Effect of Oilseed Supplementation on Amino Acid Digestibility in Laying Hen Diets

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Abstract

Linseed and camelina seed are used in laying hen diets for obtaining eggs enriched in PUFA, being also a potential source of protein for poultry. The bioavailability of amino acids is an important criterion used to evaluate the efficient utilization of feedstuffs. This study was performed in order to determine the amino acid digestibility coefficients from diets supplemented with oilseeds and fenugreek seeds. An experiment was conducted on 114 laying hens, assigned to 3 groups (C, E1, E2) and housed in metabolic cages (2 hens/cage, 38 hens/group). The hens were fed with a corn-soybean meal based diet. The experimental diets enriched in PUFA were supplemented with 5% linseed and 2% camelina seed (E1), and 2% linseed, 2 % camelina seed and 1% fenugreek seed (E2). During the final week, the ingesta, the feed leftovers and the excreta were daily recorded, in order to form weekly average samples for amino acid balance. The aminoacids were determined by HPLC using a method according to the UE Regulation 152/2009. The digestibility coefficients of the dietary essential aminoacids decreased significantly in E2 ($P \leq 0.05$) when compared with the control: for lysine $86.85 \pm 2.74\%$ in C, $81.33 \pm 1.97\%$ in E2; for methionine $87.30 \pm 1.43\%$ in C, $80.99 \pm 3.09\%$ in E2; for cystine $87.21 \pm 1.40\%$ in C, $85.16 \pm 1.48\%$ for E2. The group E1 did not register any significant differences compared with C and E2. The results of this study revealed a decreasing effect on aminoacid digestibility in the group with supplemented fenugreek seed and oilseeds.

Keywords: *amino acid digestibility, oilseed, laying hen*

Introduction. Linseed and camelina seed are used in laying hen diets for obtaining eggs enriched in PUFA, being also a potential source of protein for poultry (Aziza *et al.*, 2010). The bioavailability of amino acids is an important criterion used to evaluate the efficient utilization of feedstuffs (Ravindran, 1999), being important in the formulation of diets more closely to requirements of bird (Lemme *et al.*, 2004).

Aims and objectives. This study was performed in order to determine the aminoacid digestibility coefficients from hens diets, supplemented with oilseeds and fenugreek seeds.

Materials and methods. *Plants origin.* Fenugreek, camelina and linseed were grown on the experimental plots of the INCDA-Fundulea, in

the South East region of Romania.

Animal experiment. The experiment was conducted in an experimental hall on 114 Lohmann Brown hens (age 59 weeks), divided into 3 groups (C, E1, E2). The laying hens were housed in metabolic cages (2 hens/cage, 38 hens/group). During the 5 weeks of experiment, the feed and water were provided *ad libitum*. Diet formulation was in agreement with the nutritional requirements for laying hens (NRC, 1994). The structure of the control diet was: corn (32.67%), rice (15%), wheat (15%), rapeseed meal (15%), soybean meal (10%) and sunflower oil (1%). The control diet had 16.35% crude protein, 5.44 % crude fat and 2710 kcal/ kg feed. The E diets differed from C by inclusion of: 5% linseed and 2

Tab. 1 The aminoacid concentrations in laying hens diets, % DM and apparent digestibility coefficients (%) for analyzed amino acids

Amino acid	C	E1	E2	C	E1	E2
aspartic acid	1.731	1.739	1.688	83.74 ± 2.55 c	81.89 ± 2.00 c	77.50 ± 2.70 ab
glutamic acid	4.229	4.439	4.324	85.41 ± 2.42 c	83.15 ± 2.12 c	79.07 ± 2.74 ab
serine	1.025	1.037	1.117	89.91 ± 1.66 c	89.27 ± 1.10	87.68 ± 1.64 a
glycine	0.792	0.804	0.848	71.20 ± 3.21 c	69.17 ± 3.39	64.74 ± 4.18 a
threonine	0.757	0.773	0.826	78.68 ± 3.11 c	78.35 ± 1.89	75 ± 2.66 a
arginine	1.246	1.110	1.220	90.42 ± 1.78 bc	85.73 ± 1.71 a	83.88 ± 1.75 a
alanine	0.967	1.006	1.029	77.90 ± 4.34 c	75.64 ± 2.68 c	71.14 ± 3.46 ab
tyrosine	0.538	0.581	0.580	86.12 ± 2.89 c	84.14 ± 1.90 c	80.32 ± 2.96 ab
valine	1.340	1.161	1.127	84.98 ± 2.41 bc	81.27 ± 1.79 ac	76.12 ± 3.41 ab
phenylalanine	0.952	0.802	0.873	85.93 ± 1.81 bc	81.89 ± 2.51 a	80.17 ± 3.34 a
isoleucine	0.655	0.743	0.752	79.07 ± 3.30	80.22 ± 1.83 c	75.72 ± 3.86 b
leucine	1.529	1.553	1.513	86.49 ± 2.16 c	85.47 ± 1.34 c	80.79 ± 2.83 ab
lysine	0.878	0.911	0.940	86.85 ± 2.74 c	86.02 ± 1.54 c	81.33 ± 1.97 ab
cystine	0.423	0.471	0.468	87.21 ± 1.40 c	88.10 ± 1.44 c	85.16 ± 1.48 ab
methionine	0.502	0.467	0.454	87.30 ± 1.43 c	84.94 ± 1.46 c	80.99 ± 3.09 ab

Where: a, b, c = significantly different ($p \leq 0.05$) from C; E1; E2.

% camelina meal (E1); 2% linseed, 2% camelina seed and 1% fenugreek seed (E2). Raw materials and feed samples were analyzed for physical-chemical parameters according to Regulation (EC) no. 152/2009. During the final week of the experiment (for 5 days), the ingesta, the feed leftovers and the excreta were daily recorded with accuracy for each cage, in order to perform the amino acid balance. Aminoacid apparent digestibility coefficients were calculated based on chemical determination from ingesta and excreta samples. The coefficient of apparent digestibility represents the ratio between the amount of absorbed aminoacid and the amount of ingested aminoacid (expressed as percent). Aminoacids were determined according to the UE Regulation 152/2009 using a HPLC determination method (Varzaru *et al.*, 2013).

Results and discussion. The analysis of the laying hen diets showed that the compound feeds were balanced in regard of all aminoacids considered. Aminoacid digestibility coefficients were calculated taking into account the ingested and excreted aminoacid amounts during the balance period (Tab. 1).

The digestibility coefficients of the dietary essential amino acids decreased significantly in E2 ($P \leq 0.05$) when compared with the control: for lysine $86.85 \pm 2.74\%$ in C, $81.33 \pm 1.97\%$ in E2; for methionine $87.30 \pm 1.43\%$ in C, $80.99 \pm 3.09\%$ in

E2; for cystine $87.21 \pm 1.40\%$ in C, $85.16 \pm 1.48\%$ for E2. The group E1 did not register any significant differences compared with C. The essential amino-acid digestibility from E2 decreased significantly ($P \leq 0.05$) when compared with the E1.

Conclusion. The results of this study revealed a decreasing effect on aminoacid digestibility in the group with supplemented fenugreek seed and oilseeds.

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