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EFFECT OF FIELD BEANS (*VICIA FABA* L.) AND AGE OF LAYERS ON SOME PRODUCTION PARAMETERS

VPLYV ZARADENIA BÔBU OBYČAJNÉHO (*VICIA FABA* L.) DO KŔMNEJ ZMESI PRE NOSNICE NA ŽIVÚ HMOTNOSŤ A PRODUKCIU VAJEC

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The aim of this experiment was to study the influence of field beans (FB) and also birds' age on some production performances of commercial layers. Raw Faba Bean "RFB" 10 %, 20 % and 30 % were compared with Roasted Faba Bean "RoFB" 10 %, 20 % and 30 %, and both groups were compared with control C. The experiment was performed in a seven-group laying test with 3 repetitions, with a total number of 630 birds aged 43 weeks. Body weight (BW), egg production (EP), feed consumption (FC), and feed conversion ratio (FCR) were studied. BW was not essentially affected by treatments. A significantly higher EP was observed in T4 (10% RoFB). The lowest EP was registered in T2 (20% RFB) and T3 (30% RFB), but values in T1, T5 (20% RoFB) and T6 (30% RoFB) groups were insignificantly higher than C. In the group T2 there was a significant reduction in FC, and a significant increase in the group T4 was observed. A significantly higher value of FCR was observed in T4, while significantly lower values were obtained in T2 and T3. An increase of the birds' age had not essential effects on the BW of hens, but other values were significant and fluctuated in our experiment. EP decreased insignificantly from the week 44 of bird's age. FC increased significantly and progressively with advanced ages. FCR was lowered gradually and significantly as the age of the birds increased.

Key words: *Vicia faba*, layers, egg production, feed consumption, feed conversion

Inclusion of certain grain legumes at low to moderate concentrations in layer diets may boost production and improve the efficiency of feed utilization. The use of grain legumes for poultry is restrained by the uncertainty on the amount and the effect of anti-nutritional factors (ANFs) they may contain (Wiryawan and Dingle, 1999). Flaeh et al., (1998) pointed out numerous anti-nutritional factors in FB seeds (proteinas inhibitors, tannins, vicine, convicine, heme agglutinins, phytic acid, and saponin). Heat treatment is one of the most effective means to dispose anti-nutritional factors in legume seeds (Mohsin, 2000). Al-Nouri (1979) commented that roasted FB seeds contained proteins utilized more efficiently than obtained from other treatments. Thus the nutrition value improved and odor and flavours make it more palatable to birds. Brufau et al. (1998) observed that FB seeds treated with heat can improve the utilization of faba beans, containing high ANFs.

Using RFB in the 20 % and 30 % version in layers' diets did not affect body weight (Guillaum and Bellec, 1977; Naber, 1988).

By using 10%RFB in layers' diets, egg production was not affected significantly (Wilson and Teague, 1974; Robblee et al., 1977; Matteos and Puchal, 1982). Robblee et al. (1977) Matteos and Puchal, 1982; Naber, 1988) also found that using 20%RFB with sufficient quantities of methionine and cystine in the diet did not affect the egg production. (Wilson and Teague, 1974; Castanon and Perez-Lanzac, 1990) however found insignificant decreases. In trials with hens which consumed diets containing 30 % RFB for a long period, egg production decreased significantly ($p \leq 0.05$), in the (Davidson, 1973; Robblee et al., 1977; Guillaume and Bellec, 1977; Campbell et al., 1980) experiments. However, Robblee et al. (1977) observed the reverse effect when using 30%RFB in the diet. (Nanakaly, 1998; Al-Haweizy, 2002) observed a significant decrease in egg production with advanced birds' age.

Including RFB in layers' diets resulted in a decrease of feed consumption and symmetrically an increase of RFB levels (Mateos and Puchal, 1982; Castanon and Perez-Lanzac, 1990). Wilson and Teague (1974) observed an insignificant depression in feed consumption when using diets containing 10 % RFB, while Mateos and Puchal (1982) pointed out the reverse by a sufficient supplementation of methionine according to the requirements of hens. Increasing the level of RFB in the diet to 20 % insignificantly decreased the feed consumption (Wilson and Teague, 1974; Mateos and Puchal, 1982; Castanon and Perez-Lanzac, 1990). A reduction in feed consumption was observed when diets included 30% of RFB, fed to layers, but it was insignificant ($P \leq 0.05$) (Davidson, 1973; Guillaume and Bellec, 1977; Mateos and Puchal, 1982).

