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Chemical whole body composition of female chickens of four genetically diverse purebred layer lines reared with increasing dietary L-arginine

Ganzkörperzusammensetzung weiblicher Hühner vier genetisch divergenter Reinzuchtlegelinien in Abhängigkeit steigender L-Arginin-Konzentration im Futter

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L-arginine (Arg) is dietary indispensable for chickens. Among others, the Arg requirement for optimal body growth depends on chickens' genetically determined growth potential. In its function as precursor of body proteins, multifunctional nitric oxides and growth-promoting polyamines, Arg is capable of modulating several pathways of the protein and lipid metabolism. Therefore, the effects of an increasing dietary Arg supply on the chemical whole body composition of female chickens of four layer lines differing in phylogeny and performance (WLA/R11: high/low performing white layers; BLA/L68: high/low performing brown layers) were examined from hatch to 18 weeks of age.

Methods: 36 one-day-old female chicks of each line were distributed to three diets providing 70 (LA), 100 (AA) and 200 % (HA) of recommended Arg supply (NRC, 1994; GfE, 1999) under *ad libitum* feeding conditions. From week 7 to 18 birds were fed with corresponding Arg diets for pullets. Residual feed was recorded weekly. From hatch to 18 weeks of age three chicks of each group were weighed and bloodless killed by CO2 in six-week-intervals. The ingesta were removed from birds' digestive tract totally. These emptied bodies including feathers were frozen at -20°C and ground. Thereafter homogenized bodies were freeze-dried over 48 hours and analysed for dry matter, crude ash and crude protein in accordance to the VDLUFA methods. Crude fat was calculated by the difference between organic matter and crude protein. The statistical evaluation of data was performed with a 4 x 3 x 4 three-factorial ANOVA (line, diet and age) by using Tukey-Kramer test in SAS procedure MIXED. LSMeans differences were considered to be statistically significant for $p<0.05$.

Results: Brown layer lines showed higher emptied body weights with a higher relative ash content than white lines ($p<0.001$; Table). Whereas chicken bodies showed no genetic impact on the relative lipid content, the relative protein content of R11 was higher than that of the other lines ($p<0.001$). In addition to feed consumption and emptied body weight, the relative content of ash, protein and lipid increased age-dependently in chickens ($p<0.001$). In contrast to the adequate and surplus dietary Arg supply, deficient dietary Arg depressed feed consumption and body growth from week 6 onwards ($p<0.001$) and elevated the relative lipid content of 18-week-old brown layers ($p<0.01$).

Conclusions: The rearing of layer-type chicken comprises a period of body growth and its chemical composition, whose quality strongly depends on chicken's phylogenetic origin and adequate nutrient supply. In this period deficient dietary Arg serves as source of metabolic variation between brown and white layer lines. Although Arg does not influence chickens' protein content in this study, the Arg deficiency seems to intensify the metabolic redistribution of nutritional energy from the accretion of proteins to those of lipids.

	Line (L)	Hatch			Week 6			Week 12			Week 18			PSEM
		LA	AA	HA	LA	AA	HA	LA	AA	HA	LA	AA	HA	
Emptied body weight (EBW, g)	WLA	34	35	34	241	312	289	667	743	843	898	962	1015	15.5
	BLA	37	37	37	243	280	308	697	775	747	794	848	941	
	R11	33	34	33	218	242	197	566	597	574	704	862	878	
	L68	38	38	38	263	362	275	804	955	740	1156	1148	1082	
Lipid content (% of EBW)	WLA	9.7	9.8	9.9	10.8	10.0	11.1	10.4	11.5	14.2	11.5	12.3	12.1	0.7
	BLA	7.6	7.7	7.8	14.9	12.4	9.4	13.3	13.3	11.2	12.2	9.7	10.6	
	R11	8.0	8.1	8.1	11.9	11.0	11.2	14.1	11.7	11.7	10.2	12.3	11.9	
	L68	9.2	9.4	9.3	12.1	9.9	9.1	12.5	14.9	12.0	15.5	12.7	11.7	
Protein content (% of EBW)	WLA	12.0	12.2	12.1	19.1	19.2	18.4	20.8	20.8	20.0	21.7	21.8	21.8	0.4
	BLA	13.4	13.5	13.7	18.0	18.0	19.4	19.4	20.2	20.5	21.9	22.2	21.9	
	R11	15.3	15.3	15.3	18.4	19.9	19.0	20.4	21.6	21.2	23.1	22.3	22.0	
	L68	14.7	14.8	14.9	18.7	19.7	18.8	18.7	20.7	20.8	21.5	20.8	22.0	

ANOVA (p values)	Line	Diet	Age	L x Diet	L x Age	Diet x Age	L x Diet x Age
EBW	**<0.001**	**<0.01**	**<0.001**	0.097	**<0.001**	0.335	0.622
Lipid content	0.164	**<0.05**	**<0.001**	**<0.01**	**<0.001**	0.175	**<0.05**
Protein content	**<0.001**	0.067	**<0.001**	0.169	**<0.001**	0.087	0.143

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