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Topic 3 - Transition towards organic and sustainable food systems

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NUTRIENT DIGESTIBILITY IN ORGANIC SLOW-GROWING BROILERS FED WITH GRASS AND CHICORY AS SUPPLEMENTS

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Abstract: At the end of an experiment with organic broilers reared under free-range conditions, a digestibility experiment was performed with a slow growing hybrid I657 including six treatments: diet C (control), C + grass, C +chicory; diet F1, F1 (reduced protein) + grass, F1+chicory. No difference was found in feed intake of the diets, however, the intake of C + chicory and F1 + chicory was significantly higher ($P < 0.01$) than for groups with no access to forage material (C + F1). The digestibility experiment showed a variation between diets as a higher nitrogen retention was recorded for all F1 diets given both supplements, chicory and grass compared to control diets ($P < 0.05$). This indicates that the use of low protein diets in organic broiler production, with access to an attractive forage area, can reduce excess nitrogen excretion on outdoor areas, where diets with higher protein content result in higher N excretion.

Introduction: An attractive range area can contribute to the nutrition of poultry. Therefore feed from range should be considered when formulating diets for poultry reared in free-range systems with attractive forage vegetation available (Horsted and Hermansen, 2007). In laying hens a high intake of silages has shown to influence gizzard weight (Steenfeldt et al., 2007), indicating that poultry adapt to more coarse feed and subsequently can eat more of this type of feed. Slow-growing broiler genotypes have a lower protein requirement and a higher foraging activity level compared with fast growing broilers. Thus, they are able to find a part of the nutrient requirement from feed items in attractive range areas (De Almeida et al. 2012). Including feed from range in the diets may increase the use of local resources and ease the transition to 100% organic feed without imported protein feed.

Material and methods: A study was performed with a medium and a slow growing genotype (RedBro Ja & I657) during a period of 14 weeks in the summer months at Aarhus University, Denmark. After hatching, the chicks were reared indoor for four weeks, where after the chickens were weighed and moved to outdoor facilities with mobile houses and access to pasture field covered with grasses and different herbs. The chickens were fed with two different diets: a standard organic diet for broilers (Control C: protein 20.4 % (22.7 %DM), methionine 2.75g/kg (3.06 %DM)) and a diet with a lower protein content (diet F1: protein 14.9 % (16.8 %DM), methionine 2.11g/kg (2.37 %DM)). The diet F1 with the lower protein content was given to stimulate foraging on plant material as well as insects and worms from the outdoor area.

At the age of 14 weeks, where the main experiment ended (data not shown), a digestibility experiment was performed indoor in battery cages with raised floors and trays for collection of excreta. Only the slow growing hybrid I657 was used in this experiment. Two feeding troughs were placed in front of each cage containing the diets and forage materials, respectively, so that pelleted diets and green supplements (ryegrass or chicory leaves) could be weighed separately. A total number of 72 female broilers of the I657 (Hubbard) genotype were used and two broilers were allocated to each cage from the control C and F1 treatments. Six experimental treatments were included in the digestibility trial: C, C + grass, C +chicory; F1, F1+ grass, F1+chicory, with six replicates and where ryegrass was considered as a representative of monocotyledonous plants and chicory leaves a representative of dicotyledonous plants. Feed and water were supplied ad libitum and feed consumption was recorded per cage each with two broilers. The initial and final weight of the broilers was recorded during the 10 days, where the experiment were carried out in the battery cages (permission given from the Danish authorities for this restricted period). The ryegrass and chicory leaves were given fresh in small portions twice daily with an adaptation period of seven days, after which excreta samples were collected on three consecutive days and stored in freezer until chemical analysis. Diet, ryegrass, chicory leaves and excreta were analysed for DM, the amino acids methionine, cystine, lysine and threonine and nitrogen (N).

The digestibility of amino acids and N were determined by measuring the diet and forage intake and excreta output by the total collection method. Apparent digestibility coefficients were calculated according to the analysed contents of nutrients (% DM) in feed (diet + forage, analysed separately) and in excreta, taking into account the amount of feed eaten and excreta voided on a dry matter basis, using the general formula given by Scott et al. (2001).