Many studies illustrated an insignificant decrease in feed efficiency when diets containing FBs were used for hens, and reverse effects were observed by increasing FB levels in the diet. (Wilson et al., 1974; Robblee et al., 1977; Mateos and Puchal, 1982) pointed out any differences in feed efficiency between the groups fed with diets containing 10%RFB and the control group. Diets containing 20% and 30%RFB decreased the feed efficiency insignificantly, see a 20%RFB diet as reported by (Davidson, 1973; Wilson et al., 1972; Robblee et al., 1977; Naber, 1988; Castanon and Perez-Lanzac, 1990) and for a 30% RFB diet see (Davidson, 1973; Robblee et al., 1977; Mateos and Puchal, 1982). However, Guillauma and Bellec (1977) noticed a significant ($P \leq 0.05$) decrease in feed efficiency when diets containing 30%RFB were used for Rhode Island layers.

Material and methods

The experiment was carried out within the Erbil poultry project, and the laboratory analysis in the nutrition laboratory of the Agriculture College of the University of Salahaddin.

The study comprised the determination of the effects using 10 %, 20 % and 30 % of RFB and the same levels of RoFB compared with the control group, with commercial Hy-Line®W98 layers, on body weight, egg production, feed consumption, feed conversion efficiency.

The body weights of 630 hens aged 43 weeks were determined. The birds were housed in automatic controlled housings in 3-floor caged batteries (45 x 40 x 45 cm) for each cage. The birds were distributed randomly into seven groups, each group comprised 90 birds distributed in 18 cages (3 replications x 6 cages x 5 birds) fed by different feed mixtures. The experiment period was 140 days.

Table

Treatments (1)	Description (2)
Control (3)	Commercial feed mixture (4)
T1	10 % Raw Faba Bean (10%RFB)
T2	20 % Raw Faba Bean (20%RFB)
T3	30 % Raw Faba Bean (30%RFB)
T4	10 % Roasted Faba Bean (10%RoFB)
T5	20 % Roasted Faba Bean (20%RoFB)
T6	30 % Roasted Faba Bean (30%RoFB)

Tabuľka
(1) skupiny, (2) opis, (3) kontrolná skupina, (4) komerčná kŕmna zmes

Diets were fed to birds ad libitum, and at the end of the week remaining diets were collected and weighed to determine the daily feed consumption for each replication. Diets' compositions are illustrated in table 1. The daily light period was 17 hours with light density 10 lux.

Heat treatment of FB seeds was carried out by roasting (baking) in a locally set up bakery. The method is following:

1. Seeds were soaked in water for 5 minutes before 24 hours of the roasting period to stimulate the seed endosperm growth, primarily to improve the dietary values of the protein (Mohsin, 2000).
2. Seeds were soaked in the water a few minutes before placing them inside the bakery, to prevent seeds from direct high temperature exposure of the bakery (180 °C). Seeds' temperatures were measured for two minutes after heat processing. The temperature was 126–130 °C.

Chemical analyses of the seeds were carried out according to A.O.A.C. 1975. Moisture was 7.08 %, crude protein was 23.5 %, crude fat was 1.0 %, crude fiber was 7.72 %, and ash was 3.7 %.

Body weigh was registered monthly (for 28 subsequent days). Egg production was calculated according to HD % (North, 1984). Statistical analyses were carried out by a factorial experiment conducted in C.R.D, with the model equation $Yijk = \mu + Ti + Pj + eijk$ and means were compared by the Duncan Multiple Range Test (Duncan, 1955), on a probability level of 5 %.

