INFLUENCE OF SUBSTITUTION OF COCOON MEAL (BOMBYX MORI L.) FOR MEAT MEAL IN FORAGE MIXTURES ON JAPANESE QUAILS GROWTH

ВЛИЯНИЕ НА ЗАМЯНАТА НА ТРУПНО БРАШНО ВЪВ ФУРАЖНАТА СМЕСКА С БРАШНО ОТ КАКАВИДИ НА КОПРИНЕНАТА ПЕПЕРУДА (BOMBYX MORI L.) ВЪРХУ РАСТЕЖА НА ЯПОНСКИТЕ ПЪДПЪДЪЦИ

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ABSTRACT

A study is carried out with two groups of japanese quails in order to check the possibility to substitute cocoon meal (B.mori L.) for meat meal as well as to evaluate a growth potential in these conditions. The forage mixture of control group contains 7% meat meal. The experimental forage mixture contains 7% cocoon meal and has equal nutritive value. The substitution of meat meal with the cocoon meal in quails food results in better growth development during first days of their life. Both sexes have higher body weight - 11.1%; 8.7% and 9.8% respectively in 7th, 14th and 21 day of life. Feed conversion ratio (FCR) during the period from 0 to 35th day as well as the final body weight of birds in two groups is equal. The cocoon meal can be the suitable constitutor in starter forage mixture for quails guaranteed equivalent growth and FCR.

KEY WORDS: japanese quails, meat meal, cocoon meal, growth, FCR

РЕЗЮМЕ

Проведено е проучване с две групи японски пъдпъдъци с цел да се установят възможностите за заместване на трупното брашно с брашно от какавиди на копринената пеперуда (Bombyx mori L.) и да се оценят растежните способности на пъдпъдъците при това. Фуражната смеска на контролната група съдържаше 7% трупно брашно, а на опитната - 7% какавидено, при еднакъв хранителен състав. Заместването на трупното брашно с какавидено в смеските за пъдпъдъци е свързано с по-добро тегловно развитие на птиците през първите дни от живота им. Общо за двата пола живото тегло на птиците от опитната група е било достоверно по-високо с 11,1; 8,7 и 9,8% съответно на 7-, 14- и 21-дневна възраст. Конверсията на фураж за периода 0-35 дни, както и крайното живо тегло на птиците от двете групи са практически еднакви. Какавиденото брашно може успешно да замени трупното в стартерните смески за пъдпъдъци, като гарантира равностоен растеж и конверсия на фуража.

КЛЮЧОВИ ДУМИ: японски пъдпъдъци, трупно брашно, какавидено брашно, растеж, конверсия на фураж

РАЗШИРЕНО РЕЗЮМЕ

Съставянето на стартерни фуражни смески за японските пъдпъдъци изисква значителни количества протеинови източници- соев шрот, рибно брашно, трупно брашно и др., по – голямата част от които се импортират. В същото време не се използват отпадъчни материали от различните промишлености с високо протеиново съдържание. Един от тях е какавиденото брашно (*Bombyx mori L.*).

Целта на настоящото проучване е да се оцени влиянието на замяната на трупно брашно в смеските с какавидено брашно върху динамиката на растежа и конверсията на фуража при японските пъдпъдъци.

Опитите са проведени във вивариума на секция "Птицевъдство" на Тракийски Университет гр. Стара Загора със 160 пъдпъдъка - 74 женски и 86 мъжки, отнасящи се към яйценосна популация. При излюпването пъдпъдъчетата бяха теглени и маркирани. Формирахме две групи. Контролна, хранена със стандартна фуражна смеска, съдържаща 7% трупно брашно и опитна – със замяна на трупното брашно със 7% какавидено брашно.

Птиците бяха отглеждани в клетъчни батерии при осигурена площ 150 cm^2 на птица. Храната и водата бяха предоставени ad libitum. Температурата и влажността на въздуха в помещението бяха съответно 22-24^oC и 60-65% при допълнитерно локално отопление с несветещи излъчватели през първите три седмици. Светлинният ден беше с продължителност 17 h.Живата маса се контролираше индивидуално с точност до 0,1g при излюпването и в края на всяка седмица до 35-дневна възраст. При навършване на 21-дневна възраст птиците бяха разделени по пол и до 35-я ден се отглеждаха разделнополово. Разходът на фураж се контролираше ежеседмично по групи. Интензивността на растежа беше оценена чрез абсолютния среднодневен и относителен прираст.

