



Influence of vitamin-mineral supplement on protein metabolism in rabbits' organisms

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Article info

Received 03.12.2020

Received in revised form

04.01.2021

Accepted 05.01.2021

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Abstract

The purpose of the study is to study the influence of different vitamin-mineral supplement "Tekro" doses on biochemical parameters in blood plasma and liver of rabbits of New Zealand breed. The research methodology is based on research according to generally accepted research methods. Biochemical parameters were studied in rabbits' organisms at 45, 60, 75 and 90 days of rearing with feeding of different doses of vitamin-mineral supplement "Tekro", namely 3 %, 3.5 %, 4 %. The academic novelty is that nowadays the problem of the effect of different vitamin-mineral supplement "Tekro" doses on biochemical parameters in the blood and liver of rabbits has not been studied. Analyzing the indicators of the total protein content in the blood plasma of rabbits of the experimental groups and the control one for 90 days, it was noted that there was no significant difference in the indicators. In the liver of rabbits of the age from 45 to 90 days there was a tendency to increase the protein content due to the effects on the body of various doses of vitamin and mineral supplement "Tekro". It has been established the positive effect of vitamin-mineral supplement "Tekro" on ALT activity of rabbits in experimental groups. At the age of 75 days, significantly higher ALT activity was recorded in rabbits of the 3rd experimental group by 35.8 % compared to animals in the control group.

Key words: rabbits, total protein, creatinine, AST, ALT, alkaline phosphatase.



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Citation:

Fedorchenko, M. (2021). Influence of vitamin-mineral supplement on protein metabolism in rabbits' organisms. *Ukrainian Journal of Veterinary and Agricultural Sciences*, 4(1), 3–6.

1. Introduction

In recent years, with the intensive rearing of rabbits for meat, the problem of solving a balanced diet has become urgent. It is necessary when preparing rations to take into account not only the amount of nutrients in the feed, but also their digestibility, i.e. how much of feed is absorbed by rabbits (Dadakova et al., 2011; Dadakova et al., 2012; Zhu, et al., 2014; Darmohray et al., 2019). To maintain vital functions and the formation of products, the rabbit's body needs a constant supply of energy. The only source of energy is the nutrients contained in the feed (Szkucik & Pyz-Łukasik, 2008; Gerencser et al., 2012; Boiko et al., 2020).

A large number of scientists give evidence that it is necessary to balance the diets of rabbits in terms of macro- and micronutrients (Capra et al., 2013; Zhu, et al., 2016; Lesyk et al., 2020). And look for new non-traditional sources of nutrients, in order to increase live weight gain, resistance to various diseases, safety and fertility (Bunka et al., 2013; Vizzarri et al., 2014). There are a number of data in the

literature that the use of various additives in rabbits' feeding has a positive effect on productivity, safety and reproductive function of animals (Talukder, 2013). However, not all authors agree, but on the contrary, they argue that not all supplements have a positive effect on productivity indicators (Smet et al., 2008; Gugolek & Kowalska, 2020). Analyzing the results of studies of both domestic and foreign scientists dealing with the introduction of optimal doses of macro- and micronutrients to improve the productivity of rabbits and digestibility of nutrients in the diet, we see that this problem has not been sufficiently studied yet, and the obtained results are contradictory. Therefore, the research aimed to determine the effect of different doses on metabolism, digestibility of nutrients and their balance in the body of rabbits is relevant (Mertin et al., 2012; Pogany Simonova et al., 2012; Mattioli et al., 2018).

Proteins are the most important and basic structural part of living organisms. The role of proteins in the body is multifarious. The most important functions are: energy, transport, enzymatic, regulatory, structural, protective and

others. The level of protein in rabbits depends on housing conditions, level of feeding and physiological state of the body (Simitzis et al., 2014; Sirocchi et al., 2014; Zou et al., 2014).

The purpose of the article is assessment of the level of protein metabolism in rabbits. For the purpose of this assessment, a study of the content of total protein and creatinine, as creatinine is the end product of protein metabolism was executed, as well as studies of the activity of AST, ALT and alkaline phosphatase in the blood plasma and liver of New Zealand rabbits.

