Relationship between Lysine Levels and Packed Cell Volume under Different Temperatures in Caged Broiler Breeders

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Abstract
The objective of the present study was to identify whether there was a significant relationship between lysine levels and the Packed Cell Volume (PCV) in broiler breeders when kept under two different ambient temperatures (21oC and 32oC). The lysine concentrations used in the diet were 40, 50, 60, 70, 80 and 90 g/kg Crude Protein. Ninety six Ross (308 Broiler Breeder) were individually caged and blood variables were examined. The relationship between the lysine concentrations and the PCV variable was compared by regression analysis. Increasing dietary lysine increased (P=0.044) blood lysine concentration and increased (P=0.026) PCV values in birds kept at 21oC but not in those kept at 32oC.

Keywords: Broiler breeders, PCV, lysine, temperature

Introduction
The poultry industry is one of the most dynamic and progressive industries in the world. In order to meet the fast growing demand of poultry and poultry products, researchers must conduct studies on all the different areas of the poultry industry. Broiler breeders are one of the major areas of the industry which needs improvement through research. Previous studies found significant linear relationships between lysine deficiency and PCV and haemoglobin levels in chickens (Braham et al., 1961) but there is no direct evidence for broiler breeders.
The specific objectives of the present study were; to examine and explain the effects of two different ambient temperatures (21oC and 32oC), six dietary lysine concentrations (40, 50, 60, 70, 80 and 90 g/kg CP) and their interactions on the PCV in individually caged laying broiler breeders. In addition, to examine whether blood lysine concentration was affected by temperature, dietary lysine supply and their interactions.

Materials and Methods
Ninety-six 28-week old hens (308 Broiler Breeder, Ross Breeders Ltd.) were randomly placed in one of 12 identical cages in each of eight environmentally controlled rooms (for a period of 12 weeks). A daily feed restriction programme was followed, (156 g/bird/day) as per supplier recommendation. There were two different temperatures used in the study (21oC and 32oC) and each was applied in four replicate rooms. Relative humidity was maintained at 70-75%.
A single lysine deficient wheat-based diet (40 g/kg protein) that contained 160 g/kg crude protein was formulated according to National Research Council (1994) and Ross Breeders Limited (1998). Five further dietary levels of lysine were achieved by adding lysine-HCl to the deficient diet to give six dietary concentrations of lysine (40, 50, 60, 70, 80 and 90 g/kg crude protein) for the 12 weeks experimental period.

Blood collection and compositional measurements
Blood samples were collected from all birds at the end of the experimental period.

Packed cell volume:
PCV capillary tubes were filled up to 2mm with blood and placed in a micro centrifuge to separate red blood cell from plasma. A PCV auto-reader was used to calculate the percentage of red blood cells.

Plasma lysine determination:
Deproteinization of the plasma was carried out within 1 hour of blood collection. Samples were placed in a centrifuge then placed into an eppendorf tube. The samples pH were adjusted between 6 and 8, filtered, crimped and stored at 4oC for the HPLC analysis to determine lysine concentrations.

Statistical analysis:
A split-plot design was used in which four rooms (main plots), were kept at one of two constant temperatures. Within each room, 12 cages (sub-plots) were fed six different diets. Data were compared by analysis of variance of the measured and calculated variables, using a split-plot design that examined the effects of temperature of the rooms and the effect of diet and the diet x temperature interactions within the sub-plots (cages) (GENSTAT statistical package, Lawes Agricultural Trust, 1998).

Results and Discussion
Throughout the study the allocated amounts of feed were always eaten. Increasing lysine concentration tended to give a linear increase ($P= 0.064$) in blood lysine concentration at 21oC but not at 32oC. In addition, increasing temperature resulted in an increase ($P=0.024$) in blood lysine concentration. Furthermore, there were significant ($P<0.05$) temperature x lysine concentration interactions in PCV at 21oC but not at 32oC (Table 1). The observed effects of temperature on blood confirm observations in the literature of birds kept at high temperatures. Huston (1960, 1965); Washburn and Huston (1968); Donkoh (1989); Zhou et al.,(1998) in broilers and Parker and Boone (1971) in adult turkeys and Vo et al., (1978) in laying hens found that the haematocrit value was decreased in birds kept at high temperatures.
The study demonstrated that dietary lysine concentration affected the PCV and blood lysine content in the hens, but these responses interacted with the ambient temperature. Increasing dietary intakes of lysine gave increasing ($P<0.05$) blood lysine concentrations in the hens kept at 21oC but not at 32oC (temperature x lysine concentration interaction $P=0.044$; Table 1). The blood samples were taken after two hours of first introducing the feed, so birds kept at 21oC would have consumed most of their feed before this time but those kept at 32oC would have eaten only a small proportion. It is therefore logical that birds kept at 21oC would have a blood lysine content that is more sensitive to the dietary lysine supply.
There was a significant temperature x lysine interaction in PCV in the present study. This lysine response was evident at 21oC, with a peak PCV at 60-70 g lysine/ kg diet but there was no response at 32oC (Table 1). Braham et al., (1961) also found that lysine deficiency reduced PCV and haemoglobin levels in chickens but did not report their rearing temperatures.

Table 1 Effects of six dietary lysine levels on blood Packed Cell Volume (PCV) and Blood Lysine Concentration of female broiler breeders (28-40 weeks of age) kept at 21 or 32oC (Experiment 3)

Temperatures (oC)	Variables	Lysine concentrations (g/kg Crude Protein)						Mean
		40	50	60	70	80	90	
21								
	PCV (%)	38.8	41.5	43.3	44.9	41.7	39.5	41.6
	Lysine (mMol /L)	0.25	0.28	0.30	0.32	0.38	0.36	0.33
32								
	PCV (%)	36.1	37.1	32.8	32.1	34.8	33.6	34.4
	Lysine (mMol /L)	0.43	0.34	0.29	0.42	0.37	0.41	0.38
Mean	PCV (%)	37.5	39.3	38.1	38.5	38.2	36.5	
	Lysine (mMol /L)	0.34	0.31	0.29	0.37	0.37	0.38	

Statistical significance and SEM of treatment means

	Temperature (n=4)		Lysine (n=16)		Temperature x lysine (n=8)	
	P	SEM	P	SEM	P	SEM
PCV (%)	P>0.10	2.93	P>0.10	1.47	Quadratic (P= 0.026)	3.49
Lysine (mMol /L)	P=0.024	0.036	linear (P= 0.064)	0.024	linear (P= 0.044)	0.046

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