Замяната на трупното с какавидено брашно в смеските за пъдпъдъци резултира в по – добри растежни показатели през първите дни от живота им. Двата пола показват по – високо живо тегло – 11.1%; 8.7% и 9.8% съответно на 7-ми, 14-ти и 21 ден. Конверсията на фураж от 0-35 ден, както и крайното живо тегло на птиците от двете групи бяха еднакви. Какавиденото брашно може да бъде подходящ заместител в стартерите за пъдпъдъци, гарантиращ еквивалентен растеж и конверсия на фуража.

INTRODUCTION

Combining of starter forage mixtures for Japanese quails required a significant quantity of protein sources - soybean oil meal, fish meal, meat meal, etc., while a majority of them are imported. At the same time, residual materials with high protein content from different production are useless. One of these is the cocoon meal (Bombyx mori L.). In Bulgaria, this waste material was been a subject of scientific interest. Data about its chemical composition and digestibility are provided by [11, 1, 12, 10, 3].

In scientific literature, there are data about the possibility to substitute cocoon meal for meat meal and influence of cocoon meal to the chicken broilers growth and meat quality [11]. But there is no data about the application of cocoon meal onto other bird species.

According to [3, 5] the cocoon mail has the following characteristics in DM: true metabolizable energy ($n-_0$) – 21.18 MJ/kg, crude protein- 56.2%, lysine- 3.99%, methionine+cystine- 1.71%.

The main object of this study is to evaluate the influence of substitution of meat meal with cocoon meal in forage mixtures to the quails on dynamic growth and feed conversion ratio (FCR).

MATERIALS AND METHODS

The experiment is carried out with 160 quails – 74 females and 86 males in the vivarium of the Dept. of Poultry Science, Thracian University, Stara Zagora.

When the quails were hatched, they all were individually weighted and marked. Birds were divided into two groups. The first is control group fed with standard forage mixture containing 7% meat meal and the second is experimental fed with 7% cocoon meal instead of meat one. The composition and nutritive value of forage mixture are shown in Table 1. The forage mixture is prepared using in maximal extent unexpensive and available forage components.

The birds were kept in the cage battery with guaranteed area of 150 cm^2 per chicken. Food and water are provided ad libitum. The temperature and air humidity in the cage were kept 22-24^oC and 60-65 %, with additional source of heating (nonlight radiation) during first three weeks. Daylight duration was 17h. The body weight was controlled immediately after hatching and in the end of each week within 0.1 g of the dimension required up to the 35 day of age. At 21 day of age the birds were separated according to the sex.

The feed consumption was controlled weekly at each group. Growth intensity was assessed by average daily gain and relative gain in quails, (%).

The relative gain (%) was estimated by the next formula:

Table 1. Composition and nutritive value of feed used

	Groups	
Components, g	I	II
Corn	270.65	283
Wheat	272	282.9
Sunflower oil meal	149	130
Soybean oil meal	175	175
Meat meal	70	0
Cocoon meal	0	70
Salt	2.5	2,5
Lysine, 20%	1.485	1,95
DL-methionine	0.165	0.15
Fats	38	24
Dicalcium phosphate	13.2	19
Limestone	7.5	11
Vitamin premix	0.5	0.5
Total:	1000	1000
1 kg mixture contains: ME, MJ/kg	12,54	12.54
Crude protein, %	22,04	22.04
Lysine,%	1,30	1,30
Methionine+cystine, %	0,80	0,80
Calcium, %	1.00	1,00
Phosphorus, %	0,50	0,50
Crude fibre, %	5,30	5,37

