

The effect of the field bean variety ‘Ada’ on broiler growth and nutritional value of meat

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Abstract

The effect of natural and processed (heated) field beans of the Lithuanian variety ‘Ada’ on the growth of broilers up to the age of 6 weeks was investigated. Every experimental group was divided into two subgroups: the birds of subgroup (a) received not-heated (natural) field beans in the diet, while the chickens of subgroup (b) received the same amount of heated field beans in the diet. The broilers of group 1 received 15% of soy-bean meal and 5% of field beans, group 2 received 10% of soy-bean meal and 10% of field beans, group 3 received 5% of soy-bean meal and 15% of field beans and group 4 received 20% of field beans instead of soy-bean meal. The replacement of soy-bean meal by heated and non-heated field beans resulted in 2.5% and 1.8% higher weight of male chicken broilers, respectively.

The best growth results of female chicken broilers were obtained when 20% of soy-bean meal was replaced with natural field beans and 5% soy-bean meal. However, the diet with heated field beans resulted in a slightly smaller weight increase (+1.7%).

The content of abdominal fat in the carcass of male and female chicken broilers was increasing with the increasing amount of field beans in the diet. The content of amino acids in the meat of breast and legs did not depend on the composition of diets and gender but it depended on the anatomy of muscles.

Key words: chicken-broilers, field beans, growth, meat.

Introduction

The complete value of feeds for birds depends on the quality of the components of vegetable and animal origin and the ratio of the main nutrients. The nutritive value of vegetable components of the feed also partially depends on the natural climate conditions, the structure of soil, fertilization level and agro technical conditions. It should be noted that leguminous and cereal crops grown in different natural conditions differ in the content of protein and metabolic energy /Ruiz et al., 1987/.

The deficiency of protein and not synthesized amino acids in diets is balanced by protein components and synthetic amino acids /Jeroch et al., 1998/. Feeding field beans, lupines, peas and rapeseeds grown in Lithuania is suitable for this purpose.

Field beans (*Vicia faba* L.) are a protein rich feed which contains 22–30% protein, and approximately 10.2–10.7 MJ kg⁻¹ metabolizable energy. Field beans are also rich in carbohydrates (57%), mineral matter (4%), especially phosphorus (0.54%) and vitamins. The protein of field beans is known for its high biological value, because it contains all not synthesized amino acids for birds /Bhargava, O'Neil, 1976; Guillaume, Bellec, 1977; Mateos, Puchal, 1981; NRC, 1994; Weber, 1996; Архипов, Топорова, 1984; Федоров, 1988/. The areas where peas, field beans, lupines, vetch and rapeseed are growing are not inconsiderable in Lithuania, however, there is little evidence about the use of these crops in the diets of birds /Agriculture in Lithuania, 2003/. 'Ada', 'Aušra' and 'Kupa' varieties of field beans are most popular in Lithuania. The protein content of 'Ada' field beans accounts for 27–30% /Leikus et al., 1999/.

However, field beans possess some negative features. The inhibitor of trypsin suppresses the processes of digestion in the body of birds. Tannins which block the growth of birds, the decrease lashes of ileum mucous membrane and their structural changes, bring influence to bear on the degeneration of liver hepatocytes, which leads to the limited use of field beans in diets for birds /Kardivel, Clandinin, 1974; Ortriz et al., 1994; Leikus et al., 1999/.

Some authors recommend replacing soybean meal in the poultry diets by 7–10% of field beans /Kracht, Mosch, 1981/ others suggest no more than 15% /Архипов, Топорова, 1984/. And there are also those who indicate that the feed with 20% of non-heated field beans is absolutely fit for the feeding of chickens /Herstad, 1978/. Slightly slower growth of chickens and relative increase of pancreas was observed after the amount of field beans in diet was increased up to 35% /Kardivel, Clandinin, 1974; Bhargava, O'Neil, 1976/.

The inhibitors of tripsin are inactivated by heating the field beans. According to Kadirvel and Clandinin the amount of heated field beans in the diets up to 20% did not have any harmful effect on the growth rate of chicken-broilers /Kardivel, Clandinin, 1974/. Other authors indicated that the content of protein and amino acids was slightly lower in heated field beans /Bhargava, O'Neil, 1979; Cardiner et al., 1980/.

In order to maintain all vital functions of the body, it should receive all not synthesized amino and fatty acids, mineral substances, not synthesized vitamins E, K, B, etc.

In the digestive tract protein is broken into separate amino acids, fat into glycerol and fatty acids, carbohydrates into mono- and disaccharides which are assimilated by the body in the small intestines. These substances take part in the construction of cells of a new body.

In some experiments it was also proved that not synthesized amino acids are also produced by the microflora of the large intestine of animals.