Results and discussion

A significant lower body weight was observed in T2, as compared to the other groups (table 2). In general, bird's age does not affect significantly body weight in the near end of the production (table 3). Egg production in the T4 group significantly excelled when compared with other groups (table 2). This is attributed to the fractional substitution of RoFBs protein to the soy bean protein and a harmonized amino acid balance, in addition this is attributed also to the reduction or elimination of ANFs activity and seeds' proteins denatured by the effect of heat processing, and thus improving feed efficiency, which results in sufficiently available nutrients which support egg production. On the other side, feed consumption incremented was in the birds in this treatment. A significant preeminence for T5 and T6 was observed on T2 and T3 respectively. It is attributed to the effect of heat treatment of the ANFs, particularly tannic acid and trypsine inhibitors (Kempen, 1993; Brufau, 1998; Roger, 1998). In addition, the effect of a significant distinction between T5 and T6 of feed conversion efficiency, as compared to T2 and T3 respectively, was attributed to the effect of additional ANFs in T2 and T3, such as a trypsine inhibitor (Wilson et al., 1974) and tannic acid, (Jansman et al., 1994) and heme-agglutinin (Marquardt et al., 1974). T1 has significant preeminence on T2 and T3. This is attributed to the increase of the RFB proportion in T2 and T3, and consequently the high concentrate of ATFs in these diets. This result was confirmed by Robblee et al. (1977); Wilson and Teague (1974); Mateos and Puchal (1982). In T2 and T3 there was a significant depression when compared with the control group. This result was also confirmed by Campbell et al. (1980); Robblee et al. (1977) but disagreed upon by Mateos and Puchal (1982). This effect is attributed to the variation in FB species used in each experiment. Using higher levels of heat treated FB did not significantly vary the comparison with the control group. This was confirmed by Campbell et al. (1980)

Table 1 The diets formula

Feed staffs % (1)	Treatments (2)						
	T1	T2	T3	T4	T5	T6	control (27)
Broad bean (3)	10	20	30	10	20	30	0.0
SBM 44 %* (4)	10.985	6.618	2.252	10.985	6.618	2.252	15.347
Wheat (5)	11.833	20.636	29.444	11.833	20.636	29.444	3.260
Barley (6)	55.240	40.714	26.188	55.240	40.714	26.188	69.518
Vegetable Fat (7)	0.800	0.800	0.800	0.800	0.800	0.800	0.800
Methionine (8)	0.138	0.171	0.203	0.138	0.171	0.203	0.106
Lysine (9)	0.122	0.127	0.132	0.122	0.127	0.132	0.117
Limestone (10)	9.291	9.278	9.265	9.291	9.278	9.265	9.303
Di Cali Pho** (11)	1.017	1.055	1.094	1.017	1.055	1.094	0.979
Salt (12)	0.375	0.375	0.374	0.375	0.375	0.374	0.376
[Cx-Layer]*** (13)	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Avienzyme**** (14)	0.080	0.080	0.080	0.080	0.080	0.080	0.080
Choline Chloride (15)	0.044	0.069	0.093	0.044	0.069	0.093	0.039
Minerals***** (16)	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Calculated Chemical analyses for diets (17)							
Kcal ME/Kg Diet (18)	2 570	2 570	2 570	2 570	2 570	2 570	2 570
Crud Protein % (19)	15.19	15.19	15.19	15.19	15.19	15.19	15.19
Crud Fiber % (20)	5.503	5.308	5.144	5.503	5.308	5.144	5.608
Calcium % (21)	3.700	3.700	3.700	3.700	3.700	3.700	3.700
Phosphorus % (22)	0.350	0.350	0.350	0.350	0.350	0.350	0.350
Lysine5 (23)	0.800	0.800	0.800	0.800	0.800	0.800	0.800
Methionine + Cystin % (24)	0.580	0.580	0.580	0.580	0.580	0.580	0.580
Sodium (25)	0.170	0.170	0.170	0.170	0.170	0.170	0.170
ME / CP (26)	169.19	169.19	169.19	169.19	169.19	169.19	169.19

*Soy bean meal; ** Di Calcium Phosphate; ***Vitamin Complex, K3, E, Biotin, Pantothenic acid, Niacin, Folic acid, B12, B6, B2, B1, D3, A; **** Xylanase, β-Glucanase; ***** Mineral Complex, Cu, Fe, I, Mn, Si

Tabuľka 1 Zloženie krmiva

(1) kŕmne látky, (2) skupiny, (3) Vicia faba, (4) 44 % sójová múčka, (5) pšenica, (6) jačmeň, (7) rastlinný tuk, (8) metionín, (9) lyzín, (10) vápenec, (11) dikalcium-fosfát, (12) soľ, (13) vitamínový komplex, (14) xylanáza, β-Glukanáza, (15) cholínchlorid, (16) minerály, (17) kalkulovaná chemická analýza krmív, (18) kcal metabolizovateľnej energie/kg krmiva, (19) hrubý proteín, (20) hrubá vláknina, (21) kalcium, (22) fosfor, (23) lyzín, (24) metionín + cystín %, (25) sodík, (26) metabolizovateľná energia/hrubý proteín, (27)kontrola

