigation. Samples were analyzed in the Department of Agricultural Product Processing and Qualification of the Kaposvár University.

2.1 SAMPLE PREPARATION, COLOUR, AND SHEAR FORCE

All measurements were carried out on the Pectoralis superficialis (breast) muscle. Half of the samples (1 cm^3 cubes) were cooked in a water bath for 60 min on 85 °C before evaluations. The colour parameters (L*, a*, b*) were measured using MINOLTA CHROMA METER CR-300, following the CIELAB colour system (1976). Taking the individual colour values, classification of samples of different origin and ΔE* value was calculated. Latest was defined as the difference between two colours in L* a* b* colour space. Values determined are based on the following mathematical formula according to Abril et.al. (2001): $\Delta E^* = \sqrt{}(\Delta L^*) + (\Delta a^*) + (\Delta b^*)2$

ΔE*	Differences between samples (Abril *et al.*, 2001)
0–0.5	invisible
0.5–1.5	small difference
1.5–3	medium difference
3.0–6.0	obvious difference
6.0–12	very obvious difference

For evaluating texture and tenderness, samples were taken from the muscle fibres by cutting them through with a standardized Warner-Bratzler blade meat shear apparatus (Zwick 2005 Texture analyser). Shear force was determined in Nm/mm^2.

2.2 PANEL TEST

For the panel test, samples were cooked at 80 °C for 2 hours without salt or spices, than immediately sliced into small pieces (approximately 1 cm × 1 cm) and randomly offered to 22 untrained panelists. Each panelist evaluated 6 samples (2 from each rearing system). Participants were mainly undergraduate students of the university and staff of the department. The traits assessed were colour, overall structure (tenderness, and juiciness), smell and taste. Samples were analysed in a single test only. Chicken meat is an every-day protein source in Hungarian kitchens; therefore we aligned our panelists "trained" for chicken meat giving them the opportunity to provide points on our unstructured scale. Panelists were asked to rate smell and taste on a scale of 0 to 10, ranging from low intensity to very intense. Colour evaluation was ranging from very light to very dark, while overall structure (tenderness, and juiciness) was characterised by very chewy to tender. Furthermore, they were asked to give preference scores on each trait (disliked (0) to preferred (10)).

***Table 1:** Colour parameters and shear force of chicken meat of different origin)*

	L*		a*		b*		WBS	
Type	Mean	SD	Mean	SD	Mean	SD	Mean	SD
INT1	78.71[a]	1.87	3.62[a]	0.77	15.79[a]	1.20	0.21[a]	0.04
INT2	80.38[a]	2.83	3.19[b]	1.15	14.70[a]	2.46	0.26[a]	0.09
ORG	73.14[b]	4.61	4.31[c]	1.76	19.52[b]	3.40	0.32[b]	0.07

[a–c] = means within a trait lacking a common superscript differ (P < 0.001),
WBS: Warner-Bratzler Shear force

2.3 STATISTICAL ANALYSIS

Differences between groups were determined by One-way ANOVA

(Tukey test) using SAS 9.0 statistical package. Based on this result, within group differences were evaluated by nested model. Treatment and supplier were fitted as fixed effects. Data obtained from panelists were analysed with PanelCheck V. 1.3.2 statistical package.

3 RESULTS

Comparing the different systems, a lower L* value was observed (P< 0.001) in ORG chickens, which supported by similar findings obtained from Grashorn and Serini (2006).

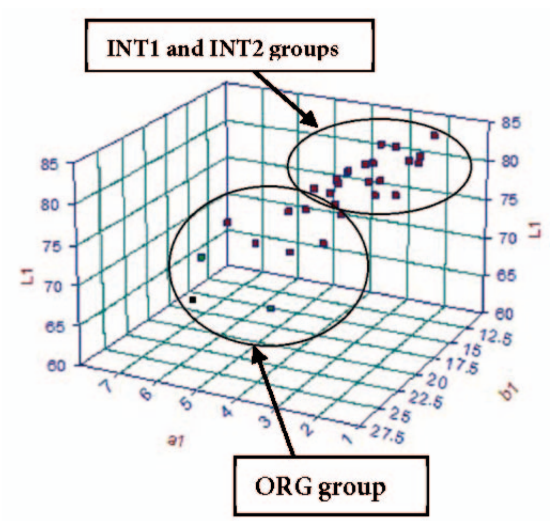

Figure 1: Classification of cooked Pectoralis superficialis samples

Based on the yellowness (b*) and redness (a*) values, different rearing systems could be distinguished accurately. Organic chickens had darker and yellower breast meat in comparison with intensively reared birds. In INT1 and INT2 groups origin had no affect on L* and b* colour parameters. L*, a* and b* value refers to certain colours in a 3 dimensional graphic. Based on this fact, classification was performed between intensive and organic environment. This step reinforced that differences were unnoticeable between the colour parameters of intensively reared chickens slaughtered at different age (P < 0.001) (Fig. 1). Based on individual L*a*b* values ΔE* was calculated (Table 2).