Due to some reasons amino acids histidine and arginine are synthesized in the animal body not in adequate amounts.

However, there is a certain amount of connective tissue in any meat. The protein of this tissue is mainly collagen and elastin, the biological value of which is low due to insufficient and incomplete composition of amino acids, where almost no tryptophan and only very little cystine is found. On the other hand, this protein contains high content of dispensable amino acid-oxypoline. The protein of the connective tissue is badly assimilated in the human body /Пшендин, 2006/.

The composition of amino acids is of great importance to people because shortage of the methionine results in fat and protein metabolism disorders. Lysine regulates the nitrogen balance, threonine- the immune system and shortage of cystine causes liver cirrhosis.

The purpose of the work was to investigate the effect of the Lithuanian variety of field beans 'Ada' on the growth of broilers and the nutritive value of their meat.

Materials and methods

The study was conducted from 2007 to 2008 at the Institute of Animal Science of the Lithuanian Veterinary Academy. The effect of natural and heated field beans 'Ada' on the growth of broilers up to the age of 6 weeks was investigated. The chemical composition of field beans is presented in Table 1.

Table 1. The chemical composition of field beans %
1 lentelė. Pašarinių pupų cheminė sudėtis %

Indicators <i>Rodikliai</i>	Literature data* <i>Literatūros šaltinių duomenys*</i>	Experimental data <i>Tyrimo duomenys</i> Field beans 'Ada' <i>Pašarinės pupos 'Ada'</i>	
	Field beans <i>Pašarinės pupos</i>	Non-heated <i>Nekaitintos</i>	Heated <i>Kaitintos</i>
1	2	3	4
Metabolizable energy MJ <i>Apykaitinė energija MJ</i>	1.02–1.07	1.10	1.11
Dry matter / <i>Sausosios medžiagos</i>	88.1–92.57	88.18	88.31
Crude Protein / <i>Baltymai</i>	21.5–30.0	27.40	26.72
Fat / <i>Riebalai</i>	1.4–2.1	1.29	1.47
Fibre / <i>Lašteliena</i>	7.0–8.0	9.67	9.49
Ash / <i>Pelenai</i>	4.0–4.05	3.57	3.15
NEM	–	44.80	45.16
Calcium / <i>Kalcis</i>	0.11	0.12	0.11
Av. Phosphorus / <i>Fosforas</i>	0.54	0.39	0.36
Potassium / <i>Kalis</i>	–	1.05	1.04
Sodium / <i>Natris</i>	0.08	0.036	0.035
Magnesium / <i>Magnis</i>	–	0.13	0.13
Sulphur / <i>Siera</i>	–	0.16	0.15
	Amino acid / <i>Aminorūgštys</i>		
Asparagine / <i>Asparagino rūgštis</i>	2.19–2.93	2.87	2.98
Threonine / <i>Trioninas</i>	0.85–0.95	0.88	0.93
Serine / <i>Serinas</i>	1.15–1.29	1.17	1.28
Glutamic acid / <i>Gliutamino rūgštis</i>	4.41–5.33	4.91	5.05
Proline / <i>Prolinas</i>	1.23	1.18	1.35
Glycine / <i>Glicinas</i>	0.73–1.13	1.07	1.13

Table 1 continued
1 lentelės tęsinys

	1	2	3	4
Alanine / <i>Alaninas</i>		0.83–1.08	1.01	1.66
Valine / <i>Valinas</i>		0.94–1.21	1.20	1.19
Methionine / <i>Metioninas</i>		0.18–0.51	0.18	0.16
Isoleucine / <i>Izoleucinas</i>		0.81–1.06	1.10	1.07
Leucine / <i>Leucinas</i>		1.55–1.89	1.94	1.98
Tyrosine / <i>Tirozinas</i>		0.66–0.80	0.92	0.95
Phenylalanine / <i>Fenilalaninas</i>		1.0–1.15	1.09	1.14
Histidine / <i>Histidinas</i>		0.59–0.82	0.66	0.68
Lyzine / <i>Lizinas</i>		1.50–1.69	1.62	1.63
Arginine / <i>Argininas</i>		1.36–2.41	2.76	3.18

* – Bhargava, O’Neil, 1976; Guillaume, Bellec, 1977; Mateos, Puchal, 1981; Архипов, Топорова, 1984; Федоров, 1988; NRC, 1994; Weber, 1996

Soy-bean meal was replaced by a certain amount of field beans in the experiment. Five cross Hybro-G one-day chicken groups were founded: one control and four experimental. The chickens of the control group received 20% of soy-bean meal and no field beans during the experimental period. Every experimental group was divided into two subgroups: the birds of subgroup (a) received natural, non-heated field beans in the diet while the chickens of subgroup (b) received the same amount of heated field beans. Field beans were heated for 30 minutes at +125°C. The broilers of group 1 received 15% of soy-bean meal and 5% of field beans, group 2–10% of soy-bean meal and 10% of field beans, group 3–5% of soy-bean meal and 15% of field beans, and group 4 received 20% of field beans instead of soy-bean meal. Each subgroup consisted of 90 broilers.

