

### Modelling Energy Utilization In Laying-Type Pullets

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#### Abstract

Three trials were conducted to elaborate the ME requirement models for two laying-type pullet strains. In the first trial, 128 pullets with 9 wks age Hy line Brown (HLB) and Hy line W36 (HLW36) were used to determine the efficiencies of energy utilization (kg) by the comparative slaughter method. In the second trial was determined the effect of temperatures (12, 18, 24, 30 and 36 °C) and the feathering levels (0, 50, and 100%) on ME maintenance requirements (ME<sub>m</sub>) of two strains. In the third trial, 300 chicks were distributed in four groups and sacrificed weekly to analyze the body composition. The ME requirement for weight gain was estimated based on body energy content per gram and the kg. Considering the results obtained  $ME_m = W^{0.75}92.40 + 0.88(T - LCT)$  ( $T \geq LCT$ ) and  $ME_m = W^{0.75}92.40 + 6.73(LCT - T)$  ( $T < LCT$ ) and the ME requirement for growing (kcal/g of BW), the ME models were elaborated for two laying type-pullet strains.

#### Introduction

Pullet feeding programs have not received as much attention as those of broilers and laying hens. These birds nevertheless constitute a considerable part of the poultry population, so the nutrition of replacement pullets deserves more attention. The feeding programs presently in use need to be evaluated in order to determine whether they are sufficiently accurately designed to meet the energy and other nutrient requirements of the pullet during rearing.

Since strains have showed different growth curve, body composition and feed intake, the energy requirement and the efficiencies of energy utilization can be different.

The factorial method is the most frequently method used to represent poultry energy intake. The model can be represented by  $ME = ME_m + RE(1/kg)$ , where the ingested ME is used for maintenance and body deposition considering the efficiency of energy retention (kg) (Sakomura, 2004).

This experiment was carried out to elaborate models to estimate energy requirement of laying type pullets based on factorial approach and considering body weight, environment temperature and feathering level to determine ME maintenance requirement and body weight gain for ME growing requirement.

#### Material and Methods

In the first trial, 64 Hy-Line Brown (HLB) and 64 Hy-Line W36 (HLW36) from 9 to 13 weeks-old were allocated in a controlled temperature room at 24°C to determine the efficiency of body energy utilization (kg). The pullets were fed daily under four levels of feeding, *ad libitum*, 70, 50 e 35% of *ad libitum* intake. The comparative slaughter method was used to determine the body energy retained (BER). The kg was provided by the slope of the regression equation of BER in function of EM intake.

In the second trial, 240 pullets of each strain HLW36 and HLB were allocated at five different temperatures (12, 18, 24, 30 and 36°C) and submitted at three feathering levels (a

group totally (0%), the other group half body unfeathered (50%) and the other one the feathers were kept (100%) to determine the effect of environment temperature and feathering on ME maintenance requirement (ME<sub>m</sub>). The comparative slaughter method was used to determine the body energy retained (BER). The ME<sub>m</sub> were determined by the formula: ME<sub>m</sub>=MEI – RE/kg, MEI is the ME intake, kg is the efficiency of energy utilization determined in the first trial.

In the third trial, 300 chicks of each strain were distributed into four groups and raised from 1 to 18 week-age. A sample of birds of each group was killed weekly in order to analyze body energy composition (BE). The NE requirement (kcal/gram of body was determined by regression equation of BE in function of BW. Considering the kg determined in the first trial and the NE it was estimated the coefficient of ME requirement (kcal/g of body) for each growth phase (1 to 6, 7 to 12 and 13 to 18 weeks).

The models for ME requirement were elaborated considering the coefficients determined for maintenance and growing.

## Results and Discussion

Since feathering affects the lower critical temperature (LCT), the LCT was established according to feathering levels (LCT=24.54 – 5.65F), where F is feathering fraction (0 to 1). According to this equation, the LCT changed with feathering levels (19, 22 and 24°C for 100, 50 and 0% of feathering).

The ME<sub>m</sub> changed with LCT, at temperatures below of LCT the ME<sub>m</sub> increases 6.73 kcal/kg W<sup>0.75</sup>/d for each increase of 1°C (ME<sub>m</sub>=W<sup>0.75</sup>92.40+6.73(LCT –T)). At temperatures above the LCT, the ME<sub>m</sub> increases 0.88 kcal/kg W<sup>0.75</sup> /d for each increase of 1°C (ME<sub>m</sub>=W<sup>0.75</sup>92.40+0.88(T–LCT)).

The increase of ME<sub>m</sub> in temperatures above LCT, is attributed to energy spent in losing heat by evaporation increasing the respiratory rate. On the other hand, when the temperature started decreasing from LCT, there was an increase in ME<sub>m</sub> to keep the body temperature. O'Neill and Jackson (1974) and Peguri and Coon (1999) found an increase on ME<sub>m</sub> of laying hens with incompletely feather coverage compared to birds completely coverage.

The ME requirement for weight gain (kcal/g of BW) determined for each growth phase changed according to body composition, the pullets older had higher fat deposition and consequently the NE was higher.

Considering these coefficients determined for maintenance and growth requirement, the models were elaborated to determine the daily ME requirement for HLW36 and HLB (Table 1).

Table 1. Models to predict the ME requirements for laying-type pullets

<b>Brown Hy Line (kcal/bird/day)</b>	
1 to 6	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 3.22WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 3.22WG$ (T ≥ LCT)
<b>Brown Hy Line e W36 (kcal/bird/day)</b>	
1 to 6	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 3.44WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 3.44WG$ (T ≥ LCT)
<b>Brown Hy Line (kcal/bird/day)</b>	
7 to 12	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 4.94WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 4.94WG$ (T ≥ LCT)
<b>Hy Line W36 (kcal/bird/day)</b>	
7 to 12	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 5.19WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 5.19WG$ (T ≥ LCT)
<b>Brown Hy Line (kcal/bird/day)</b>	
13 to 18	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 6.22WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 6.22WG$ (T ≥ LCT)
<b>Hy Line W36 (kcal/bird/day)</b>	
13 to 18	ME = $W^{0.75}92.40 + 6.73(LCT - T) + 6.74WG$ (T < LCT) $W^{0.75}92.40 + 0.88(T-LCT) + 6.74WG$ (T ≥ LCT)

ME=ME requirement(kcal/bird/day)  $W^{0.75}$ =Metabolic Body Weight (kg), T = Temperature (°C),  
WG =body weight gain (g), LCT = 24.54 – 5.65F (F score of feathering 0 to 1)

## References

O'NEILL, S. J. B., JACKSON, N. (1974). **Observations on the effect of environmental temperature and environmental at moult on the heat production and energy requirements of hens and cockerels of a white leghorn strain. J. Agric. Sci., 82: 553-558.**

PEGURI, A., COON, C. (1993) Effect of Feather Coverage and Temperature on Layer Performance. Poultry. Sci, 72: 1318-1329.

SAKOMURA, N.K. (2004) Modeling energy utilization in broiler breeders, laying hens and broilers. Brazilian Journal of Poultry Science, 6: (1) 1-11.