2. Materials and methods

The research was carried out in the production conditions of the “Gregut” LLC (Kyiv region) rabbit farm on New Zealand breed rabbits, which were kept on the farm. All rabbits were clinically healthy. The animals were fed with complete feed. Access to food and water was free.

For research on the farm, 4 groups of animals were formed: 1 – control, animals of which consumed the basic diet (BD); 2 – research – BD with the content of the vitamin-mineral supplement (GTE) “Tekro” 3.0 %; 3 – research

– BD with the content of GTE “Tekro” 3.5 %; 4 – research – BD with the content of GTE “Tekro” 4.0 %.

Determination of creatinine, AST, ALT in the blood of experimental animals was performed according to generally accepted methods.

The obtained data were statistically processed using Statistica 11.0 software. The Student’s *t*-test was used to estimate the statistical significance of the obtained values. We considered our data were marginally significant, significant, and highly significant as $P < 0.05$, 0.01 , and 0.001 .

3. Results and discussion

The content of total protein in the blood plasma and liver of animals of the control and experimental groups tended to changes (Table 1).

When determining the content of total protein in the blood plasma of rabbits, it was found that at animals of the control group of the age of 60 days, this figure increased and was higher by 21.2 % compared to the previous age period. In rabbits from the experimental group (60 days of cultivation) the content of total protein in blood plasma was 7.2 % higher compared to animals of the control group and 31.07 % ($P \leq 0.05$) higher than in the previous period.

Table 1

The content of total protein and creatinine in the blood plasma and liver of rabbits $\bar{X} \pm S_{\bar{X}}$ (n = 80)

Age, days	Total protein			
	Plasma, g/dm ³			
	1 control	2 experimental	3 experimental	4 experimental
45	84.92 ± 6.85	84.58 ± 8.23	84.17 ± 9.78	84.22 ± 6.52
60	102.89 ± 6.13	110.29 ± 6.18	110.33 ± 4.79*	112.30 ± 5.28
75	85.90 ± 7.29	84.09 ± 7.02	83.10 ± 8.50*	85.12 ± 6.10
90	81.82 ± 6.67	70.5 ± 7.30	70.60 ± 5.01	72.68 ± 8.50
Liver, mg/g				
45	31.12 ± 0.68	30.60 ± 0.71	30.75 ± 0.72	31.56 ± 0.70
60	31.91 ± 0.55	35.30 ± 0.60	35.69 ± 3.56	36.20 ± 0.78
75	33.14 ± 0.81	35.70 ± 2.15	35.90 ± 2.33	36.22 ± 3.26
90	34.68 ± 2.22	36.50 ± 1.94	36.70 ± 3.71	37.18 ± 3.30
Creatinine				
Plasma, μmol/dm ³				
45	129.90 ± 4.92	130.24 ± 3.06	130.05 ± 9.14	131.06 ± 5.12
60	122.92 ± 3.84	125.10 ± 4.82	125.45 ± 2.93	126.30 ± 4.98
75	134.34 ± 8.56	136.06 ± 6.68	137.83 ± 5.58	138.22 ± 6.18
90	150.83 ± 8.96	153.40 ± 7.60	153.37 ± 3.87	154.42 ± 5.54
Liver, mg/g				
45	3.90 ± 0.40	3.59 ± 0.42	3.64 ± 0.32	3.70 ± 0.40
60	4.60 ± 0.29	4.84 ± 0.38	4.93 ± 0.29*	5.02 ± 0.45
75	4.71 ± 0.44	4.52 ± 0.33	4.34 ± 0.24	4.92 ± 0.33
90	4.82 ± 0.50	4.70 ± 0.63	3.93 ± 0.16	4.00 ± 0.25

Note: * – $P \leq 0.05$ – compared to the previous age

Comparing the content of total protein in the blood plasma of rabbits on the 75th day, it was found that a significant difference in the indicators of the experimental groups and the control group was not detected. Similar results were obtained on the 90th day of food-producing animals.