Depending on the age, two rations were formulated – from 0 to 3 weeks and from the 4 to 6 weeks of age (Tables 2, 3).

Table 2. Diet ingredients and nutrition value for broilers up to 3 weeks of age %
2 lentelė. Broilerių (iki 3 savaičių) lesalo sudėtis ir maistingumas %

Component <i>Komponentai</i>	Group / <i>Grupė</i>								
	Control <i>Kontro- linė</i>	1		2		3		4	
		a	b	a	b	a	b	a	b
1	2	3	4	5	6	7	8	9	10
Corn <i>Kukurūzai</i>	32.0	33.7	33.7	34.0	34.0	33.6	33.6	31.2	31.2
Wheat <i>Kviečiai</i>	12.9	15.0	15.0	15.0	15.0	14.0	14.0	20.0	20.0
Barley <i>Miežiai</i>	16.6	11.8	11.8	9.4	9.4	5.7	6.2	0.4	0.4
Soy-bean meal <i>Sojų rupiniai</i>	20.0	15.0	15.0	10.0	10.0	5.0	5.0	0	0

Table 2 continued
2 lentelės tęsinys

1	2	3	4	5	6	7	8	9	10
Peas <i>Pupos</i>	0	5.0	5.0	10.0	10.0	15.0	15.0	20.0	20.0
Fish meal <i>Žuvų miltai</i>	7.0	9.0	9.0	9.1	9.1	10.0	9.5	10.0	10.0
Yeast <i>Pašarinės mielės</i>	9.0	8.0	9.0	9.0	9.0	9.5	9.5	10.0	10.0
Milk meal <i>Pieno miltai</i>	0	0	0	2.0	2.0	4.0	4.0	5.0	5.0
Fat <i>Riebalai</i>	1.5	1.5	1.5	1.5	1.5	2.2	2.2	2.4	2.4
Premix <i>Premikšas</i>	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100 g fodder contain / 100 g lesalo yra:									
Crude protein <i>Žalių baltymų</i>	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Metabolizable energy MJ 100 g ⁻¹ <i>Apykaitinės energijos MJ 100 g⁻¹</i>	1.27	1.28	1.28	1.27	1.27	1.28	1.28	1.28	1.28
Crude fibre <i>Laštelienos</i>	3.6	3.3	3.3	3.1	3.1	3.0	3.0	2.7	2.7
Calcium <i>Kalcio</i>	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Av. phosphorus <i>Fosforo</i>	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Sodium <i>Natrio</i>	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Lyzine <i>Lizino</i>	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2
Methionine <i>Metionino</i>	0.45	0.45	0.46	0.47	0.47	0.47	0.46	0.46	0.46
Threonine <i>Treonino</i>	0.75	0.75	0.76	0.76	0.75	0.76	0.76	0.77	0.76
Tryptophan <i>Triptofano</i>	0.22	0.22	0.22	0.22	0.22	0.23	0.21	0.23	0.21

Note. b – heated beans; * – premix contains per 1 t: vit. A – 1 000 mln. IU, vit. D₃ – 100 mln. IU, vit. K – 200 g, vit. B₂ – 400 g, vit. B₃ – 1 kg, vit. B₄ – 70 kg, vit. B₅ – 2.5 kg, vit. B₁₂ – 3 g, vit. C – 5 kg, coccidiostat 12.5 kg, Mn – 5 kg, Fe – 2 kg, Cu – 250 g, Zn – 900 g, Co – 200 g, I – 200 g, antioxidants – 12.5 kg.

Pastaba. b – kaitintos pupos; * – 1 t premikso yra: vitaminų A – 1 000 mln. TV, D₃ – 100 mln. TV, K – 200 g, B₂ – 400 g, B₃ – 1 kg, B₄ – 70 kg, B₅ – 2,5 kg, B₁₂ – 3 g, C – 5 kg, kokcidiostatikų – 12,5 kg, Mn – 5 kg, Fe – 2 kg, Cu – 250 g, Zn – 900 g, Co – 200 g, I – 200 g, antioksidantų – 12,5 kg.

