Sensory properties of broiler meat - A comparison between different experimental series and origins

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Summary

Carcass value and meat quality of different origins of either gender were investigated in 13 experimental series as well as in 10 Bavarian feeding performance tests. From this significant number the sensory value of breast and thigh meat was recorded (n = 3154). For sensory analysis a semantic-numeric interval scale was available, where a higher number of points stood for a better evaluation. An expert panel surveyed with respect to juiciness, tenderness, flavour and overall impression. The highest evaluation was for tenderness (5.4-5.7), followed by juiciness (4.9-5.0), flavour and overall impression (4.4-4.7; n = 2154). Comparing different origins, sensory evaluation was quite on an upper quality level (4-6; n=1000). Best evaluations were achieved for Cobb 500 and Peterson origins. Hence it can be stated that as to sensory quality poultry meat can compete against beef and pork.

Keywords: carcass value – meat quality – sensory value – sensory evaluation – breast and thigh meat – broiler

Introduction

For meat marketing different criteria of the carcass are important with respect to quantity and meat composition. For the recording of meat composition different methods are available (RISTIC, 1984). According to HOFFMANN (1973, 1995) meat quality is the sum of sensory, nutritional, hygienic-toxicological and technologically processing properties of meat. Physical criteria for recording meat quality directly after slaughter are considered to be important (HONIKEL, 2006; PETRACCI and BAEZA, 2007). Consumers care amongst others about the sensory properties of meat. For this purpose different test procedures are applied (HAMMER, 2006; DIN, DLG). Compared to the production of pork and beef poultry production is more intensive. However, feeding intensity and duration are of importance for broiler production as well (RISTIC, 2004).

Materials and Methods

Samples from broilers of different origins of either gender from various test series spanning 15 years were available. Furthermore, sensory data of broilers of different origins (ASA, AA, Hybro, Lohmann, Ross, Shaver, Pilch, Peterson, Cobb) from Bavarian feeding performance tests were recorded in Kitzingen (n = 1000; feeding duration 5-6 weeks). Data were compared to those of conventional (Ross 308, 5 weeks) and organic production (RedBro/Shaver, 10 weeks). Prior to the sensory testing the samples of breast and thigh meat were packed in aluminium foil and heated in a brazier to 75 °C core temperature. Ten samples each were evaluated by a test panel of 6 persons. For sensory analysis a semantic-numeric interval scale ranging from 6 to 1 was available, where a higher number of points stood for a better evaluation. Tests were carried out with respect to juiciness, tenderness, flavour and overall impression according to the following table (RISTIC, 1983):

Score	Juiciness	Tenderness	Flavour	overall impression
6	very juicy	very tender	excellent	excellent
5	juicy	tender	very good	very good
4	slightly juicy	slightly tender	good	good
3	slightly dry	slightly firm	satisfying	satisfying
2	dry	firm	satisfactory	satisfactory
1	very dry	very firm	little satisfactory	dissatisfying

Statistical analysis was done using a SAS- and SPSS (ANOVA) program package, resp., according to a fixed model. The multiple mean value comparison was carried out using TUKEY-test ($p \leq 0.05$). In doing so the influence of gender and feeding duration was disregarded despite the differences (KIRCHGESSNER *et al*., 1993). The aim of this study was to record all the sensory data from different test series and origins in order to gain comprehensive information on the taste value of broilers.

Results and discussion

Table 1 shows the sensory data of the breast meat of different test series (n = 2154). Referring to juiciness scores ranged from 3.8 to 4.9, implying juicy to slightly juicy. The mean value of all 13 test series was 4.4. Scores for tenderness were 5.0 to 5.7, corresponding to very tender meat. Referring to flavour and overall impression, values were 3.9-4.7 and 4.1-4.7, respectively.

A comparison of the mean values of these data to those of conventional and organic production today (n = 200) shows better ones for conventional production of broilers (Ross 308), whereas organic production led to a reduction in quality (RedBro). The juiciness of the thigh meat led to a better evaluation (4.3-5.9, Tab. 2). Values for tenderness

were between 4.9-5.4, values for flavour and overall impression were almost at the same level (3.5-4.4 and 3.7-4.5, resp.). Compared to the total median value, sensory values for thigh meat originating from conventional production were better. Again there was a less favourable validation for organic production. Comparing the sensory data of breast meat to those of thigh meat it could be stated that there was a better juiciness for thigh meat whereas breast meat reached better results concerning tenderness, flavour and overall impression.

Table 3 depicts some important characteristics of carcass and meat. Carcass weight was nearly 1.4 kg on average, and the percentage of abdominal fat was 2.7 %. Fat content was 0.42 % for the muscle tissue of breast meat and 3.58 % for thigh meat. Protein content ranged between 23.5 % (breast meat) and 19.9 % (thigh meat).