At animals of the control and experimental groups during the 45–90 day period there was a tendency to increase the protein content in the liver with age. Under the action of different doses of vitamin and mineral supplement “Tekro” there is a tendency to increase the protein content in the liver of rabbits of the experimental groups.

It was found that the content of creatinine in the blood plasma of rabbits of the experimental groups did not differ

significantly from this figure at animals of the control group at 45 days of age. From 60 days, a gradual increase in creatinine with age in the blood plasma of animals of all groups. The increase in creatinine in the blood plasma of rabbits of the experimental groups (60, 75 and 90 days of cultivation) was not significant. During the period of rabbits’ rearing from 45 to 60 days, significant deviation in the content of creatinine in the liver of animals of the experimental and control groups were not found out. Decrease of creatinine content in the liver of rabbits of the experimental group (75 and 90 days) relatively to the control of bolo was within the acceptable error limit.

During the period of rabbits' rearing from 45 to 60 days, significant deviation in the content of creatinine in the liver of animals of the experimental and control groups was not found out. Reduction of creatinine in the liver of rabbits of the 3rd experimental group (75 and 90 days) relatively to the control of bolo was within the acceptable error limit.

After analyzing the activity of aminotransferases and alkaline phosphatase throughout the experiment, fluctuations in the values of blood plasma and liver of New Zealand rabbits were found (Table 2).

Table 2

AST, ALT and alkaline phosphatase activity in New Zealand rabbits $\bar{X} \pm S_{\bar{X}}$ (n = 80)

Age days	AST			
	Plasma, $\mu\text{mol}/\text{year} \times \text{cm}^3$			
	Control 1	Experimental 2	Experimental 3	Experimental 4
45	0.64 ± 0.05	0.61 ± 0.01	0.61 ± 0.06	0.63 ± 0.04
60	0.57 ± 0.07	0.44 ± 0.06	0.45 ± 0.01*	0.49 ± 0.01
75	1.12 ± 0.06***	0.80 ± 0.008^^	0.81 ± 0.03***^^	0.81 ± 0.06^
90	0.64 ± 0.05***	0.30 ± 0.01^^	0.29 ± 0.02***^^	0.30 ± 0.02^^
Liver, $\mu\text{mol}/\text{year} \times \text{g}$				
45	1.97 ± 0.36	2.25 ± 0.26	2.24 ± 0.32	2.25 ± 0.29
60	1.45 ± 0.12	2.10 ± 0.32	2.17 ± 0.16^^	2.20 ± 0.18
75	2.15 ± 0.20**	2.50 ± 0.22	2.58 ± 0.14	2.58 ± 0.30
90	1.99 ± 0.17	2.10 ± 0.15	2.08 ± 0.15*	2.10 ± 0.18
ALT				
Plasma, $\mu\text{mol}/\text{year} \times \text{cm}^3$				
45	1.17 ± 0.04	1.17 ± 0.02	1.19 ± 0.04	1.20 ± 0.01
60	0.90 ± 0.22	1.02 ± 0.05	1.02 ± 0.13	1.05 ± 0.12
75	1.27 ± 0.08	1.24 ± 0.06	1.23 ± 0.04	1.26 ± 0.04
90	1.72 ± 0.11**	1.42 ± 0.02	1.47 ± 0.07*	1.50 ± 0.06
Liver, $\mu\text{mol}/\text{year} \times \text{g}$				
45	1.70 ± 0.11	1.58 ± 0.18	1.59 ± 0.15	1.60 ± 0.20
60	1.76 ± 0.19	2.06 ± 0.12	2.01 ± 0.22	2.00 ± 0.18
75	2.04 ± 0.07	2.67 ± 0.15	2.77 ± 0.12*^^^	2.80 ± 0.16
90	2.63 ± 0.27*	2.60 ± 0.10	2.63 ± 0.12	2.70 ± 0.11
Alkaline phosphatase				
Plasma, $\mu\text{mol}/(\text{c} \times \text{cm}^3)$				
45	6.92 ± 0.68	6.98 ± 0.52	6.91 ± 1.03	7.05 ± 0.50
60	7.13 ± 0.42	7.02 ± 0.68	7.01 ± 0.53	7.08 ± 0.42
75	9.22 ± 0.72*	7.10 ± 0.70	7.12 ± 0.37^	7.15 ± 0.52
90	5.33 ± 0.79**	6.41 ± 0.72	6.40 ± 0.84	6.50 ± 0.60
Liver, nmol/(c × g)				
45	18.24 ± 2.33	18.42 ± 1.30	18.39 ± 2.26	18.40 ± 1.30
60	10.03 ± 1.26*	12.99 ± 1.18	13.83 ± 0.65^	13.92 ± 1.44
75	13.85 ± 3.16	12.25 ± 1.20	12.21 ± 1.28	12.35 ± 1.38
90	17.04 ± 2.62	17.80 ± 1.10	17.84 ± 2.82	18.00 ± 1.28