Table 3. Diet ingredients and nutritional value for broilers from 4 to 6 weeks of age %
3 lentelė. Broilerių (nuo 4 iki 6 savaičių) lesalo sudėtis ir maistingumas %

Component <i>Komponentai</i>	Group / <i>Grupė</i>								
	Control <i>Kontrolinė</i>	1		2		3		4	
		a	b	a	b	a	b	a	b
Corn / <i>Kukurūzai</i>	27.0	28.0	28.0	29.9	29.9	31.6	31.6	37.2	37.2
Wheat / <i>Kviečiai</i>	15.0	15.0	15.0	15.0	15.0	10.9	10.9	12.0	12.0
Barley / <i>Miežiai</i>	26.0	23.5	23.5	20.0	20.0	20.0	20.0	11.7	11.7
Soy-bean meal <i>Sojų rupiniai</i>	20.0	15.0	15.0	10.0	10.0	5.0	5.0	0	0
Peas / <i>Pupos</i>	0	5.0	5.0	10.0	10.0	15.0	15.0	20.0	20.0
Yeast <i>Pašarinės mielės</i>	4.0	4.8	4.8	5.3	5.3	7.5	7.5	7.6	7.6
Fish meal <i>Žuvų miltai</i>	4.0	4.2	4.2	5.3	5.3	5.5	5.5	7.0	7.0
Fat / <i>Riebalai</i>	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Premix <i>Premikšas</i>	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100 g fodder contains / 100 g lesalo yra:									
Crude protein <i>Žalių baltymų</i>	19.8	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7
Metabolizable energy MJ 100 g ⁻¹ <i>Apykaitinės energijos MJ 100 g⁻¹</i>	1.30	1.29	1.29	1.29	1.29	1.28	1.28	1.28	1.28
Crude fibre <i>Laštelienos</i>	3.7	3.7	3.7	3.5	3.5	3.4	3.4	3.1	3.1
Calcium / <i>Kalcio</i>	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Av. phosphorus <i>Fosforo</i>	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Sodium / <i>Natrio</i>	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lyzine / <i>Lizino</i>	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Methionine <i>Metionino</i>	0.4	0.41	0.41	0.41	0.41	0.4	0.42	0.4	0.4
Threonine <i>Treonino</i>	0.66	0.66	0.65	0.67	0.66	0.67	0.67	0.66	0.66
Tryptophan <i>Triptofano</i>	0.19	0.18	0.2	0.18	0.19	0.19	0.19	0.2	0.19

Note. b – heated beans; * – premix contains per 1 t: vit. A – 700 mln. IU, vit. D₃ – 100 mln. IU, vit. E – 500 g, vit. B₂ – 300 g, vit. B₃ – 1 kg, vit. B₄ – 70 kg, vit. B₅ – 2.5 kg, vit. B₁₂ – 3 g, vit. C – 5 kg, Mn – 5 kg, Fe – 2 kg, Cu – 250 g, Zn – 900 g, Co – 200 g, I – 200 g, antioxidants – 12.5 kg. *Pastaba.* b – kaitintos pupos; * – 1 t premikso yra: vitaminų A – 700 mln. TV, D₃ – 100 mln. TV, E – 500 g, B₂ – 300 g, B₃ – 1 kg, B₄ – 70 kg, B₅ – 2,5 kg, B₁₂ – 3 g, C – 5 kg, Mn – 5 kg, Fe – 2 kg, Cu – 250 g, Zn – 900 g, Co – 200 g, I – 200 g, antioksidantų – 12,5 kg.

Broilers were kept on deep litter, in poultry houses without windows. The chickens were weighed every week and at the age of 5 weeks the balance experiments of feed assimilation were carried out /Томмэ, 1969/.

At the age of 6 weeks, from every experimental group 5 male and female chicken broilers of the average weight were selected for control slaughtering. Before slaughter the birds were kept without feed for 12 hours. The anatomic carcass dressing was carried out in accordance with the “Methodological recommendations for anatomic carcass dressing and organoleptic evaluation of domestic poultry meat” /Лукашенко и др., 1984/.

There were taken composite samples of the test groups composed of male and female chicken breast meat and leg meat for chemical composition and amino acids analysis. Standard methods were used to determine the chemical composition and quality of feeds and meat (AOAC, 1990 a – for feed and AOAC, 1990 b – for meat) the caloric content of meat was determined by burning a dry sample in the calorimetric bomb, tryptophan was determined by the method of Marina and Shut /Марина, Шуть, 1970/, oxyproline by the method of Neiman and Logan /Метод определения..., 1977/. The levels of amino acids in the diet and meat were determined in an automatic amino acid analyzer AAA-T 339 M (‘Microtechna’, Czech Republic).

Statistical analysis. The data were expressed as the mean response (\pm standard deviation, SD), and differences in the means were evaluated using *Student’s test* /Snedecor, Cochran, 1989/. All differences quoted in the text are significant at $P < 0.05$.