Table 2. Body weight of the quails, g

Period of age, Days	I control x±Sx	VC	II experimental x±Sx	VC	Signifi-Cance
		male and female			
Hatched	6.499±0.067	11.1	6.522±0.067	10.9	-
7	25.673±0.550	19.8	28.531±0.486	15.4	***
14	51.591±0.591	16.1	56.084±0.977	15.5	**
21	73.615±1.110	13.4	80.827±1.275	13.9	***
28	95.115±1.215	11.4	98.951±1.455	13.0	-
35	111.035±1.715	13.7	112.115±2.063	16.3	-
		Female			
Hatched	6.635±0.134	12.8	6.549±0.113	10.2	-
7	25.976±0.845	19.5	28.099±0.776	16.6	-
14	52.531±1.220	13.5	56.135±1.516	16.2	-
21	74.271±1.456	11.4	81.911±2.093	14.3	**
28	97.737±2.057	12.3	103.989 ± 2.511^{f}	14.5	-
35	122.786 ± 2.306^{m}	11.0	125.781 ± 2.551^{n}	12.2	-
		Male			
Hatched	6.559±0.112	10.1	6.604±0.112	10.3	-
7	26.082±0.833	19.2	29.536±0.672	13.8	**
14	51.268±1.522	17.6	56.758±1.356	14.5	**
21	73.333±1.869	14.9	80.429±1.694	12.8	*
28	93.592±1.537	9.6	94.866 ± 1.330^{f}	8.5	-
35	101.117 ± 1.386^{m}	8.0	98.737 ± 1.305^{n}	8.0	-

Note: * - P≤0,05; **, f - P≤0,01; ***, m,n - P≤0,001

Table 3. Average daily gain in quails, g

Period of age, Days	I control x±Sx	VC	II experimental x±Sx	VC	Signi - ficance
		male and female			
0-7	2.771±0.073	24	3.170±0.069	19.2	***
7-14	3.646±0.078	19.1	3.942±0.083	18.6	**
14-21	3.124±0.069	19.5	3.508±0.074	18.7	***
21-28	3.071±0.095	27.6	2.589±0.105	35.6	**
28-35	2.303±0.186	31.2	1.881±0.187	37.8	-
		Female			
0-7	2.809±0.100	21.1	3.104±0.109	21	*
7-14	3.718±0.108	17	4.005±0.128	19.2	-
14-21	3.106±0.090	16.9	3.682±0.117^{a}	19.1	***
21-28	3.352±0.140^{b}	24.3	3.154±0.120^{m}	22.8	-
28-35	3.578±0.205^{c}	33.5	3.113±0.230^{n}	44.2	-
		Male			
0-7	2.814±0.120	25.6	3.276±0.093	17.2	**
7-14	3.573±0.130	21.5	3.889±0.115	18.0	-
14-21	3.104±0.116	21.9	3.882±0.091^{a}	26.4	-
21-28	2.894±0.142^{b}	40.3	2.062±0.136^{m}	40.1	-
28-35	1.106±0.140^{c}	32.9	0.553±0.076^{n}	43.2	***

Note: *,a,b,c - P≤0,05; ** - P≤0,01; ***, m,n - P≤0,001

Table 4. Relative gain in quails, %

Period of age, days	I control x±Sx	VC	II experimental x±Sx	VC	Signi- ficance
		male and female			
0-7	118.098±1.599	12.3	125.601±1.415	10.0	***
7-14	42.901±0.982	20.4	43.082±0.689	14.1	-
14-21	35.237±0.768	19.3	35.973±0.636	15.6	-
21-28	25.720±0.809	27.8	20.303±0.791	34.4	***
28-35	15.821±1.132	32.4	11.980±1.151	34.9	*
		Female			
0-7	117.415±1.694	8.7	125.483±2.623	12.5	*
7-14	42.670±1.659	22.7	44.382±1.005^{a}	13.6	-
14-21	34.495±1.000	16.9	37.463±0.940^{b}	15.1	*
21-28	27.233±0.837	17.9	23.821±0.771^{m}	19.4	**
28-35	22.766±1.218^{k}	31.2	19.223±1.452^{n}	35.3	-
		Male			
0-7	119.843±3.086	15.2	126.239±1.458	7.0	-
7-14	41.256±1.427	20.2	41.496±0.972^{a}	14.3	-
14-21	35.239±1.314	21.4	34.714±0.861^{b}	15.1	-
21-28	24.788±1.510	35.0	16.897±1.238^{m}	44.6	***
28-35	8.224±1.106^{k}	36.1	4.047±0.569^{n}	45.6	***

