THERMAL MEAL TREATMENT IMPROVES SOME MEAT QUALITY TRAITS IN CHICKEN

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Introduction

Treatment of feed components may modify both physical and chemical characteristics. The pelleting conditions greatly influence enzyme inactivation and pelleting at temperatures over 85°C negatively affect bird performances (Inborr and Bedford, 1994). Pelleting has been shown to increase digestibility and weight gain (Petterson *et al.*, 1991) more than the extrusion process (Vukić Vranješ *et al.*, 1994), but high temperature short time extrusion and expansion processes of whole feeds has been proved to enhance AME of feeds for broilers (Plavnik and Sklan, 1995). Recently, a process of thermal meal treatment has been developed by Bühler with the aim to produce contamination-free premixes. This research was designed to determine whether this thermal meal treatment could enhance the meat quality traits in the broiler.

Materials and Methods

Three hundred and twenty hybrid chicks (Ross 508) were, at 1 day of age, divided into 2 groups. One group were fed a commercial diet (Control), while the other group received the control diet submitted to a further thermal process (Bühler technology, DTMT4000) which hygenize the meal by the addition of steam (up to the mass temperature of 85°C for 180 sec, followed by drying for 90 sec) obtaining the Sanix diet of Natcor s.n.c.. In order to cover the energy and nutrient requirements of birds along their growth, 3 diets were formulated. In each phase, Control and Sanix diets were prepared (Table 1). Chicks were reared indoor in pens up to 3 weeks of age and randomly allocated to cages by 4 weeks (38 kg liveweight/m^2). At 56 days of age 133 chickens, equally representing the 2 diets, were slaughtered and the breast and thigh meats dissected and used for meat quality analysis. Diets were analysed for chemical composition (dry matter, protein, fat, crude fibre, ash), for starch, lysine, macrominerals, xanthophylls and carotenoids, gross energy and peroxydes contents (Table 1). Meat measurements included the pH (pHu) and the L*a*b* colour values (CIElab, 1976) of *Pectoralis major* (PM) and *Iliotibialis lateralis* (ITL) muscles at 24 hours *post mortem*. Water losses and the Warner-Bratzler shear force of PM and thigh were measured after 2 weeks of frozen storage at -20°C. The L*a*b* colour was also determined 24 hours *post mortem* on the skin of the thigh. ANOVA was performed using the proc GLM of the SAS (1990) program, by including the diet D (Control, Sanix), the gender G and the DxG interaction as fixed effects.

Results and Discussion

Thermal heat treatment increased the content of crude fat but reduced the content of starch in all the diets, resulting in a moderate increase of the gross energy content (Table 1). Also the xanthophyll and carotenoid content was slightly increased by the heat treatment.

Table 1: Composition of the experimental diets (g/100g, as-fed basis).

	Starter phase (1-21d)		Grower phase (22-49d)		Finisher phase (50-56d)	
	Control	Sanix	Control	Sanix	Control	Sanix
Dry matter (DM), g/100g	88.35	88.22	88.00	88.38	88.07	88.39
Crude protein	20.85	22.02	20.06	19.65	20.64	20.50
Crude fat	6.27	6.50	7.17	8.67	7.36	8.25
Crude fibre	2.45	3.14	2.76	2.70	1.96	1.97
Crude ash	5.57	5.29	5.47	5.68	6.02	5.87
Starch	36.2	34.0	35.0	33.6	35.3	33.9
Lysine	1.07	1.29	0.97	1.37	0.89	1.01
Xanthophylls and carotenoids	0.66	0.67	0.41	0.55	0.53	0.68
Ca	1.17	1.19	1.43	0.91	0.91	1.52
K	0.80	0.85	0.83	0.80	0.78	0.80
P	0.58	0.57	0.48	0.59	0.50	0.58
Na	0.13	0.11	0.26	0.18	0.18	0.14
Peroxydes, mg active O_2/kg fat	41.68	43.28	26.40	32.00	47.41	36.42
Gross Energy, MJ/kg	16.86	17.03	17.05	17.30	17.08	17.29

The results of the effects of the two experimental diets on the chickens' weight and meat quality are summarized in Table 2. No difference in slaughter weight between diets was observed. Steam heating treatment of the Sanix diet did not affect the water loss or the Warner-Bratzler shear force of the breast meat. On the contrary, the birds fed with the Sanix diet exhibited less cooking losses of the thigh than those fed the Control diet. Colour parameters were strongly affected by the diets. L* was significantly reduced by the Sanix diet both in breast and thigh meats. The greatest effect of the Sanix diet concerned the b* value (yellowness), significantly higher in breast meat and in thigh skin, compared to the Control diet. Sex effect was significant for slaughter weight, for meat water losses and for some colour values of meat and skin.

Table 2: Quality traits of chicken meat measured 24h *post-mortem* (water losses and Warner-Bratzler shear force measured after 2 weeks frozen storage at -20°C).

	Diet (D)		Gender (G)		Significance[1]		
	Control	Sanix	F	M	D	G	DSR
animals for SW, pHu, L*a*b* colour, n	68	65	52	81			
animals for WHC and W-B shear force, n	32	32	32	32			
Slaughter Weight, g	3648	3574	3345	3877	ns	***	221
Breast:							
Cooking losses, %	25.3	25.4	24.8	25.8	ns	*	1.6
Warner-Bratzler shear force, kg/cm^2	4.50	5.12	5.06	5.05	ns	ns	0.30
pHu m. *Pectoralis major* (PM)	5.76	5.78	5.76	5.78	ns	ns	0.12
Lightness (L*) m. PM	56.0	55.1	55.3	55.8	*	ns	2.2
redness (a*) m. PM	-0.45	-0.24	-0.28	-0.41	ns	ns	1.07
yellowness (b*) m. PM	10.80	12.30	12.70	10.50	**	***	2.68
Thigh:							
Thawing losses, %	1.36	1.29	1.50	1.15	ns	**	0.46
Cooking losses, %	20.6	18.6	20.6	18.7	**	*	2.9
total losses, %	21.9	19.9	22.0	19.8	**	**	2.9
Warner-Bratzler shear force, kg/cm^2	3.72	3.87	3.78	3.81	ns	ns	0.37
pHu m. *Iliotibialis lateralis* (ITL)	6.20	6.25	6.22	6.23	ns	ns	0.16
L* ITL	54.7	53.6	53.4	54.9	**	***	2.3
a* ITL	0.55	0.84	0.66	0.72	ns	ns	1.23
b* ITL	11.70	12.40	12.40	11.70	ns	ns	2.86
L* skin	71.9	71.5	72.2	71.2	ns	**	2.0
a* skin	-1.20	-1.01	-0.81	-1.39	ns	*	1.54
b* skin	27.6	30.3	30.9	27.0	***	***	4.1

[1] *: P<0.05; **: P<0.01; ***: P<0.001; No interaction DxG was found.

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Conclusions

Steam heating treatment of the Sanix diet modify the content of some nutrients. From the meat quality point of view, the highest content of xanthophylls and carotenoids in the Sanix diet increased meat and skin yellowness.

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