Results and discussion

In the first 4 weeks the male chicken broilers fed 20% field beans gained weight most rapidly. The weight of group 4 (b) male chicken broilers fed 20% of heated field beans was 1 163 g, and the weight of group 4 (a) cockerels fed natural field beans was 1 096 g in comparison with the control group ($P < 0.05$). However, female chicken broilers grew equally well fed both 15% and 20% of field beans and their weights practically did not differ. Those fed by natural field beans, group 3 (a) and group 4 had the weight of 973/995 g respectively, while the weight of group 3 (b) and group 4 (b) given heated beans was, 943 g and 991 g, respectively ($P < 0.05$) in comparison with the control group.

In six weeks the best growing results were obvious with male chicken broilers fed 20% of field beans processed by heat, their daily weight gain was 52.0 g ($P < 0.01$), for group 4 (b) and 48.9 g ($P < 0.05$) for group 4 (a).

The growth of the male chicken broilers fed 15% of both heated and natural field beans and 5% of soy-bean meal was almost the same, their daily weight gains were 47.8 g for group 3 (a) and 47.9 for group 3 (b) ($P < 0.05$) (Table 4).

In 42 days female chicken broilers put on weight equally well. Female chicken broilers fed 15% of field beans and 5% of soy-bean meal gained daily 41.6 g (group 3 a) and 40.4 g (group 3 b) ($P < 0.05$), while female chicken broilers fed 20% of field beans without soy-bean meal gained daily 42.5 g (group 4 b) and 42.7 g (group 4 a) ($P < 0.05$).

The growth rate of male chicken broilers fed diets containing 10% field beans and 10% soy-bean meal was lower, the daily gain of group 2 (a) and 2 (b) male chicken broilers were 44.2 and 44.7, respectively g ($P > 0.05$). The growth rate of female chicken broilers was lower when they were fed natural field beans. The weight of female chicken broilers in group 2 (a) was 1 631 g ($P < 0.01$) and in group 2 (b) – 1 626 g ($P < 0.01$ comparing with control group).

Table 4. Broiler weight, daily gain and carcass composition at 6 weeks of age
4 lentelė. Broilerių (6-ių savaičių) augimo ir skerdenos dalių pagrindiniai rodikliai

Group Grupė	Weight Svoris g	Daily gain Paros priesvoris g	Carcass yield Skerdenos išeiga %	Breast meat Krūtinės raumenų mėsa %	Leg meat Kojų raumenų mėsa %	Abdominal fat Vidiniai riebalai %
Male chicken broilers / Gaidžiukai						
Control Kontrolinė grupė	1985 ± 36	46.0	73.72	12.2	13.6	1.8
1 a	1769 ± 53**	40.8	74.91	12.4	13.5	1.2
1 b	1787 ± 44**	41.2	75.48	12.6	14.2	1.3
2 a	1910 ± 39	44.2	74.63	12.5	14.4	1.7
2 b	1933 ± 44	44.7	74.44	12.5	14.3	1.9
3 a	2053 ± 25	47.8	73.85	12.5	14.6	2.0
3 b	2068 ± 35	47.9	74.80	11.7	13.5	2.0
4 a	2107 ± 36*	48.9	74.82	12.3	14.1	2.3
4 b	2137 ± 28**	52.0	74.10	11.7	14.0	2.7
Average Vidurkis			74.60	12.3	14.1	
Female chicken broilers / Vištaitės						
Control Kontrolinė grupė	1796 ± 30	41.6	73.86	12.8	13.1	2.4
1 a	1440 ± 35***	33.1	74.80	13.9	13.9	1.8
1 b	1472 ± 35***	33.9	74.01	12.7	13.5	1.6
2 a	1631 ± 35**	37.6	73.63	13.1	14.3	1.8
2 b	1626 ± 37**	37.6	74.63	12.2	13.7	1.9
3 a	1802 ± 30	41.6	73.27	13.3	14.0	2.7
3 b	1746 ± 30	40.4	73.33	12.6	13.9	2.7
4 a	1842 ± 39	42.7	73.70	13.1	14.2	2.6
4 b	1836 ± 27	42.5	73.15	12.5	12.7	2.8
Average Vidurkis			73.80	12.9	13.8	

Note / Pastaba. * – $P < 0.05$, ** – $P < 0.01$, *** – $P < 0.001$.

Replacement of 5% of soy-bean meal by both natural and heated field beans resulted in the lowest growth rate of chicken broilers. The male chicken broilers in group 1 (a) weighed 1 769 g ($P < 0.01$), in group 1 (b) – 1 787 g ($P < 0.01$) and the weights of female chicken broilers in group 1 (a) – 1 440 g ($P < 0.01$), in group 1 (b) – 1 472 g ($P < 0.01$).

The survival rate of broilers during the experiment was 97.7–100%. Different composition of the diets had no influence on the survival rate of birds.

The control slaughter data at the age of six weeks indicated that there was almost no difference for dressing percentage between the groups: the dressing percentage was from 73.7 to 75.5% for male chicken broilers and from 73.2 to 74.8% for female chicken broilers.