Note: * – P ≤ 0.05; ** – P ≤ 0.01; *** – P ≤ 0.001 – compared with the previous age;

^ – P ≤ 0.05; ^^ – P ≤ 0.01; ^^ – P ≤ 0.001 – compared to the control

Studying the activity of LF in the blood plasma of rabbits on the 45th day of rearing, it was found that a significant difference between the control and experimental groups was not observed. A similar result was found on the 60th day of animals rearing. It has been experimentally proved that with the use of 3.5 % vitamin-mineral supplement "Tekro" (3rd experimental group) the activity of LF in blood plasma is probably reduced by 75 days. The decrease in enzyme activity was within the physiological norm. The activity of LF in the liver of rabbits of the experimental groups at 45, 75 and 90 days of cultivation probably did not differ from the control indicators. It was found that on the 60th day at animals of the 3rd experimental group the activity of LF in the liver was 37.8 % (P ≤ 0.05) higher than in the control. This phenomenon can be explained by the increased level of metabolism in the body of rabbits of the 3rd experimental group.

The study of blood plasma of rabbits on the 45th day of their cultivation showed that the use of different doses of vitamin and mineral supplement "Tekro" did not cause a

probable decrease in the activity of AST relatively to control one.

It was found that in rabbits of the 3rd experimental group on the 60th day probably reduces the activity of AST. In the plasma of animals of the 2nd, 3rd and 4th experimental group AST on the 75th and 90th days was probably less than in the control one.

Examining the activity of AST in the liver of rabbits, it was found that on the 45th day of cultivation, the activity of the enzyme at animals of the experimental groups was higher than in the control one. The difference was of trend character. It was found that under the action of 3.5 % vitamin-mineral supplement "Tekro" (3rd experimental group) the activity of AST in the liver of rabbits was higher than in the control one (P ≤ 0.01).

On the 75th and 90th days of rabbits' breeding, it was found that under the action of the studied additives there is a tendency to increase the activity of AST in the liver of experimental animals relatively to control indicators.

The indicators of ALT in the blood plasma of rabbits of the control and experimental groups in the period from 60 to 90 days of age were characterized by a tendency to increase. These indicators were highest at animals of 90 days of age. It was found that from 45 to 75 days a significant difference in the activity of ALT in the blood plasma of rabbits of the control and experimental groups was not found. At animals of the 3rd experimental group of 90 days of age, the activity of ALT in blood plasma was 14.5 % lower compared to animals in the control group and higher ($P \leq 0.05$) by 19.5 % compared with animals of the previous age period.

ALT activity in the liver of rabbits of the control and experimental groups had slight fluctuations during the experimental period from 45 to 90 days of age.

4. Conclusions

It was found that under the action of different doses of the studied additive in the experimental groups for 60 days revealed a tendency to increase the activity of ALT in the liver of rabbits relatively to control. ALT activity in the liver of rabbits of the 3rd experimental group at 75 days of age was significantly higher by 35.8 % compared to animals of the control group and probably higher by 37.8 % compared to animals of the previous period. Such a change in the activity of ALT in blood plasma and liver tissues of the experimental group may be evidence of the positive effects of both mineral and organic compounds in rabbits, in particular by increasing the intensity of redox processes and protein metabolism.

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