Nine origins (n = 1000) were compared in several Bavarian feeding performance tests. Simultaneously a sensory analysis was performed (Tab. 4). Cobb 500 reached the highest score for juiciness of breast meat (4.7). For tenderness Shaver and Cobb 500 reached 5.5. The best evaluations concerning flavour were 4.5 (Lohmann, Shaver), again 4.5 for overall impression (AA, Lohmann, Shaver, Cobb 500), 4.9 for juiciness and 5.4 for the tenderness of the thigh meat (Peterson, Tab. 5). Cobb 500 scored best for flavour (4.2) and overall impression (4.3). Again it could be stated that the juiciness of the thigh meat was estimated better, whereas tenderness, flavour and overall impression were better for breast meat.

Carcass value of the tested origins was between 1172 g (ASA) and 120 g (Pilch), abdominal fat content ranged between 2.2 (Peterson) and 2.8 % (AA, Shaver, Tab. 6). Fat content of breast meat was 0.31 (Cobb) to 0.44 % (Pilch), and protein content 23.4 (Hybro) to 23.7 % (Ross).

A comparison of meat quality of broilers of different origins did not show better sensory criteria for organic production (RISTIC *et al*., 2007) as the obtained values were in an upper quality level of 4 to 6. CASTELLINI and MOURVAKI (2007) gave attention to the sensory perception of organically produced poultry meat. Concerning the sensory quality of guinea fowl, pheasant and broiler the latter reached the best evaluations, especially for tenderness (RISTIC *et al*., 2001). Another study examined the significance of the origin (Ross 308, Cobb 500, Cobb 800) and different weight categories. It could be stated that Cobb 800 broilers (1.8 kg) reached best scores for juiciness, tenderness, flavour and overall impression (RISTIC and STEINER, 2005). “Landkornhähnchen” (fed on a higher cereal content, slaughtered at 46 d) showed better values for the tenderness of breast meat (RISTIC, 1992). A comparison of

broiler production in different European countries revealed best scores for tenderness of breast meat for “Polo Arena”-broilers originating from Italy whereas Tetra-broilers from Hungary showed better values for the tenderness of thigh meat (RISTIC, 1991). The influence of feeding supply was stated for juiciness and flavour of breast meat, the highest energy supply resulting in better values (RISTIC *et al.,* 1990). Storage conditions (± 0 °C, -1 C, -4 C) can have an impact on the sensory properties of broiler meat. For breast as well as thigh meat best sensory values were achieved applying a storage temperature of ± 0 °C and a storage time of 8 d (RISTIC and HECHELMANN, 1990).

When applying organic production a higher environmental impact and higher costs have to be assumed (ELLENDORFF, 2002). Concerning sensory quality no significant difference could be ascertained between intensive and free range on the one hand and organic production on the other. Researching heavy-weight pigs with different live weight classes, FISCHER *et al.* (2006) found sensory values ranging from 3.0 to 3.9 meaning a medium quality level compared to broiler meat. A study on consumer’s acceptance of beef and lamb from Germany and Uruguay revealed that higher fat contents and longer ripening led to better sensory values (BRANSCHEID *et al.*, 2006). The overall acceptability of beef depended more on tenderness; in the case of lamb, it was determined more by flavour. Implementing an evaluation scheme from 1-8, values for the tenderness of beef ranged from 5.0 to 5.5. The threshold for an evaluation meaning “still good” was 5.

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Tab. 1: Sensory data of breast meat[1)] (n = 2154 and 200, resp.)

Experimental series	Juiciness		Tenderness		Flavour		Overall impression	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
A	4.6	0.5	5.0	0.4	**4.7**	0.5	**4.7**	0.4
B	4.4	0.4	5.1	0.4	4.2	0.6	4.3	0.5
C	3.8	0.5	5.1	0.4	4.1	0.4	4.1	0.4
D	4.2	0.5	5.2	0.4	4.2	0.5	4.3	0.5
E	4.4	0.5	5.3	0.3	4.3	0.4	4.4	0.4
F	4.6	0.5	5.4	0.3	4.2	0.5	4.4	0.4
G	4.7	0.5	5.3	0.3	4.4	0.4	4.5	0.4
H	4.1	0.5	5.3	0.3	3.9	0.5	4.1	0.5
I	4.8	0.6	5.5	0.4	4.0	0.8	4.2	0.8
J	**4.9**	0.4	**5.7**	0.2	4.5	0.6	4.6	0.5
K	4.6	0.4	5.3	0.3	4.3	0.4	4.5	0.3
L	4.4	0.7	5.4	0.3	4.4	0.6	4.5	0.5
M	4.0	0.6	5.0	0.5	4.2	0.6	4.3	0.5
$\bar{x}$ total	4.4	0.6	5.2	0.4	4.3	0.6	4.4	0.5
conventional production	4.5	0.5	5.2	0.4	4.7	0.5	4.7	0.4
organic production	3.8	0.6	5.0	0.5	4.2	0.4	4.3	0.5

[1)] semantic-numeric interval scale ranging from 1 (very unsatisfying) to 6 (excellent)

Tab. 2: Sensory data of thigh meat (n = 2154 and 200, resp.)

