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COMPARATIVE EVALUATION OF TWO DIFFERENT RATION TYPES FOR GROWING RABBITS*

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Abstract

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A trial was carried out to evaluate the effects of two ration types for the growth rate, food consumption, nutrient digestibility and meat quality of growing rabbits.

Growing rabbits were allotted into two groups. The rabbits in Group 1 were given the ration composed of on farm made concentrated feed mixture and hay. The rabbits in Group 2 were fed the ration composed of manufactured compete compound feed for rabbits and hay.

The results from the trial showed that rabbits fed manufactured complete compound feed and hay had the highest weight gains. Feeding this ration type resulted in 38.5% higher daily weight gain and 23% lower food consumption. The nutrient digestibility of the ration composed of manufactured complete compound feed and hay was higher in comparison with that of the ration composed of on farm made concentrated feed mixture and hay. Dry matter content in the meat if treated rabbits was higher by 0.80%, protein – 0.68%, fat – 0.08%, fatty acid content (linolic – 4.09%, $P<0.025$, linoleic – 1.30%, $P<0.025$) in the intramuscular fat than the corresponding items for the control group.

Key words: rabbits, food consumption, digestibility, ration

Introduction

Rabbit breeding is one of non-traditional branches of animal production. Currently in Lithuania the development of this branch is gaining more and more attention. However, so far the supply of rabbit meat is not high – only 180 g per capita per year (Lebas et al., 1997), whereas in Italy, France and Spain it is 2.6-5.7 kg per capita per year. In case meat-type rabbit breeding were develop by establishing modern farm, our rabbit breeders could supply sufficiently the domestic market with rabbit meat and also export it to other countries (Ribikauskiene, 2005).

Feedstuffs and their quality have a great influence on rabbit health, fattening qualities, fertility, and milk production by females, fur density and lustre. Quality production from rabbits (meat, skin, down) is based on adequate feeding which influences directly the digestive tract, and through it other organs and all the body. Therefore, feed quality and origin on rabbit farms has to meet strict requirements. Rabbits have to be supplied with energy and nutrients that meet all the sanitary requirements (Bakutis, 2003; Council Regulation, 1999; Ribikauskiene, 2005).

However, it is little known what growth rate and economic indicators can be achieved when rabbits are fed different types of rations and if profitable rabbit growing is possible without using expensive commercial compound feeds.

The aim of the study was to analyze and compare the influence of ration types on the growth rate of rabbit's food consumption, nutrient digestibility, meat quality and economic indicators.

Material and Methods

The trials were carried in July-September and lasted for 10 weeks. The rabbits were divided into two groups of 11 animals each. At the start of the trials the average age and weight of rabbits were, respectively, 75 days and 1.20 kg (Figure 2).

Every group of rabbits was given different rations the composition of which is presented in Table 1. Rabbits in Group 1were fed compound feed for rabbits produced at joint-stock company "Kretingos grudai" and hay, while rabbits in Group 2 were offered the ration composed of on-farm made concentrated feed mixture and hay. The composition of concentrated feed mixture is shown in Tables 2 and 3. Growing rabbits were fed twice daily at 8 a.m. and 4.30 p.m. Water and hay were given *ad libitum*.

The trials were conducted on Daiva Ribikauskiene's farm. The area of the premises was 33 m^2, volume – 91 m^3. The room for rabbit growing had two windows with the area of 0.96 m^2. Both groups of rabbits were kept separately.

Food consumption was determined by morning weighing of feeds. Besides prior to morning feeding, all the remains of feeds and water were collected and weighed. The average food consumption per rabbit was determined by the amount of feeds as fed and number of feeding days. The rabbits were weighed once a week. The samples of feed, manure and meat were analyzed at the Analytical laboratory of the LUHS Institute of Animal Science.

The classical method was applied to determine the nutrient digestibility: three rabbits from each group were taken to house and fees in individual hutches of 1.6 m^2 in size. The length of the trial was 10 days. The rabbits were weighed at the start and end of the digestibility trial. Every day equal amount of manure was collected from every rabbit to store at 0-4°C temperature. The samples of manure were collected once daily in the morning and analyzed for dry matter, protein, fat and fibre (Table 4). The coefficients of dry matter, protein, far and fibre were determined on the basis of the chemical analysis.

Meat quality was evaluated by the following indicators of *M. longissimus dorsi*: dry matter by drying the samples at +105°C, protein by Kjeldahl method, fat by Soxlet method, ash by burning the samples at 400-600°C, tryptophan by H. Heller's method modified by J. Spice and D. Chambers, oxyprolin by the method of Stedgeman-Staldjer. Fatty acid content in the meat was determined by gas chromatograph G2010 SHIMADZU with hydrogen flame detector and by using capillary column ATTM-FAME (30 m, ID:0.25 mm). Fatty acid content (% of total acid content) was determined by processing chromatograph data. The sensory characteristics of meat were assessed by the panel board of the LUHS Institute of Animal Science.

