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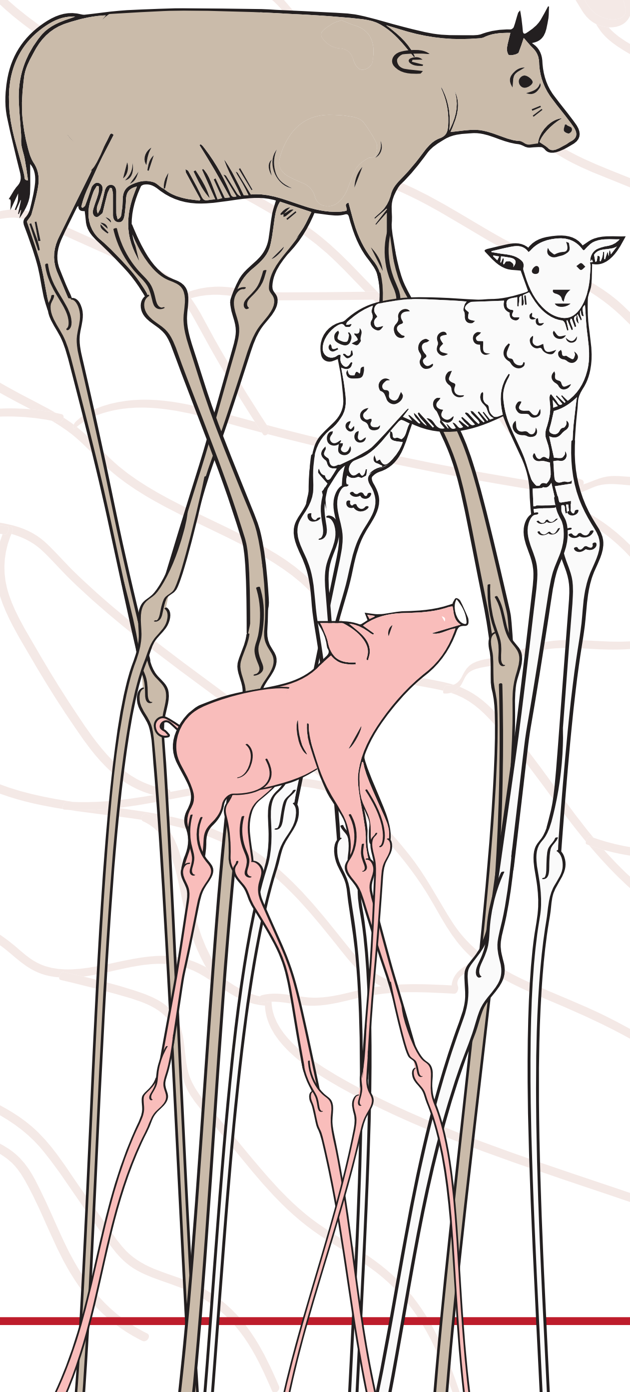

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MEAT QUALITY TRAITS OF FAST-, MEDIUM- AND SLOW-GROWING CHICKENS FED DIETS WITH DIFFERENT PROTEIN TO ENERGY RATIO

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I. INTRODUCTION

The growing consumer interest and awareness regarding animal welfare and product quality are leading to a rising demand for foods of animal origin from less intensive and outdoor farming practices [1]. For that, the Better Chicken Commitment (BCC) was launched in 2018 with the goal of establishing standards to enhance broiler welfare and the sustainability of the supply chain by 2026 [2]. One of the key objectives of the BCC is to encourage the adoption of alternative chicken genotypes that exhibit slower growth rates and are better suited for extensive and outdoor production systems as alternative to the fast-growing hybrids, which are currently predominant worldwide in broiler production. Thus, the present study aimed to evaluate the main quality traits of chicken meat from three genotypes with different growth rates fed diets with different protein to energy ratio.

II. MATERIALS AND METHODS

A total of 1,800 one-d-old male chickens were reared in an environmentally controlled poultry facility and randomly allotted in 36 concrete floor pens (6 m^2; 50 birds/pen), in compliance with BCC standards. Specifically, three genotypes were included in this study: fast-growing (FG, Ross 308), medium-growing (MG, Ranger Gold), and slow-growing (SG, Gray Kabir Naked Neck), slaughtered at the same live weight of approximately 2.8 kg reached at different ages according to their different growth rate (FG=34 d, MG=50 d, SG=77 d). Throughout the trial, all chickens were fed a multi-phase basal diet that differed in protein-to-metabolizable energy ratios: the control diet (C) was a standard commercial diet for fast-growing broilers, while the experimental diet (T) was characterized by 10% less protein and the same metabolizable energy content than the control diet, which can be considered as representative of a commercial diet for slower-growing genotypes. Fifteen carcasses per group were randomly selected and used to evaluate quality traits of breast meat (pHu, colour, cooking loss, shear force, TBARS and carbonyls). Data were analyzed by factorial ANOVA considering the main effects of the genotype and diet along with their interactions. When significant, means were separated by Tukey-HSD test (P<0.05).

