Calculation of ME and Protein Requirments for Poultry

I Calculation of ME requirements

Problem1. (a) Calculate total MEm (kcal/day) of an adult non-laying hen weighing 2 kg, reared in cage system.

(b) Calculate total MEm (kcal/day) of an adult non-laying hen weighing 2 kg, reared in deep litter system.

Solution: (a) **NEm** (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(2)^{0.75}$

= 83 x √√(2x2x2)

= 83 x √√(8)

= 83 x 1.68

= 139.44 (kcal/day)

MEm (kcal/day) = NEm (kcal/day) ;Because NE is about 82 % of ME
82 % or 0.82

$$= \frac{139.44}{82} \times 100 \text{ or } \frac{139.44}{0.82}$$

= 170.05 (kcal/day)

To this add activity increment **(it is accounted as 37 % of MEm in cage system)**

$$170.05 \times \frac{37}{100} = 62.92 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 170.05 + 62.92

Answer (a) = **232.97 Kcal/day**

(b) **NEm** (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(2)^{0.75}$

= 83 x √√(2x2x2)

= 83 x √√(8)

= 83 x 1.68

= 139.44 (kcal/day)

MEm (kcal/day) = NEm (kcal/day) ;Because NE is about 82 % of ME
82 % or 0.82

$$= \frac{139.44}{82} \times 100 \text{ or } \frac{139.44}{0.82}$$

= 170.05 (kcal/day)

To this add activity increment (**it is accounted as 50 % of MEm in deep litter system**)

$$170.05 \times \frac{50}{100} = 85.03 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 170.05 + 85.03

Answer (b) = **255.08 Kcal/day**

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Problem2. (a) Calculate total MEm (kcal/day) of an adult laying hen weighing 2 kg, reared in cage system and egg production level is 100%.

(b) Calculate total MEm (kcal/day) of an adult laying hen weighing 2 kg, reared in deep litter system and egg production is 85 %.

Solution: (a) **NEm** (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(2)^{0.75}$

= 83 x √√(2x2x2)

= 83 x √√(8)

= 83 x 1.68

= 139.44 (kcal/day)

MEm (kcal/day) = $\frac{\text{NEm (kcal/day)}}{82 \text{ \% or } 0.82}$;Because NE is about 82 % of ME

$$= \frac{139.44}{82} \times 100 \text{ or } \frac{139.44}{0.82}$$

= 170.05 (kcal/day)

To this add activity increment **(it is accounted as 37 % of MEm in cage system)**

$$170.05 \times \frac{37}{100} = 62.92 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 170.05 + 62.92

= **232.97 Kcal/day**

To this add ME for egg production i.e. 86 kcal/day, if egg production is 100 %

Total ME (Kcal/day) = MEm+ ME_{egg}

Total ME (Kcal/day) = 232.97+ 86

Answer (a): Total ME (Kcal/day) = 318.97

(b) **NEm** (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(2)^{0.75}$

= 83 x √√(2x2x2)

= 83 x √√(8)

= 83 x 1.68

= 139.44 (kcal/day)

MEm (kcal/day) = NEm (kcal/day) ;Because NE is about 82 % of ME

82 % or 0.82

$$= \frac{139.44}{82} \times 100 \text{ or } \frac{139.44}{0.82}$$

= 170.05 (kcal/day)

To this add activity increment (**it is accounted as 50 % of MEm in deep litter system**)

$$170.05 \times \frac{50}{100} = 85.03 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 170.05 + 85.03

= **255.08 Kcal/day**

To this add ME for egg production i.e. 86 kcal/day, if egg production is 85 %

The $\mathbf{ME_{egg}}$ (kcal/day) will be $= 86 \times \frac{85}{100} = 73.10$

Total ME (Kcal/day) = MEm+ ME_{egg}

Total ME (Kcal/day) = 255.08+ 73.10

Answer (b): Total ME (Kcal/day) = 328.18

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Problem 3. Calculate total MEm (kcal/day) for a growing broiler breeder hen aged 25 weeks, weighing 2.5 kg, having growth rate 500 g in 10 weeks with egg production level 85%, reared in deep litter system.

