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The effect of source of forage and level on feed intake and diet digestibility in redbros

Research with Distinction (non-honors)

Abstract:

In recent years there has been increased consumer demand for “free range” or “pasture reared” poultry. A popular strain used for pasture rearing is called a “RedBro” and this strain was used in Experiment 1 and both the RedBro and commercial broilers were compared in Experiment 2. There is a perception that pasture can provide a significant proportion of the daily dietary needs of poultry but there is little published literature on how forage type and level will influence feed intake or forage utilization. The objective of the current study, therefore, was to determine how different forage sources and levels would influence feed intake and forage digestibility. The forage sources were dried ground alfalfa leaves, dried ground orchard grass hay, and dry ground alfalfa from bales. The four levels of dietary inclusion were 0% (basal corn/soy diet) or the basal supplemented with 5%, 10%, or 15% of each forage source. There was increased feed intake with increasing levels of forage inclusion. Excreta neutral detergent fiber (NDF) and acid detergent fiber (ADF) concentrations increased with increasing forage intake and a corresponding decrease in total tract diet digestibility.

Introduction:

The localvore food movement has renewed interest in “pastured poultry” or “free ranged” poultry meat and eggs as an alternative to products from conventional production facilities (confined). There is a common perception in the popular press that forage consumption by birds on pasture can make a substantial contribution to their overall nutrient intake. A deeper understanding of poultry nutrition, however, suggests that most commercial poultry cannot utilize the limited forage they might consume because of the size and anatomical location of the hindgut and its constituent microbial population. There is also the perception, backed by some

data in the literature, that even when given access to forages, intake by birds on pasture will be limited as a proportion of total intake. Ponte et al., (2008 a,b) reported that when given access to fresh legume forages, broiler type chickens consumed between 2.5 and 16 % of total intake as forage (% DM). This supports the previously stated hypothesis that broiler type chickens will not consume sufficient forage to serve as a primary source of nutrients. This has not, however, prevented poultry producers, particularly in Europe, from developing niche markets for broilers fed diets containing supplemented forages.

One of the challenges with designing research studies to quantify the effects of dietary forage for poultry is that intake can be highly variable and difficult to measure, particularly for birds on pasture. The quantity of forage consumed per bird is also problematic in group housing situations but if the forage is harvested, dried, and mixed into a complete diet, intake is more easily determined. Mourão et al (2008) reported that when a mature legume and grass forage blend was included in the diet at levels of 5% and 10%, there were no significant effects on final body weight when compared to the control. The diet containing 10% forage resulted in a significant increase in feed intake and a subsequent increase in the feed conversion ratio. This study utilized forage that was harvested at the flowering stage which suggests that it was mature forage which would contain a different proportion of neutral and acid detergent fiber when compared with less mature, more digestible forage. Ipek et al. (2009) studied the influence of broiler genotype on forage intake and concluded that forages could be one part of a suitable feeding strategy for slower growing strains.

The experiments that are reported herein used two very different strains of chickens raised for meat production, commercial broilers developed for conventional confinement rearing and RedBros, a slower growing strain that is often used for pasture rearing. Our working

hypothesis is that if chickens are consuming a truly isocaloric diet, the inclusion level of a forage should not influence intake until "gut fill" precludes further consumption. The overall goal of our studies, therefore, was to determine the effect of equal levels of different forages on feed intake when compared with a corn and soybean meal based control diet.

Objective 1: Observe differences in intake over time.

Objective 2: Determine the differences in digestibility between levels and type of forage.

Objective 3: Determine the differences in excreta microbial populations due to source of forage.

Materials and Methods:

All animal procedures were approved by the Agricultural Animal Care and Use Committee of The Ohio State University and followed guidelines recommended in the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching.

Animals and Diets:

All birds were obtained from commercial sources and allotted to diets randomly. The forages used in the experiment were as follows: dried ground alfalfa leaves; ground orchard grass hay; ground baled alfalfa hay.

Experimental Design:

Experiment 1: Slower growing RedBro broilers (n=40) were allotted to 40 Petersime growing battery pens at 9 weeks of age. The birds were ad libitum fed and had 16 hours of light per day. The birds had a one day transition period after being placed in the battery pens where they were fasted but had access to water. Feed intake was subsequently determined for 9 days. At the end of the 9 day experimental period, all birds were fasted for 24 hours to clear the

digestive track followed by a 3 day period of quantitative feed intake and excreta collection. The excreta was subsequently dried in a forced air drying oven and analyzed for NDF and ADF.

Experiment 2: RedBro (n=48) and commercial broiler (n=48) chickens were allotted to 48 Petersime growing battery pen by strain at 21 days of age (n=2/pen). All bird weights were determined on a pen basis. The birds had a one day transition (fasting) period upon being placed in the battery pens. Feed intake was subsequently determined for 9 days. At the end of the 9 day experimental period, all birds were fasted for 24 hours to clear the digestive track followed by quantitative feed intake and excreta collection for 3 days. The pooled excreta samples were subsequently dried in a forced air drying oven and analyzed for NDF and ADF.

Results

The experimental diets and fiber (NDF, ADF) concentration of the respective forages are shown in Tables 1, 2. There were only small differences in the ADF values between forage types and the orchard grass had an approximate 15-20% increase in NDF compared with the two sources of alfalfa. The determined ADF values for the 5% and 10% forage diets were extremely variable and the 15% forage diets had the expected highest levels of ADF and were consistent across all forage types. The NDF values showed the expected linear increases with increasing level of forage.