III. RESULTS AND DISCUSSION

The results concerning the effect of genotype, diet and their interaction on breast meat quality traits are reported in Table 1. As expected, the genotype strongly affected almost all meat quality properties considered in the present study. Breast meat from both MG and SG groups exhibited significantly lower pHu if compared to FG (5.77 vs. 5.55 and 5.54, P<0.001). As observed in previous studies, FG genotypes have reduced glycolytic potential and post-mortem acidification extent especially in the breast muscle as an indirect effect of selection for fast growth-rate and higher breast-development [3]. However, despite the higher values of pHu, cook losses were greater in FG birds (P<0.001). These results might indicate that the difference in the ability to retain liquid during cooking was more related to a physical than a pH-induced effect. It is well known that the diameter of muscle fibers is higher in FG chickens thus changing the structural characteristics of the muscle [4]. This structural effect might also contribute to the differences found in shear values, which were higher in MG and SG when compared with FG. It is well-known that smaller fiber diameters might allow a higher packaging density and increase toughness. This factor could have exacerbated the age-effect as SG and MG were slaughtered at a higher age. In addition, SG showed a yellower colour (b*) which could be related to an increased deposition of subcutaneous fat. As concern for lipid oxidation, significant higher TBARS values were found in SG compared to MG and FG groups which did not differ from each other (0.86 vs. 0.50 and 0.50 mg MDA/kg of meat, P<0.001). This might be ascribed to the fact that the SG genotypes are more susceptible to lipid oxidation due to greater locomotor activity which leads to increase *in vivo* utilization of antioxidants to mitigate higher oxidative stress [5].

On the other hand, meat quality traits were slightly modified by dietary treatment. T group exhibited a higher a* value (P<0.001) cooking losses and lower carbonyls (P<0.001, P<0.05 respectively). However, all these parameters also showed significant 'genotype × diet' interactions. Indeed, only SG birds showed higher redness, cooking losses and lower carbonyls, when fed experimental diets with 10% less protein (T). This could be attributed to the greater sensitivity of SG chickens to protein depletion which may have impacted some quality traits of the meat related to muscle growth such as water holding capacity and protein oxidation [6]. In fact, few information is currently available on nutritional recommendations and resilience of these new genotypes.

Table 1 – Quality traits of breast meat of fast (FG), medium (MG) and slow-growing (SG) chickens fed diets with different protein to energy ratio.

Effect	Group	n.	pHu	Lightness *L**	Redness *a**	Yellowness *b**	Cooking loss (%)	Shear force (kg)	TBARS (mg MDA/kg of meat)	Carbonyls (nmol/mg of protein)
Genotype	FG	*30*	5.77^{x}	46.4^{z}	2.32^{y}	2.97^{z}	18.1^{x}	4.34^{y}	0.50^{y}	2.96
	MG	*30*	5.55^{y}	53.6^{x}	2.76^{x}	5.05^{y}	13.1^{y}	6.05^{x}	0.50^{y}	1.81
	SG	*30*	5.54^{y}	51.8^{y}	2.06^{z}	6.28^{x}	13.8^{y}	6.54^{x}	0.86^{x}	2.57
Diet	Control (C)	*45*	5.61	51.1	1.83	4.71	14.2	5.65	0.63	2.78
	Treated (T)	*45*	5.62	50.1	2.93	4.83	15.8	5.63	0.60	2.12
Genotype x Diet	FG-C	*15*	5.77	46.6	1.97^{cd}	2.76	17.6^{ab}	4.30	0.52	2.64^{ab}
	FG-T	*15*	5.76	46.1	2.66^{abc}	3.19	18.6^{a}	4.37	0.47	3.27^{ab}
	MG-C	*15*	5.53	54.0	2.27^{bc}	4.19	13.5^{c}	6.36	0.48	1.98^{ab}
	MG-T	*15*	5.56	53.2	3.24^{a}	5.20	12.7^{c}	5.74	0.50	1.63^{ab}
	SG-C	*15*	5.53	52.5	1.23^{d}	6.45	11.5^{c}	6.30	0.90	3.70^{a}
	SG-T	*15*	5.55	51.1	2.89^{ab}	6.10	16.1^{b}	6.78	0.82	1.44^{b}
esm			*0.02*	*0.4*	*0.10*	*0.20*	*0.3*	*0.14*	*0.40*	*0.22*
						P-value				
Genotype			***	***	**	***	***	***	***	ns
Diet			ns	ns	***	ns	***	ns	ns	ns
Genotype x Diet			ns	ns	*	ns	***	ns	ns	*

esm= error standard means; ***= <0.001; **= <0.01; *= <0.05; ns= not significant x-z, a-c= mean values followed by different letters significantly differ among the groups (p<0.05).

IV. CONCLUSION

In light of the current findings and considering the relevance of this topic within the framework of the Better Chicken Commitment, the results of this study highlight the potential implications of adopting slow-growing genotypes on meat quality parameters, leading to products with distinct and genotype-specific characteristics. Nevertheless, the nutritional requirements of slow-growing genotypes remain not fully defined, and other studies are needed to understand the effects of dietary treatments on the physicochemical and functional properties of the meat.

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