Table 1
Diet composition and nutritive value

Item	Group 1	Group 2
Perennial grass hay, g	31.5	15.1
Compound feed Kret-KOM 90, g	-	126.0
On farm mixture of concentrated feed, g	65.5	-
Average daily intake per rabbit:		
dry matter, g	84.0	124.0
DE, MJ	1.35	1.71
crude protein, g	9.46	22.4
fat, g	1.29	3.83
fibre, g	13.67	22.56
calcium, g	0.617	1.566
phosphorus, g	0.494	0.843
sodium, g	0.137	0.258
lysine, g	0.39	1.07
methionine+cystine, g	0.36	0.45
threonine, g	0.38	0.94
tryptophan, g	0.13	0.26
ferrum, g	6.09	12.6
zinc, mg	2.55	8.82
manganese, mg	1.14	1.26
copper, mg	0.41	1.26
iodine, mg	0.02	0.06
vitamin A, IU	316	1512
vitamin D, IU	36	151
vitamin E, mg	1	6

The research data were processed by the methods of statistical biometry (Snedecor and Cochran, 1989) using Microsoft Excel.

Results

The amounts of on-farm made concentrated feed mixture and commercial compound feed "Kret-KOM 90" used in the trial were, respectively, 43.94 and 75.46 kg. The rabbits in Group 2 consumed 31.52 kg (or 41.8 %) more compound fees than those in Group 1. The average intake of feeds per rabbit was 6.9 kg in Group 2 and 4 kg in Group 1. According to the consumption of feeds as fed in grams and the number of feeding days, it was found that the average daily feed allowance per rabbit in Group 2 was 126 g and in Group 1 – 65.5 g (Figure 1).

Table 2
Composition of on farm mixture of concentrated feed

Item	Content
Barley, %	40.0
Wheat, %	52.0
Peas, %	5.0
Vitamin – mineral premix (T-1, Join stock company ''Biofabrikas''), %	3.0

Table 4
Chemical and physical composition of manure, %

Item	Group 1	Group 1
Dry matter, %	65.96	43.4
Total nitrogen, mg/%	1.69	1.35
NH_3 nitrogen, mg/%	214.85	370.45
Phosphorus, %	0.677	0.657
Potassium, %	0.325	0.659
Ash, %	6.64	7.74
pH	7.56	9.13

Table 3
Physical and chemical characteristics of feed

Item	Feed		
	On farm mixture of concentrated feed	Compound feed	Hay
Dry matter, %	86.52	89.31	85.93
Crude protein, %	12.03	20.50	6.26
Fat, %	0.56	1.55	0.34
Crude fibre, %	4.48	13.85	35.09
Nitrogen-free extracts, %	66.29	47.83	40.87
Crude ash, %	3.16	5.58	3.37
Calcium, %	0.49	1.08	0.28
Phosphorus, %	0.72	0.63	0.25
Potassium, %	0.415	0.55	1.42
pH	6.30	5.92	-
Carotene mg/kg	-	-	2.08