Table 2: Comparison of cooked breast samples of different origin according the ΔE value*

	INT1	INT2	ORG
INT1		0.56	4.51
INT2	small		3.51
ORG	obvious	obvious	

It is known that texture is affected by age which is caused by alterations in the water content of the meat and quality changes in the collagen content. As we expected, shear force differed (P < 0.001) between keeping systems, while intensively reared chickens had more tender meat. Panelists showed an overall preference of intensively reared chicken breast obtained from birds slaughtered at 6 weeks of age (INT1), followed by the breast of older chickens (INT2), in comparison to organic samples. Significant preference was observed for juiciness, tenderness, initial smell and taste in INT1 birds. However, panellists did not recognized significant differences between INT2 and ORG birds in most traits, except juiciness, which is possibly due to the similar age at these birds at slaughter. Naturally prepared ORG samples were found tasteless, dry and tough by the panelists. Points received during the panel test are shown in Fig. 2.

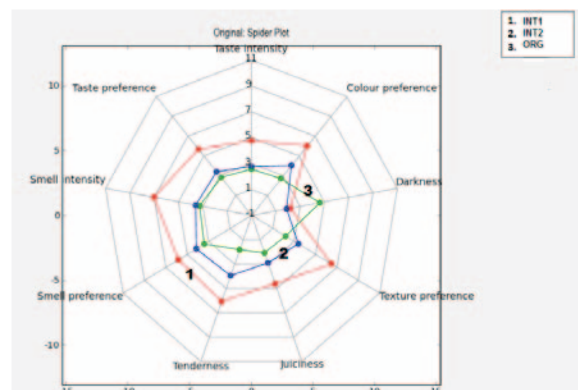

Figure 2: Sensory analyses – Profile diagram of cooked breast muscle

Human panelists given inconsistent answers (5 out of 22) were excluded by the PanelCheck software to create a proper data set. Following this step, remaining participants were managed to distinguish groups significantly by different sensory traits. Statistical coherences between sensory test and samples groups as well as distances between measured traits and experimental groups were demonstrated with Bi-plot method (Fig. 3), which based on principal component analysis (PCA) of different components. Bi-plot is a graphical tool to display the matrix by both the results of the panel test and the experimental groups. The closer one sensory trait gets to a group the more typical of it. According to our panelists, most parameters were associated with INT1 group, except darkness. The two principal components (PC1 and PC2) contained 100% of the total variability. Again, traits featured in one of the three groups (INT1, INT2, ORG),

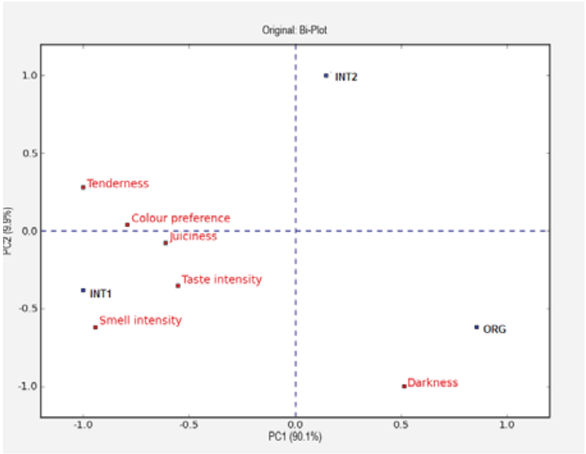

Figure 3: *Sensory analysis – Comparison of breast samples obtained from different rearing systems by Bi-plot method*

during the panel test showed the same tendency and allocation in the Bi-Plot.

4 CONCLUSIONS

The aim of our study was to investigate the commercially available poultry meat products of different origin that are available today for a Hungarian consumer. Physical and sensory characteristics of the meat are important traits when buying a product. Colour parameters (L*, a* and b*) of intensively reared bird's meat could be distinguished accurately from organic chicken's meat, latest being darker and yellowish favoured by most consumers in Hungary. Shear force was significantly higher in organic samples, which also resulted in tougher, drier meat when came to the panel test. Simply cooked breast samples originated from commercial birds (INT1) were in favour of the other keeping system by our panelists, which they found juicer, tastier and they were also preferred its smell. However, they found it hard to eliminate INT2 samples from ORG samples only by their taste. In our opinion, it was due to the small age difference between these 2 groups. We need to emphasize, that this study was only an objective investigation of different chicken products. Consumer preferences are moving on a wide scale and what ones like is disliked by another. Darker, more mature meat is the best basis for making traditional dishes and gives a distinguished flavour to it. Although it requires longer cooking, its time well spent for a different experience.

5 ACKNOWLEDGEMENT

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