Results: The chemical analyses of ryegrass and chicory leaves showed a protein content of 20.7 and 21.8 % DM, and a methionine/cystine/lysine content of 3.24/2.11/10.08 and 3.87/1.81/11.98 g/kg DM, respectively. During this digestibility experiment, there was no record of mortality and the weight gain showed that broilers with access to the low protein diet (F1) were not adversely affected as there was no weight loss during the 10-day experiment. The broilers gained weight on average 36.5g/hen/day for C groups and on average 30.8g/hen/day for the F1 groups and the highest gain within each group was seen when giving chicory leaves as supplement. This was on the same level as the control group (group C).

Table: Weights (g) and weight gain (g) (7days) and intake of diets and grass/chicory leaves (g/bird/day) and digestibility of amino acids (See image at the bottom)

a,b,c,d means in the same row with different superscripts differ significantly ($P < 0.05$). ¹SUM AA: sum met, cys, lys, thr.

No significant difference was found with regard to feed intake of the diet, however, the intake of C + chicory and F1 + chicory was significantly higher ($P < 0.001$) than for the groups with no access to forage material (C + F1). The intake of ryegrass from both diets was lower compared to the intake chicory leaves, indicating a preference for chicory leaves. The results from the digestibility experiment showed a variation between dietary treatments as a higher nitrogen retention was recorded for all F1 diets given both supplements (chicory and grass) which were significantly different ($P < 0.001$) from the control diets. The amino acid digestibility contents obtained showed no significant difference except for cystine which differed significantly ($P < 0.01$) between some of the treatments and where the highest values were seen with the F1 diets.

Discussion: Supplementation with ryegrass and chicory leaves increased the total intake of feed compared to diets without forage supplementation. The data indicate that organic broilers may obtain certain amounts of protein and amino acids from forage, especially when low protein diets are fed. This is in accordance with a study, which found that broilers increased their forage intake from outdoor pasture with restricted feeding in the finishing period (De Almedia et al., 2012). The nitrogen retention was higher in broilers given the low protein diet and ryegrass and chicory leaves ($P < 0.01$) compared to the C diet plus supplement. This indicate that the use of low protein diets in organic broilers production can

reduce excess nitrogen excretion outdoor areas, where diets with a higher protein content result in higher N excretion. Thus, stimulating foraging activity through use of low protein diets with slow growing genotypes may ease the transition to 100% organic feed supply in organic production.

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Image:

Treatments	C	C+grass	C+chicory	F	F+grass	F+chicory	P-value
Start weight	2615	2530	2671	2571	2548	2493	NS
Final weight	2854 ^{ab}	2752 ^b	2976 ^a	2778 ^b	2743 ^b	2737 ^b	P<0.05
Weight gain	238	222	306	207	195	244	NS
<u>Feed intake:</u>							
Diet (D)	161	147	161	149	150	148	NS
Forage (F)	-	25 ^b	42 ^a	-	31 ^{ab}	45 ^a	P<0.05
SUM D+F	161 ^{cd}	172 ^{bcd}	203 ^a	149 ^d	181 ^{abc}	193 ^{ab}	P<0.001
<u>Digestibility:</u>							
Methionine	86.40	87.27	85.66	86.89	85.61	85.18	NS
Cystine	74.98 ^{abc}	73.85 ^{bc}	72.11 ^c	77.11 ^a	76.59 ^{ab}	75.67 ^{ab}	P<0.01
Lysine	82.37	83.56	81.67	83.45	83.17	83.55	NS
Threonine	77.75	78.82	75.30	77.63	77.74	77.74	NS
SUM AA ¹	82.28	80.87	78.69	80.98	80.87	80.60	NS
N-retention	32.64 ^d	35.62 ^{cd}	33.95 ^{cd}	38.78	41.90 ^{ab}	45.48 ^a	P<0.001

Disclosure of Interest: None Declared

Keywords: Digestibility of nutrients, Foraging material, Organic broilers