The breast meat of the control group male chicken broilers made up 12.2%, in the other groups it varied from 11.7 to 12.6% i.e. there was almost no difference. The breast meat of the group female chicken broilers made up 12.8% and in certain groups the percentage was from 12.2 to 13.9%. Thus, the part of breast meat in female chicken broilers was by 1% higher.

Table 5. Intake of nutrients from the diet with heated beans in 5-week-old broilers' rations %

5 lentelė. Broilerių (5-ių savaičių), lesintų kaitintomis pašarinėmis pupomis, maisto medžiagų pasisavinimas %

Indicators <i>Rodikliai</i>	Male chicken broilers <i>Gaidžiukai</i>		Female chicken broilers <i>Vištaitės</i>	
	Control group <i>Kontrolinė grupė</i>	Experimental group <i>Bandomoji grupė</i>	Control group <i>Kontrolinė grupė</i>	Experimental group <i>Bandomoji grupė</i>
Dry matter / <i>Sausosios medžiagos</i>				
Breast meat <i>Krūtinės raumenų mėsa</i>	24.53	24.22–24.58	24.43	23.66–24.47
Leg meat <i>Kojų raumenų mėsa</i>	25.58	26.17–27.70	27.13	25.79–26.87
Protein / <i>Baltymai</i>				
Breast meat <i>Krūtinės raumenų mėsa</i>	22.63	21.24–22.58	22.56	20.12–22.34
Leg meat <i>Kojų raumenų mėsa</i>	17.95	17.86–18.67	18.64	17.75–19.01
Ashes / <i>Pelenai</i>				
Breast meat <i>Krūtinės raumenų mėsa</i>	1.05	0.96–1.07	0.98	1.05–1.08
Leg meat <i>Kojų raumenų mėsa</i>	0.96	0.95–0.99	0.99	1.00–1.04
Fat / <i>Riebalai</i>				
Breast meat <i>Krūtinės raumenų mėsa</i>	1.89	1.52–2.52	1.60	1.28–1.89
Leg meat <i>Kojų raumenų mėsa</i>	7.01	7.16–9.63	8.06	7.18–7.82
Metabolizable energy / <i>Apykaitinė energija</i> kcal kg ⁻¹				
Breast meat <i>Krūtinės raumenų mėsa</i>	1 402.6	1 361.8–1 460.7	1 377.8	1 380.8–1 388.4
Leg meat <i>Kojų raumenų mėsa</i>	1 699.9	1 558.8–1 859.6	1 813.9	1 762.4–1 786.8

The leg meat of male chicken broilers in the control group made up 13.6%, and in certain groups the percentage varied from 13.5 to 14.6%. The percentage of leg meat was not influenced by the composition of the diets. The leg meat of female chicken broilers in the control group made up 13.1%, and in certain groups the percentage varied from 12.7 to 14.3%. Higher amounts of field beans in the diets determined higher content of abdominal fat in the carcasses. The highest percentage of abdominal fat was determined in the groups of chickens where broilers were fed diets containing no soy-bean meals and 20% of field beans group 4 (a) and group 4 (b) (Table 4).

The chemical analysis of broiler meat indicated that there were 23.8% of proteins in the breast meat of male chicken broilers, 20.6% in leg meat, when the female chicken broilers had 23.8 and 20.4%, respectively (Table 5).

The fat content in breast meat of male chicken broilers was 1.7%, in leg meat – 6.5%, and the female chicken broilers adequately possessed 2.3 and 7.2%. The caloric content of breast meat of male chicken broilers was 1 362 kcal kg⁻¹, leg meat – 1 638 kcal kg⁻¹, the female chicken broilers adequately had 1 397 and 1 690 kcal kg⁻¹.

The ash content in the breast meat of male chicken broilers made up 1.2%, in legs 1.1%, the female chicken broilers adequately had 1.2 and 1.1% (Table 5).

The studies of nutrient assimilation by broilers fed heated field beans indicated that dry matter assimilation in the control groups of cockerels and pullets accounted for 72%, while DM assimilation in the experimental groups of cockerels was from 71.4 to 73.1 %, and that of pullets from 71.8 to 73.7%.

The analysis of fat and fibre accumulation indicated that higher amounts of field beans in the diets determine higher fat and fibre accumulation. Meanwhile, the higher was the amount of beans in the diet the lower was accumulation of energy and nitrogen (Table 6).