Solution: (a) ME for maintenance

NEm (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(2.5)^{0.75}$

= 83 x √√(2.5x2.5x2.5)

= 83 x √√(15.625)

= 83 x 1.99

= 165.17 (kcal/day)

MEm (kcal/day) = NEm (kcal/day) ;Because NE is about 82 % of ME

82 % or 0.82

$$= \frac{165.20}{82} \times 100 \text{ or } \frac{165.20}{0.82}$$

= 201.46 (kcal/day)

To this add activity increment **(it is accounted as 50 % of MEm in deep litter system)**

$$201.46 \times \frac{50}{100} = 100.73 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 201.46 + 100.73

= **302.19 Kcal/day**

(b) ME for egg production i.e. 86 kcal/day, if egg production is 85 %

The $\mathbf{ME_{egg}}$ (kcal/day) will be $= 86 \times \frac{85}{100} = 73.10$

(c) ME for growth

Body wt. gain 500g in 10 weeks means, **daily gain (g/d) = $\frac{500}{7 \times 10} = 7.14$**

The concentration of **Protein- 18.0% and fat- 15.0 %** in body tissues

Therefore, protein and fat content in 7.14 g (gain/d) will be

	Calorific Value (kcal/g)	
Protein (g/d) = 18/100 x7.14 = 1.285 x	**4.0**	**= 5.14 kcal/d**
Fat (g/d) = 15/100 x7.14 = 1.05 x	**9.0**	**= 9.45 kcal/d**
	Energy gain by growth	**= 14.60 kcal/d**

Total ME (kcal/day) requirement for the given bird will be

= MEm + ME_{egg} + ME_g

= (a) 302.19+(b) 73.10+ (c) 14.60

Answer = 389.89(390) kcal/day

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Problem4. Calculate total MEm (kcal/day) of an adult broier breeder hen weighing 3 kg, reared in cage system and egg production level is 100%.

Solution: (a) Calculation of ME for maintenance

NEm (kcal/day) = $83W^{0.75}$

NEm (kcal/day) = $83(3)^{0.75}$

= 83 x √√(3x3x3)

= 83 x √√(27)

= 83 x 2.279

= 189.16 (kcal/day)

MEm (kcal/day) = NEm (kcal/day) ;Because NE is about 82 % of ME

82 % or 0.82

$$= \frac{189.16}{82} \times 100 \text{ or } \frac{189.16}{0.82}$$

= 230.68 (kcal/day)

To this add **activity increment (it is accounted as 37 % of MEm in cage system)**

$$230.68 \times \frac{37}{100} = 85.35 \text{ kcal}$$

Total MEm (kcal/day) requirement for the given hen = 230.68 + 85.35

= **316.03 Kcal/day**

(b) To this add **ME for egg production i.e. 86 kcal/day, if egg production is 100 %**

Total ME (Kcal/day) = MEm+ ME_{egg}

Total ME (Kcal/day) = 316.03+ 86

Answer: Total ME (Kcal/day) for the given broiler breeder hen = 402.03

II Calculation of Protein requirements

For calculation of protein requirement in growing chicken, Protein is needed for three purpose

(i) **Maintenance** : It is estimated as 250mg N/kg or **1600 mg/1.6 g Protein per kg body weight**

(ii) **Tissue growth** : (Tissues contain 18 % Protein) Daily body wt. gain x 0.18

(iii) **Feather growth**: Feathers contain 82 % P and comprise 7 % of body wt. of growing chicken (at 4 week of age) in WLH

Efficiency of Protein utilization in growing chicken is 61 %

Problem 5. Calculate the protein requirement for a growing chicken weighing 1.75 kg, gaining @ 8 g daily.

Solution: CP (g/d) requirement

= Protein for Maintenance + Protein for growth+ Protein for feather growth

= [(BW(g) x 1.6/1000) + (Daily gain (g) x 0.18) + (Daily gain (g) x 0.07 x 0.82)] x % Efficiency of protein utilization (61 %)

$$= \left[(1750 \times 1.6/1000) + (8 \times 0.18) + (8 \times 0.07 \times 0.82)\right] \times \frac{61\ \%}{100}$$

$$= (2.80 + 1.44 + 0.4592] \times \frac{100}{61}$$

$$= 4.699 \times \frac{100}{61} = 7.70\ \text{g/d}$$

Problem 6. Calculate the protein requirement for an adult WLH laying hen, weighing 2 kg level of egg production is 65 %.

Solution: Protein (g/d) requirement

(a) Maintenance requirement of Protein WLH hen **= 1.6 g/kg BW**

For 2kg BW = 1.6 x 2 = 3.2 g Protein/d

Protein content **in** one egg **is 6 g** and level of production is **65 %, thus**

(b) Protein (g/d) for egg production will be $= 6 \times \frac{65}{100} = 3.9$

Total Protein (g/d) = 3.2 + 3.9

Total Protein (g/d) = 6.90

Efficiency of protein utilization for maintenance and egg production is 55 %

Therefore, the above chicken will need Protein (g/d) = $6.90 \times \frac{100}{55} = 12.54$