when using 40 % heat-treated FB. Birds' age also affected egg production, but fluctuated in our experiment (table 3) and tends to decrease gradually and insignificantly. This result attributed to the influence of is decreasing the number of the developed ovum (Williams and Sharp, b 1978; Yu et al., b 1992), which was stimulated with the influence of FSH and LH hormones, which are derogate with the advanced age of the bird (North, 1984), and also should be attributed to the depression of feed efficiency (table 2). This result is in agreement with Nanakali (1998); AL-Haweizy (2002). Feed consumption and feed conversion in T4, T5 and T6 were significantly higher than T1, T2, and T3. Higher feed consumption was attributed to the improvement in palatability of the diets by heat treatments and decreased the effects of tannic acid (Vohra et al., 1966; Al-Nuri, 1979; Al-Dalali, 1987). The augmented feed efficiency is attributed to a significant increase of egg production in the former groups. A significant increase in feed consumption as observed in T4 compared to other treatments is attributed to the low level of the RoFB in T4. Consequently, a depression of tannic acid levels in the diet was observed. However, the T5 and T6 probes contained RoFB, but a portion of the tannic acid remained, even when heat treated. This result was confirmed by Marquardt et al. (1974); Trevio et al. (1992) who pointed out that there is a significant adverse relationship between tannic acid levels in the diet and feed consumption when fed to broilers. The superiority of T4 on the control group however was observed to have the same protein and energy levels. This is attributed to the improvement in the tests and the improved flavour through the presence of RoFB in the diet (Al-Nouri, 1979) and the presence of a higher level of barley in the control diet. This result is in agreement with Fernandez et al. (1972) (50 % autoclaved kidney bean); however, in disagreement with the results of Campbell et al. (1972). T1 excels T2 and T3 significantly. This is attributed to the higher concentration of tannic acid in the diet in the T2 group. This result disagrees with Wilson and Teague (1974); Guillaume and Bellec (1977); Campbell et al. (1980) but is confirmed by Davidson (1973); Mateos and Puchal (1982). The discordance may be attributed to the different spices of FB used in each diet. T4 has a higher feed conversion than the other treatments, which should be attributed to the lower level of ANFs as compared to others, which results in a higher utilization of the nutrients. This

Table 2 Effect of different levels of raw and roasted faba beans on body weight, egg production, feed consumption and feed conversion

	Performance characters (1)			
	body weight (2)	egg production (3)	feed consumption (4)	feed conversion (5)
T1	1 804.2±7.20a	81.5±0.70a	109.86±2.01bc	2.129±0.04a
T2	1 685.2±10.8e	74.3±0.74d	107.77±2.94e	2.284±0.04b
T3	1 787.9±6.70ac	79.5±0.74b	109.65±2.68c	2.226±0.03c
T4	1 772.9±4.90bcd	83.2±0.53c	110.74±1.77d	2.083±0.03d
T5	1 764.4±5.40a	81.0±0.50a	110.47±1.82a	2.167±0.03a
T6	1 800.5±12.8ab	81.5±0.82a	110.33±1.83a	2.160±0.04a
Control (6)	1 801.4±9.20a	80.7±0.66a	110.06±1.90b	2.136±0.03a

Mean values with different superscripts within a column differ significantly ($P < 0.05$)

Tabuľka 2 Vplyv rôznych úrovní surového a restovaného bôbu na hmotnosť, produkciu vajec, spotrebu a konverziu krmiva
(1) produkčné parametre, (2) hmotnosť, (3) produkcia vajec, (4) spotreba krmiva, (5) konverzia krmiva, (6) kontrola

Table 3 Effect of birds' age on body weight, egg production, feed consumption and feed conversion

	Periods (28 days) (1)				
	P1	P2	P3	P4	P5
Body weight (2)	1 757.5±9.89a	1 780.±13.5b	1 775.4±13.4a	1 780.2±10.0a	1 775.5±7.5a
Egg production (3)	81.7±0.79b	80.2±0.80a	80.1±0.75a	79.3±0.76a	79.8±0.70a
Feed consumption (4)	98.1±0.94a	105.9±0.12b	109.9±0.07c	115.5±0.04d	119.8±0.03e
Feed conversion (5)	1.976±0.05c	2.133±0.11b	2.184±0.10b	2.268±0.11a	2.284±0.09a

Mean values with different superscripts within a row differ significantly ($P < 0.05$)

Tabuľka 3 Vplyv veku nosníc na hmotnosť, produkciu vajec, spotrebu a konverziu krmiva
(1) 28-dňová perióda, (2) hmotnosť, (3) produkcia vajec, (4) spotreba krmiva, (5) konverzia krmiva

observation is confirmed by Mateos and Puchal (1982) and disagreed upon by Robblee et al. (1977). A significant distinction was observed for the control group when compared to T2 and T3. This result was confirmed by Davidson (1973); Castanon and Perez-lanzac (1990) and is in disagreement with Mateos and Puchal (1982); Wilson and Teague (1974); Campbell et al. (1980); Guillaume and Bellec (1977).