Note: *,a,b - P≤0,05; ** - P≤0,01; ***, k,m,n - P≤0,001

Table 5. Feed conversion ratio, g/g

Period of age, days	I control x±Sx	VC	II experimental x±Sx	VC	Signifi-cance
		male and female			
0-7	1.910±0.080	41.8	1.791±0.049	26.6	-
7-14	2.972±0.108	33.5	2.632±0.071	23.9	**
14-21	3.413±0.094	24.3	3.362±0.085	22.2	-
21-28	3.487±0.073	18.3	3.439±0.080	20.2	-
28-35	4.833±0.177	32.4	6.355±0.351	48.2	***
		Female			
0-7	1.819±0.133	44.0	1.867±0.082	26.4	-
7-14	2.889±0.129	26.7	2.559±0.110	25.4	-
14-21	3.335±0.139	23.9	3.287±0.105	19.2	-
21-28	3.539±0.115	18.9	3.297±0.120	21.8	-
28-35	4.293±0.146[a]	19.8	4.845±0.214[n]	26.6	*
		Male			
0-7	1.746±0.089	30.5	1.609±0.049	18.6	-
7-14	2.688±0.114	58.4	2.635±0.099	22.8	-
14-21	3.503±0.161	26.4	3.424±0.138	24.4	-
21-28	3.545±0.138	22.1	3.526±0.102	17.1	-
28-35	5.125±0.279[a]	31.3	7.940±0.623[n]	46.4	***

Note: *,a - P≤0,05; ** - P≤0,01; ***,n - P≤0,001

$$R = \frac{W_2 - W_1}{\frac{W_1 + W_2}{2}} * 100$$

RESULTS AND DISCUSSION

Up to 28th day of age body weight of the quails from the experimental group is higher. Both sexes have a significant higher body weight with 11.1%; 8.7 % and 9.8 % respectively at 7th, 14th and 21 day (Table 2).

Taking into account, that the nutritive value of the forage mixture is equal, we suppose these results are due to higher content of essential amino acids in cocoon meal to compare with the meat meal [10]. That modifies the effect of the mixture with higher protein. The birds of experimental group respond positively under these circumstance during the phase of the most intensive growth.

Until 21 day both sexes from control group have a significant lesser average daily gain (Table 3). Following the variation of the weekly gain, the data shown small difference in the female quails. Their growth curve is smooth and consistent. On the other hand, intensive growth of the female quails after 21 day of their life (in control group earlier P≤0.05 at the 3rd week) leads to increasing of the difference between the sexes (P≤0.001 in examined group; P≤0.05 in control group) during the period of 21-35 day. Those difference is found out also by other researches and due to earlier and more intensive development of the female sexual system [4, 8].

During the period 21-35 day bird's growth intensity in males and females in control group was higher. That results in higher average daily gain with 18.6-22.4 % in comparison with the examined group. This relation is logical, because after the phase of most intensive growth (0-21 day), the gain depends to less extend on the feed quality. Similar conclusion was reported by [7] in the experiment with the feeding mixtures with different protein content.

During the period of 21-35 day of quails' life the difference in growth intensity between two groups is negligible for female sex compared to male. In the male sex during the period of 28-35 day the difference reaches 100% (P≤0.001).

Data in Table 4 shown that growth intensity of females into two groups are similar. Lesser relative gain up to 21 day for females of the control group is compensated in the next 14 days. Finally, at the 35th day, the body weight of both groups is not distinguished significantly.

The growth intensity of male quails during 21-35 day in control group is proven higher (P≤0.001). Consequently, they compensate their previous dropping.

We note some differences in feed conversion ratio (FCR) related with growth intensity of male quails (Table 5). In the experimental group, feed conversion ratio up to 21 day is 6.7 % more. After 21 days it worsen, and between

28-35 days the difference is the biggest one (P≤0.001). Females do not manifest difference between groups, except the period of 28-35 days.

Up to 21 days both for two sexes from the experimental group feed conversion ratio is with 5.4% better, but the difference is not proved. Feed conversion ratio in two groups for the period 0-35 days is similar.

CONCLUSIONS

The results of this study, characterizing both growth and feed conversion ratio in Japanese quails suggest to conclusion that it is possible to substitute successfully meat meal in starter forage mixture for quails with cocoon meal, while guaranteed equivalent growth and FCR.

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