

Net Energy Requirement Models for Broiler Breeders, Laying Hens and Broilers

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Abstract

Several studies were conducted at São Paulo State University – Brazil to elaborate net energy (NE) requirement models for broiler breeders, laying hens, and broilers. The models were elaborated based on factorial approach and maintenance and production coefficients. The coefficients for maintenance NE requirement (NEm) expressed in kcal/W^{0.75} was determined by the logarithmic relationship between HP and ME intake provided the NEm, as being the fasting heat production. To determine the effect of temperature on NEm, assays were conducted at temperatures below, at and above thermoneutral zone. The coefficients for growing (kcal/gram of body weight) were determined based on energy body composition. For egg production (kcal/gram of egg) were determined according to egg composition analyses.

Introduction

The net energy system provides an energy value which is the closest to the “true” energy value of the feed. It also predicts more accurately the performance of the pigs and allows implementing new approaches (Noblet, 2001). Several studies have been done with pigs to study the NE system (Noblet et al, 1993a,b; Noblet et al, 1994), however a few researches have been done for poultry.

The factorial approach has been used to partition the energy requirements into maintenance, growth, and production. The coefficients determined for these purposes can be used to elaborate energy requirement models. These models consider the body weight, weight gain, egg production, and environmental temperature to determine the energy requirements for poultry. Predicting daily energy requirement models can help to establish better and more profitable feeding programs for poultry.

Several studies were conducted at São Paulo State University-UNESP, in Jaboticabal, São Paulo, Brazil, with broiler breeders pullets, broiler breeder hens, laying-type pullets, laying hens and broiler chicks, aiming to determine net energy requirement coefficients for maintenance, growth, and egg production and based on these coefficients net energy requirement models were elaborated for broiler breeder, laying hens and broiler chicks.

Material and Methods

Several assays were conducted with broiler breeders pullets, broiler breeder hens, laying-type pullets, laying hens and broiler chicks at temperatures below, at and above thermoneutral zone to determine the effect of temperature on maintenance energy requirement. The comparative slaughter method was used to determine body energy retained (ER), and the heat production (HP) was determined by the difference of ME intake and ER. The logarithmic relationship between HP and ME intake provided the maintenance net energy requirement (NEm), as being the fasting heat production (Lofgreen and Garret, 1968).

The energy requirements for growing were determined based on body composition. The birds were slaughtered weekly to quantify the energy of carcass and feathers. Net energy requirement for weight gain (NEg) was obtained by regression of body energy in function of body weight.

Net energy requirement for egg production was determined by the energy content of eggs (kcal/gram). Samples of egg of laying hens and broiler breeder were analyzed each 15 days during production.

Based on a factorial approach and the coefficients determined, NE requirement models were elaborated for broiler breeders, laying hens, and broilers.

Results and Discussion

Table 1 shows the NE requirement models for broiler breeder pullets, broiler breeder hens, pullet laying hens, laying hens and broiler chicks.

The effect of temperature on NEm was different, for broiler breeder pullets and hens and laying hens, the NEm decreased linearly as the T increased from 12 to 32 oC. For broiler chicks, was observed a quadratic effect. These results indicate that the low critic temperature is different for these birds, probably due to variation on body weight and body composition. For laying hens pullets, the NEm was determined at 24oC.

The NE requirement for growing (NEg) represents the body energy content per gram of body weight. As birds are getting older, the NEg increase due to higher body fat deposition. In so doing, it is more logical express the NEg based on body composition. For broiler chicks, the NEg was partitioned into body protein gain (Gp) and body fat gain (Gf).

The NE system has been studied for pigs (Noblet et al, 1993a,b). Noblet et al (1994) have demonstrated that the NE equations provide an energy value estimate of feeds for pigs is close to their “true” energy content. In addition, according to the author, the proposed equations are directly applicable from information available in feeding table and the NE system can be implemented without any further determination. Chudy et al (2003) presented a new system to determine NE of feed for poultry based on the Rostock Feed Evaluation System. Although the ME system has been utilized for poultry, the NE system can be an alternative in the next future.

Table 1. Net energy requirement models for broiler breeder pullets, broiler breeder hens, laying-type pullets, laying hens and broiler chicks

Age (weeks)	Broiler breeder pullets
3 to 8	$NE = W^{0.75}(147.04 - 1.808T) + 1.95WG$
9 to 14	$NE = W^{0.75}(147.04 - 1.808T) + 1.72 WG$
15 to 20	$NE = W^{0.75}(147.04 - 1.808T) + 2.24 WG$
	Laying hen pullets - White
1 to 7	$NE = W^{0.75}(81.34) + 2.03 WG$
8 to 12	$NE = W^{0.75}(81.34) + 3.06 WG$
13 to 18	$NE = W^{0.75}(81.34) + 5.60 WG$
	Laying hen pullets - Brown
1 to 7	$NE = W^{0.75}(91.96) + 2.03 WG$
8 to 12	$NE = W^{0.75}(91.96) + 3.11 WG$
13 to 18	$NE = W^{0.75}(91.96) + 3.98 WG$
	Broiler breeder hens
	$NE = W^{0.75}(90.977 - 1.108T) + 3.58 WG + 1.54EM$
	Laying hens
	$NE = W^{0.75}(118.5 - 1.638T) + 4.34 WG + 1.49EM$
	Broilers chicks
	$NE = W^{0.75}(212.83 - 9.658T + 0.188T^2) + 9.37Gf + 5.66Gp$

NE is the NE requirement (kcal/bird/day); $W^{0.75}$ is the metabolic body weight (kg); WG is the daily body weight gain (g/b/d); EM is the egg mass (g/b/d); Gf is the fat deposition (g/b/d); Gp is the protein deposition (g/b/d).

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