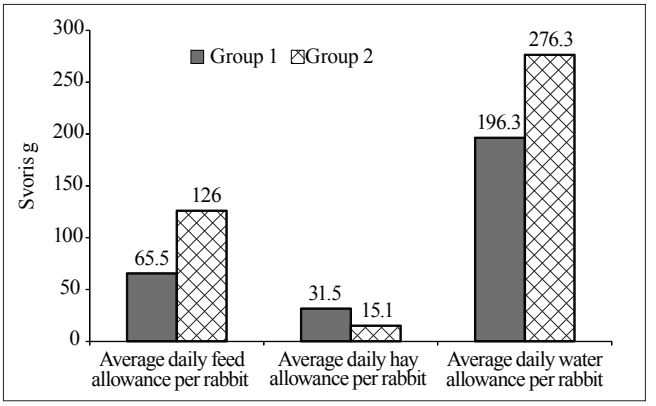

Fig. 1. Daily feed allowance per rabbit

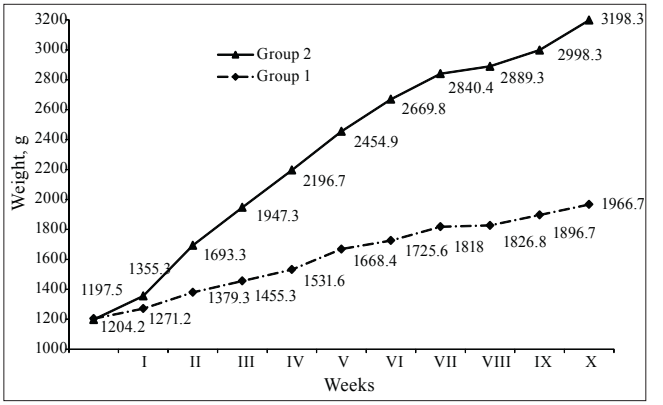

Fig. 2. Weight gain, g

The types of rations had influenced the growth of rabbits. In three trial months, the rabbits in Group 2 consumed 23% more feeds than the rabbits in Group 1 and, besides, in this period the rabbits in Group 2 gained more weight. The results indicated that at the end of the trial, the average weight of three months old rabbits fed compound feed was 1231 g (or 38.5%) higher than that of Group 1 rabbits (Figure 2). Ass the rabbits in Group 2 consumed more feeds and gained more weight, the cost price of feeds per 1 kg gain was even 42% higher than that of Group 1 rabbits.

Within the trial, both groups of rabbits consumed 30.2 kg hay: Group 1 consumed 21.17 kg and Group 2 – 9.03 kg. The results indicate that the consumption of hay was much higher by the rabbits in Group 1. The amount of hay consumed and the number of feeding days indicated that the average daily allowance of hay per rabbit was 2.1 times higher for Group 1 than for Group 2.

The rabbits in both groups were offered water *ad libitum*. The average daily amount of water consumed per rabbit in Group 2 was 1.4 times higher than that in Group 1, respectively, 276.3 and 196.3 g. This can be explained by the higher consumption of feeds in Group 2 (Figure 1).

Discussion

Feed digestibility was also a factor that influenced the growth rate of rabbits. Other authors (Matusevicius et al., 2005) indicate that crude protein digestibility is more dependent on feed components than on the chemical composition of the feed. The higher is the digestibility, the higher is nutrient assimilation and the better is the growth of rabbits. The studies of nutrient digestibility indicated that the digestibility of the ration for Group 1 was lower (Table 5), therefore, the growth of rabbits was slower, too. As it can be seen from Table 5, fibre digestibility by the treated rabbits was even 47.6% lower. In order to have normal digestion, the amount of fibre in the feed for rabbits should be >14 % (Lebas et al., 1997). The digestibility of protein and fat in Group 1 was, respectively, by 14.0% (P<0.025) and 9.0% lower.

Protein digestibility depends on the age of rabbits. Matusevicius et al. (2004, 2006) indicated that the natural probiotic "Yeasture" can be used to improve the digestibility of crude protein, dry matter and ash. Moreover, the probiotic used in the compound feed for rabbits had no negative influence on the chemical composition of rabbit meat (Matusevicius et al., 2004).

According the results of the trial (Table 6) dry matter content in the meat of the II investigated rabbit group was 0.80%, protein – 0.68%, fat – 0.08%, higher in comparison to the I rabbit group. Even the biological value (ratio of tryptophane and oxiproline was 0.29 bigger) the meat quality of the investigated II group of rabbits was better.

The intramuscular fat of the rabbits feed with the farm-made forage contained more fatty acid (Table 7), while rabbits, feed with the manufacture compound forage- more polyunsaturated linolic and linoleic fatty acids, accordingly 4.09 and 1.30% (P<0.025). According the World Health Organization, the recommended ratio of n–6 and n–3 fatty acids in food should be 1:1–6:1 (Liukevicius, 2006; Simopoulus, 2002). The results of the trial showed that the ration of n–6 and n–3 fatty acids follow the above mentioned recommendations.

Meat of the II rabbit group had better sensory qualities (Figure 3).

Rabbits, like other animals, digest not all the feed they eat. Undigested its parts retire from the body with manure. Bigger importance is of the digestible dietary components (Matusevicius et al., 2005).

Majority of the authors (Jeroch et al., 2004; Lebas at al., 1997; Bogdanov, 1990; Gumenyuk and Cherkasskaya, 1977) indicate that for the normal digestion of the compound feed it is necessary for them to contain about 14% of fibber, 17% pro-

Table 6
Chemical indication of *m. longissimus dorsi*

Item	Group 1	Group 2
Dry matter. %	23.24±0.25	24.04±0.36
Proteine. %	21.67±0.31	22.35±0.34
Fats. %	0.45±0.02	0.53±0.02
Ash. %	1.08±0.01	1.02±0.04
Tryptophane. g/100g	292.46±25.77	326.78±12.16
Oxyproline. mg/100g	54.37±4.18	57.87±3.61
Tryptophane:Oxyproline ratio	5.46±0.15	5.75±0.49