A significant and gradual increase of the feed consumption was observed with the advanced ages of the bird. This could be attributed to the increase of the requirements for maintenance; on the other side also to the adaptation to the diet flavor by the birds. This result is in agreement with Davidson (1973); Al-Haweizy (2002).

Feed conversion decreased gradually with advanced age of the birds. This is attributed to the increase of feed consumption and decrease of egg production. This result was confirmed by Davidson (1973); Scoot et al. (1982); Al-Haweizy (2002).

Conclusions

From the results of this experiment it can concluded that there was a tendency of decreasing body weight with increasing RFB levels in the diet, and this effect was relatively stable with advanced birds' age. Low levels of RFB increased the egg production insignificantly ($p > 0.05$), but using RoFB in high levels in the diet significantly increased the egg production. An increasing level of RFB significantly decreased the egg production. Birds' age decreased the egg production gradually but not significantly. There is a tendency of decreasing feed consumption when using RFB in the diet. The differences were insignificant when using 10% RFB in the diet, but they were significant when higher levels were used, while heat treatment on FB seeds prevented feed consumption from a reduction and conversely increased consumption significantly on the 10 % level and insignificantly with higher levels. Feed consumption was gradually increased by increasing birds' age. The pattern of feed conversion is similar to the feed consumption in all trials as compared to the control group. An advance in the birds' age depressed feed conversion gradually and significantly. It is necessary to study the influence of roasting (baking) FB seeds in further experimental works, particularly to determine the sufficient degree for baking FB seeds, and furthermore to study the influence of both RFB and RoFB levels in the diet on physiological parameters and inner content of nutrients in the egg. From these trial results, FBs could be a good alternative source of plant protein and could prove sufficient to substitute animal proteins sources in poultry nutrition.

Súhrn

V pokuse sa sledoval vplyv zaradenia bôbu obyčajného do kŕmnej zmesi pre nosnice a tiež vek nosníc na živú hmotnosť a niektoré ďalšie produkčné ukazovatele. Do pokusných skupín sa zaradilo 10 %, 20 % a 30 % surového bôbu „RFB“ a 10 %, 20 % a 30 % praženého bôbu „RoFB“. Sledované produkčné ukazovatele u nosníc sa porovnávali medzi pokusnými skupinami navzájom a tiež s kontrolnou skupinou C, ktorá bola kŕmená komerčnou kŕmnou zmesou. Pokus sa realizoval so 7 skupinami v troch opakovaniach na celkovom počte 630 nosníc vo veku 43 týždňov, kde sa okrem živej hmotnosti (BW) sledovala aj produkcia vajec (EP), spotreba krmiva (FC) a konverzia krmiva (FCR). Živá hmotnosť nebola podstatnejšie ovplyvnená pokusným zásahom. Preukazne vyššia produkcia vajec bola zaznamenaná v skupine T4 (10 %RoFB) a preukazne nižšia v skupinách T2 (20 %RFB) a T3 (30 %RFB). V ostatných pokusných skupinách T1 (10 %RFB), T5 (20 % RoFB) a T6 (30 % RoFB) bola tiež produkcia vajec vyššia ako v kontrolnej skupine, ale rozdiely boli nepreukazné. V skupine T2 sa štatisticky preukazne znížil a v skupine T4 štatisticky preukazne zvýšil príjem krmiva (FC). Preukazne vyššia konverzia krmiva (FCR) sa zaznamenala v T4 a preukazne nižšia v skupinách T2 a T3. Vek nosníc podstatnejšie neovplyvnil BW, zatiaľ čo ostatné ukazovatele produkcie boli kolísavo preukazne ovplyvnené. EP sa nepreukazne znížila po 44. týždni veku nosníc. FC sa postupujúcim vekom preukazne zvyšovala, zatiaľ čo FCR sa preukazne znižovala.

Kľúčové slová: *Vicia faba*, nosnice, produkcia vajec, spotreba krmiva, konverzia krmiva

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