Table 6. Intake of nutrients from the diet with heated beans in 5-week-old broilers' rations %

6 lentelė. Broilerių (5-ių savaičių), lesintų kaitintomis pašarinėmis pupomis, maisto medžiagų pasisavinimas %

Indicators <i>Rodikliai</i>	Control <i>Kontrolinė grupė</i>		1		2		3		4	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
	Dry matter <i>Sausosios medžiagos</i>	72.2	72.1	72.3	72.9	73.1	72.8	72.8	71.8	71.4
Fat <i>Riebalai</i>	65.7	63.5	61.2	60.7	67.0	66.5	68.0	69.0	70.9	69.6
Metabolizable energy <i>Apykaitinė energija</i>	74.3	75.2	74.9	75.8	76.4	75.2	76.5	75.5	74.7	74.2
Fiber <i>Lašteliena</i>	20.6	20.4	20.9	22.4	23.9	22.3	23.3	24.1	23.9	24.6
Protein digestibility <i>Baltymų virškinamumas</i>	88.6	90.5	87.3	88.8	88.5	88.7	89.7	90.0	90.3	90.9

The analysis of amino acids in all experimental groups indicated that the composition of the diets had no influence on the contents of amino acids in meat of breast and legs (Table 7).

Table 7. Average content of amino acids in cockerels and pullets' breast and leg meat %
7 lentelė. Gaidžiukų ir vištaičių krūtinės bei kojų raumenų mėsos aminorūgščių vidurkis %

Amino acid <i>Aminorūgštys</i>	Breast meat <i>Krūtinės raumenų mėsa</i>		Leg meat <i>Kojų raumenų mėsa</i>	
	♂	♀	♂	♀
Non-synthesized amino acids / <i>Nesintetinosios aminorūgštys</i>				
Threonine <i>Treoninas</i>	0.92	0.92	0.70	0.70
Valine <i>Valinas</i>	1.03	1.02	0.84	0.83
Methionine <i>Metioninas</i>	0.58	0.58	0.44	0.44
Isoleucine <i>Izoleucinas</i>	0.99	0.97	0.80	0.79
Leucine <i>Leucinas</i>	1.68	1.68	1.33	1.34
Phenylalanine <i>Fenilalaninas</i>	0.81	0.83	0.75	0.72
Histidine <i>Histidinas</i>	0.77	0.75	0.51	0.51
Lysine <i>Lizinas</i>	1.75	1.72	1.44	1.40
Arginine <i>Argininas</i>	1.31	1.39	1.08	1.02
Tryptophan <i>Triptofanas</i>	0.37	0.37	0.34	0.34
Synthesized amino acids / <i>Sintetinosios aminorūgštys</i>				
Asparagine <i>Asparaginas</i>	1.97	1.99	1.48	1.47
Serine <i>Serinas</i>	0.78	0.76	0.57	0.56
Glutamic acid <i>Glutamino rūgštis</i>	3.57	3.49	3.11	3.12
Proline <i>Prolinas</i>	0.80	0.92	0.85	0.88
Glycine <i>Glicinas</i>	0.91	0.91	0.96	0.94
Alanine <i>Alaninas</i>	1.20	1.21	1.09	1.05
Tyrosine <i>Tirozinas</i>	0.74	0.76	0.59	0.58
Oxiprolin <i>Oksiprolinas</i>	0.07	0.07	0.11	0.12

As it can be seen from Table 7, the composition of amino acids depends on the anatomic destination of meat and does not depend upon the gender of broilers.

Amino acids take part in all vital processes of animals and humans and are material basics of life. The accumulation of proteins greatly depends on the total calorificity of food. People eating lean meat of separate body parts accumulate different amounts of amino acids /Mikalauskaitė, 1986/. The daily demand for non-synthesized amino acids by a working grown-up person according to Pokrovski (1978) is presented in Table 8. Consumption of 100 g of breast meat theoretically satisfies a 24 hour need of histidine by 44.7%, lysine – 43.5%, triptophan – 37%, but one receives only 19.3% of methionine. The lean meat of breast is of great value to a growing child, because it contains high amount of not synthesized amino acid histidine. A child consuming 200 g of breast meat satisfies daily demand for histidine need by 89.4%.

Table 8. Non-synthesized amino acids demand for man and satisfaction of daily need in consumption of 100 g of broiler meat

8 lentelė. Nesintetintamųjų aminorūgščių poreikis ir jo patenkinimas, suvartojus 100 g broilerių mėsos

Amino acid <i>Aminorūgštys</i>	Amino acid daily demand <i>Aminorūgščių poreikis per parą g*</i>	Satisfaction of daily need in consumption of 100 g broiler meat % <i>Aminorūgščių poreikis ir jo patenkinimas, suvartojus 100 g broilerių mėsos %</i>	
		Breast meat	Leg meat
		<i>Krūtinės raumenų mėsos</i>	<i>Kojų raumenų mėsos</i>
Threonine <i>Treoninas</i>	2–3	36.8	28.0
Valine <i>Valinas</i>	3–4	29.4	24.0
Methionine <i>Metioninas</i>	2–4	19.3	14.7
Isoleucine <i>Izoleucinas</i>	3–4	28.0	22.9
Leucine <i>Leucinas</i>	4–6	33.6	26.6
Phenylalanine <i>Fenilalaninas</i>	2–4	27.3	24.3
Histidine <i>Histidinas</i>	1.5–2	44.7	30.0
Lysine <i>Lizinas</i>	3–5	43.5	35.5
Arginine <i>Argininas</i>	5–6	24.5	19.6
Tryptophan <i>Triptofanas</i>	1	37.0	34.0

Note / *Pastaba.* * – along / *pagal* Покровский, 1978.