Table 5
Digestibility of feed, %

Group	Dry matter	Proteine	Fibre	Fats
I	62.93±2.35	54.20±2.76	33.48±8.61	78.48±5.86
II	66.45±1.84	68.16±2.11**	81.06±17.21	87.07±2.00

Note: in this and other tables *P<0.05. **P<0.025.

teins, 1.20% calcium, 0.55% phosphorus and etc. According the results of the trial and the recommended rates of nutrient in feed, it might be stated, that the food ration of the II group was balanced better and this caused a better digestion in comparison to the I group. For this reason rabbits of the first group ate 41.8% less of the concentrated compound feed. Since concentrated compound feed of I group contained less fibber, proteins and some other minerals, rabbits of I group tried to compensate the lack of nutrient particles while eating hay. This explains why each rabbit of the first group ate even 52% more of hay in comparison to the rabbits of the second group.

For the improvement of the nutrient digestibility of the farm-made concentrated feed mixtures it is necessary to select the mixture components containing more protein (Lucerne, Soya, beans and other) (Matusevicius et al., 2004, 2005, 2006).

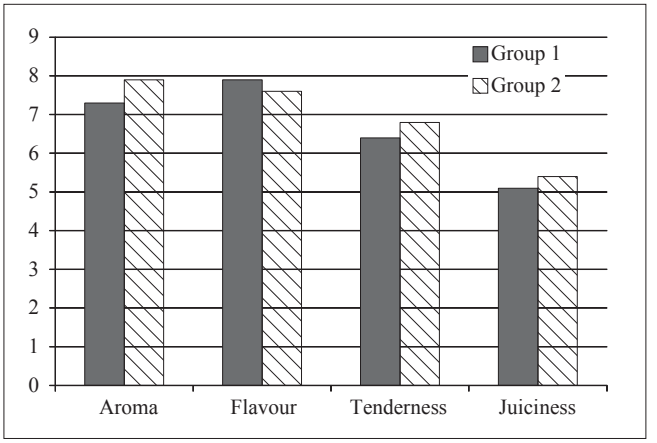

Fig. 3. Sensory evalution of *M. longissimus dorsi*

Table 7
Fatty acid content in intramuscular fat

Fatty acids	Groups	
	I	II
Fats. %	0.45±0.02	0.53±0.02
Saturated fatty acids (SFA):		
Myristic (C14:0)	3.32±0.38	2.61±0.24
Pentadecanoic (C 15:0)	0.65±0.13	0.58±0.06
Palmitic (C 16:0)	34.34±1.18	28.80±1.69
Heptadecanoic (C 17:0)	0.60±0.11	0.60±0.08
Stearic (C 18:0)	5.57±0.56	5.59±0.16
Monounsaturated fatty acids (MUFA):		
Myristoleic (C 14:1)	0.30±0.08	0.38±0.05
Pentadecenoic (C 15:1)	0.18±0.06	0.08±0.05
Palmitolic (C16:1)	4.90±0.71	5.05±0.29
Heptadecenoic (C 17:1)	0.35±0.03	0.38±0.03
Oleic (C 18:1)	21.93±0.46	23.60±0.56
Eicosenoic (C 20:1)	0.15±0.01	0.16±0.01
Polyunsaturated fatty acids (PUFA):		
Linoleic (C 18:2)	22.19±0.62	26.28±0.83**
α -linolenic (C 18:3)	2.94±0.31	4.24±0.20**
Eicosatrienoic (C 20:3)	0.20±0.01	0.19±0.02
Arachidonic (C 20:4)	1.76±0.13	1.03±0.13
Docosapentaenic (C 22:5)	0.36±0.10	0.24±0.03
Docosahexaenoic (C 22:6)	0.30±0.06	0.21±0.03
n-6	24.15±0.75	27.50±0.97
n-3	3.60±0.47	4.68±0.23
n-6/n-3	6.80±0.67	5.88±0.09
C18:2/C18:3	7.61±0.59	6.21±0.10*

Conclusions

Rabbits of the first group, fed with manufactured complete compound feed and hay ate 23% less of forage and gained 38.5% less of weight compared to the rabbits of the second group, fed with compound feed and hay.

The received coefficients of the nutrient digestibility showed that the ration composed of farm made concentrated feed mixture and hay was digested worse in comparison to manufactured complete compound feed.

Despite the fact that rabbits of the second group ate more food and gained more weight, however the costs of the used feed for the 1 kg of growth were 42% higher compared to the first group of rabbits.

The meat quality of the second group was higher: content of dry matter was 0.80%, protein – 0.68%, fat – 0.08%, fatty acid content (linolic – 4.09%, $P<0.025$, linoleic – 1.30%, $P<0.025$) in the intramuscular was higher in comparison to I rabbit group.

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