Experimental series	Juiciness		Tenderness		Flavour		Overall impression	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
A	4.7	0.4	5.0	0.3	4.3	0.5	4.5	0.4
B	4.9	0.4	5.0	0.3	3.8	0.7	3.9	0.6
C	4.3	0.4	5.0	0.3	3.5	0.5	3.7	0.5
D	4.8	0.4	5.2	0.4	3.9	0.7	4.1	0.7
E	4.4	0.4	5.0	0.3	3.9	0.4	4.0	0.4
F	4.9	0.4	5.2	0.4	3.9	0.6	4.1	0.5
G	**5.0**	0.4	**5.4**	0.3	**4.4**	0.5	**4.5**	0.4
H	4.9	0.4	5.4	0.3	4.0	0.5	4.2	0.5
I	4.7	0.4	5.2	0.4	3.8	0.6	4.0	0.5
J	4.8	0.4	5.3	0.3	4.2	0.5	4.3	0.5
K	4.7	0.4	5.1	0.3	4.2	0.5	4.3	0.4
L	4.6	0.4	4.9	0.4	4.2	0.5	4.3	0.5
M	4.3	0.6	4.5	0.6	3.9	0.6	4.0	0.6
$\bar{x}$ Gesamt	4.7	0.4	5.1	0.4	4.0	0.6	4.2	0.6
Conventional production	4.9	0.6	5.2	0.5	4.3	0.4	4.7	0.5
Organic production	4.3	0.5	4.4	0.6	3.8	0.5	4.2	0.5

Tab. 3: Some characeristics of carcass and meat (n = 2154)

Characteristics	$\bar{x}$	s	Min	Max
carcass weight (g)	1385	471	1112	2019
abdominal fat (%)	2.7	1.2	1.0	3.6
fat content (%)				
breat meat	0.42	0.32	0.16	0.81
thigh meat	3.58	1.58	3.0	4.5
protein content (%)				
breat meat	23.5	0.6	23.0	24.0
thigh meat	19.9	0.6	19.7	20.0

Tab. 4: Sensory data of breat meat (different origins; n = 1000)

Origin	Juiciness		Tenderness		Flavoura		Overall impression	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
ASA	4.4	0.5	5.3	0.4	4.3	0.5	4.4	0.4
AA	4.5	0.6	5.2	0.3	4.4	0.5	4.5	0.5
Hybro	4.4	0.6	5.2	0.4	4.2	0.5	4.3	0.4
Lohmann	4.5	0.7	5.2	0.4	4.5	0.6	4.5	0.6
Ross	4.4	0.6	5.4	0.4	4.3	0.5	4.4	0.5
Shaver	4.6	0.6	5.5	0.4	**4.5**	0.5	4.5	0.5
Pilch	4.5	0.5	5.4	0.3	4.0	0.6	4.1	0.5
Peterson	4.4	0.5	5.3	0.4	4.0	0.5	4.2	0.6
Cobb 500	**4.7**	0.5	**5.5**	0.3	4.4	0.5	**4.5**	0.4
F-value	***		***		***		***	

Tab. 5: Sensory data of thigh meat (different origins; n = 1000)

Origin	Juiciness		Tenderness		Flavour		Overall impression	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
ASA	4.7	0.4	5.2	0.4	4.1	0.5	4.2	0.4
AA	4.8	0.5	5.2	0.3	4.0	0.6	4.0	0.6
Hybro	4.7	0.4	5.1	0.4	3.9	0.6	4.0	0.6
Lohmann	4.7	0.4	5.1	0.4	3.8	0.5	4.0	0.5
Ross	4.7	0.5	5.2	0.4	4.0	0.6	4.1	0.6
Shaver	4.6	0.4	5.1	0.2	4.1	0.5	4.2	0.5
Pilch	4.8	0.5	5.3	0.4	3.9	0.5	4.1	0.5
Peterson	**4.9**	0.3	**5.4**	0.3	3.7	0.4	3.9	0.4
Cobb 500	4.7	0.3	5.3	0.3	**4.2**	0.6	**4.3**	0.5
F-value	*		***		***		***	

Tab. 6: Some chracteristics of carcass and meat (n = 1000)

Origin	carcass weight (g)		Abdominal fat (%)		Breast meat			
					Fat content (%)		Protein content (%)	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
ASA	1172	171	2.5	1.0	0.32	0.16	23.6	0.5
AA	1269	156	**2.8**	0.9	0.38	0.18	23.5	0.5
Hybro	1236	158	2.6	0.9	0.42	0.25	23.4	0.5
Lohmann	1213	177	2.6	0.9	0.41	0.23	23.5	0.6
Ross	1242	158	2.4	0.9	0.33	0.19	23.7	0.5
Shaver	1256	130	2.8	0.9	0.37	0.17	23.4	0.8
Pilch	1290	197	2.4	0.8	0.44	0.38	23.6	0.5
Peterson	1199	155	2.2	0.7	0.41	0.24	23.5	0.6
Cobb	1221	120	2.3	0.8	0.31	0.16	23.5	0.5
F-value	***		***		***		*	