Excreta ADF and NDF concentrations showed the expected linear increases with increasing dietary concentration and all diets containing supplemental forage were significantly higher than the corn/soy control (Table 4). The dried alfalfa leaves resulted in the lowest excreta NDF levels. There was a linear increase in feed intake with increasing level of forage (Table 5). The dried alfalfa leaves resulted in the lowest intake and dried baled alfalfa the highest intake. There was a small but significant decrease in diet digestibility with between the 0% corn/soy diet

and the 5% and 10% forage diets (Table 6). The 15% forage diet resulted in a major decline in diet digestibility.

Feed intake was greater in the commercial broilers compared with the RedBros but there were no differences in excreta ADF or NDF (Table 7). Across all forage treatments there no differences in feed intake. All forage treatments resulted in significant increases in excreta ADF compared with the corn/soy control and the highest level of excreta ADF was associated with the 10% alfalfa bale treatment. The same was observed for excreta NDF with the exception that both alfalfa treatments resulted in higher excreta NDF than the orchard grass diet.

Discussion and Conclusion:

The data from these experiments support the concept that feed intake is greater in commercial broiler chickens compared with RedBros but there is no difference in ADF or NDF fiber digestibility. The data also suggests that in diets containing up to 10% forage, only the alfalfa bale source of forage resulted in a significant decrease in intake. Diet digestibility will decline with as little as 5% supplemental forage and the greatest decline in digestibility occurred between 10% and 15% supplemental forage. The data suggests that from a forage utilization standpoint, there is no benefit to using slower growing strains like the RedBros for pasture rearing which is not in agreement with Ipek et al. (2009) who concluded that slower growing strains are better suited for pasture management systems.

Table 1: Composition of diets

	Control		5%			10%			15%	
Orchard grass	-	-	5.0	-	-	10	-	-	15	-
Alfalfa leaves	-	5.0	-	-	10	-	-	15	-	-
Alfalfa baled	-	-	-	5.0	-	-	10	-	-	15
Corn	60.5	60.5	60.5	60.5	53.7	53.7	53.7	47.3	47.3	47.3
Soybean meal 48%	35.0	29.3	29.3	29.3	29.5	29.5	29.5	29	29	29
Blended Fat	-	0.6	0.6	0.6	2.6	2.6	2.6	4.4	4.4	4.4
Dicalcium phosphate 18.5%	1.7	1.8	1.8	1.8	1.65	1.65	1.65	1.75	1.75	1.75
Ground limestone	1.7	1.35	1.35	1.35	1.25	1.25	1.25	1.3	1.3	1.3
Vit/min mix	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Salt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
DL methionine	0.2	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-lysine	-	0.2	0.2	0.2	0.15	0.15	0.15	0.1	0.1	0.1

*all diets were formulated to be isocaloric

Table 2: ADF and NDF of the Forages

	ADF	NDF
Orchard Grass	41. 0 %	66.5 %
Alfalfa Leaves	38.9 %	45.0 %
Alfalfa Baled	42.4 %	49.4 %

Table 3: ADF and NDF of the Diets

	ADF	NDF
Control	6.5%	13.1 %
5% Orchard Grass	11.9%	15.2 %
5% Alfalfa Leaves	8.1%	14.6 %
5% Baled Alfalfa	8.8%	14.9 %
10% Orchard Grass	5.7 %	18.3 %
10% Alfalfa Leaves	9.6%	18.5 %
10% Baled Alfalfa	10.3%	21.6 %
15% Orchard Grass	12.3%	21.1 %
15% Alfalfa Leaves	12.1%	19.7 %
15% Baled Alfalfa	12.5 %	24.1 %

Table 4: The effect of forage source and level on feed intake and excreta fiber percentage in Redbros

Level (%)	Forage	Excreta (%)	
		ADF	NDF
0	-----	11.1	24.5
5	-----	15.5	30.1
10	----	19.5	33.7
15	----	21.6	35.8
		P < .001	P < .001
	Corn/Soy	11.1	24.5
	Alfalfa	18.6	31.3
	Orchard Grass	18.2	35.1
	Alfalfa Bale	19.8	33.2
		P < .023	P < .004

There was no significant interaction between level and source of forage.

Table 5: Intake of Redbros

Intake		Grams
Forage level	5%	4951
	10%	5341
	15%	5416
Type of forage	Orchard Grass	5258
	Alfalfa Leaves	5074
	Alfalfa Baled	5375

Table 6: Digestibility of Redbros

Level		Type of forage	
0%	73.6%	Corn/Soy	73.6%
5%	72.5%	Orchard Grass	69.3%
10%	72.8%	Alfalfa Leaves	70.6%
15%	65.2%	Alfalfa Baled	70.6%

Table 7: The effect of strain and forage source on feed intake and excreta fiber percentage

Strain	Forage	Intake (g)	Excreta (%)	
			ADF	NDF
Broiler	-----	693	19.3	34.2
RedBro	-----	507	18.8	33.7
	Corn/Soy	604	12.8 c	27.2 c
	Alfalfa	602	20.9 ab	34.5 b
	Orchard Grass	601	20.4 b	37.2 a
	Alfalfa Bale	593	21.9 a	37.1 a

All forages were fed at the level of 0 (corn/soy) or 10% added forage source.

Works Cited:

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