The nutritive value of breast and leg meat is different. Consumption of 100 g of breast meat satisfies the demand for non-synthesized amino acids by 32.4% and 100 g of leg meat satisfies the demand by 26%.

Practically, the nutritive value of amino acids and their accumulation is decreased by heat processing, preservation and also by the anti alimentary factors existing in other products.

Conclusions

1. The weight of 6-week-male chicken broilers fed diets containing 20% of soy-bean meal was 1 705 g (control). Replacement of soy-bean meal by heated and natural field beans resulted in by 2.5% ($P < 0.05$) and 1.8% ($P < 0.05$) higher weight, respectively.

2. The chicken broilers at the age of six weeks weighed 1 496 g, and the best growing results were obtained when 20% soybean meal was replaced by 15% of natural beans and 5% of soy-bean meals ($P < 0.05$). The diet with field beans processed by heat resulted in a slightly worse weight increase (+1.7%) ($P < 0.05$).

3. There was almost no difference for the dressing percentage between the groups of broilers. Higher amounts of beans in the diets determine higher contents of abdominal fat in the carcasses of male and female chicken broilers.

4. The content of amino acids in the meat of breast and legs did not depend on the composition of diets and gender but depended on the anatomic destination of meat.

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Pupų veislės 'Ada' įtaka broilerių augimui ir jų mėsos maistinei vertei

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Santrauka

Tirtas natūralių ir termiškai apdorotų (kaitintų) lietuviškos pupų veislės 'Ada' poveikis broilerių iki 6-ių savaičių augimui. Tyrimo metu sojų rupiniai pakeisti atitinkamu kiekiu pupų. Buvo sudarytos penkios hibridinių (kroso Hybro-G) vienadienių viščiukų broilerių grupės: viena kontrolinė ir keturios tiriamosios. Kontrolinės grupės viščiukai per visą tyrimo laikotarpį gavo 20 % sojų rupinių, o pupų negavo. Kiekviena tiriamoji grupė buvo padalyta į du pogrupius: *a* pogrupio paukščiams į lesalus buvo pridėta nekaitintų (natūralių) pupų, o *b* pogrupio viščiukams pridėtas toks pat kiekis kaitintų pupų. Pupos kaitintos 30 min. +125 °C temperatūroje. Pirmos grupės broileriai gavo 15 % sojos rupinių ir 5 % pupų, antros – 10 % sojų rupinių ir 10 % pupų, trečios – 5 % sojų rupinių ir 15 % pupų, o ketvirtos vietoj sojos rupinių gavo 20 % pupų. Kiekviename pogrupyje buvo po 90 broilerių.

Geriausiai augo broileriai, lesinti lesalu, kurio sudėtyje buvo 20 % pupų ir visai nebuvo sojų rupinių (4 grupė). Gaidžiukai, gavę 20 % natūralių pupų, svėrė 122 g daugiau ($P < 0,05$), o gavę 20 % termiškai apdorotų pupų – 152 g daugiau ($P < 0,01$), palyginti su kontrolinės grupės. Vištaitės, gavusios 20 % natūralių ir termiškai apdorotų pupų, svėrė daugiau nei kontrolinės grupės – nuo 40 iki 46 g ($P > 0,05$).

Kontrolinės ir tyrimo grupių broilerių skerdenos išėiga ir krūtinės bei kojų raumenų mėsos santykinis dydis buvo beveik vienodas.

Vidinių riebalų kiekis gaidžiukų ir vištaičių skerdenoje didėjo, racione didinant pupų kiekį. Aminorūgščių kiekis krūtinės ir kojų raumenyse priklausė ne nuo raciono ar lyties, o nuo raumenų anatomijos. Krūtinės ir kojų raumenų mėsos maistinė vertė yra nevienoda. Suvalgius 100 g broilerių krūtinės raumenų mėsos, gaunama vidutiniškai 32,4 %, o tiek pat kojų raumenų mėsos – 26 % žmogaus organizme nepakeičiamų aminorūgščių.

Reikšminiai žodžiai: viščiukai broileriai, pupos, augimas, mėsa.