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INFLUENCE OF VITAMIN-MINERAL SUPPLEMENT ON GROWTH INTENSITY AND SLAUGHTER INDICATORS OF RABBITS

There was studied the influence of vitamin-mineral supplement of Tekrou firm, that contain a number of macro-elements, trace elements, vitamins, amino acids, in the amount of 0.35 g per 100 g of fodder on growth and development of the New Zealand rabbits breed of 45-, 60-, 75- and 90- days old. In order to evaluate the influence of vitamin and mineral supplements on the rabbits organism, we used zoo-technical methods of research (live weight, absolute, relative and average daily gain, slaughter quality of rabbits) and statistical methods. There was conducted a comparative analysis of the positive gain dynamics and live weight of experimental rabbits under the influence of vitamin and mineral supplements.

There were established group differences in pre-slaughter weight and weight of carcasses in rabbits that consumed different doses of vitamin and mineral supplements. The 90 days old rabbits increased body mass index by 8.89%, under the influence of vitamin and mineral supplements, which exceeded the indicators of control group animals. In addition, we determined the mass metric indices of the carcasses and internal organs of 45-, 60-, 75- and 90- days old rabbits after slaughter. The obtained data on the organism growth, the mass metric indices of the carcasses and the internal organs of the experimental groups rabbits after slaughter can testify to the positive influence of vitamin-mineral supplements on the intensity of the organism development and some internal organs, which contributes to the increased flow of metabolic processes and building of a greater body mass in experimental animal groups. Feeding experimental groups rabbits of New Zealand breed with vitamin and mineral supplements for 45 days contributed to a better transformation of food nutrients into products.

It was recorded that the vitamin-mineral supplement use in the ration of New Zealand rabbits increases the intensity of body growth during 45 days and provides the opportunity for a better transformation of fodder nutrients into products, in order to increase the body weight of animals.

Key words: rabbits, vitamin-mineral supplement, body weight, mass of internal organs, gain, absolute gain, average daily gain, rabbit carcass, internal organs, slaughter output.

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Formulation of the problem. One of the main tasks of the animal husbandry is the population supply with food of animal origin. The rabbit industry plays a special role in the supplying with high quality products due to rabbit biological characteristics such as growing speed, high fodder conversion and breeding power.

The rabbit feeding involves a complex of mechanical, chemical and microbiological processes that participate in the sequential splitting, absorption and use of fodder nutrients and they are characterized by certain age peculiarities [1, 2].

The digestion of fodder starts in the oral cavity. The fodder starch splits into glucose and it is absorbed by the oral mucosa, due to four saliva gland pairs, which produce a diastatic enzyme [3, 4].

Different parts of the young rabbit digestive system develop gradually. It has been established that the formation completion of the digestive channel for plant fodder consumption occurs when they are three month-old [5, 6].

A distinctive feature of the rabbit feeding is the food frequent consumption in small portions. If there is a free access to food, in average the adult rabbits eat 25–30 times a day. The eating duration takes them 5–10 minutes. The young rabbits eat fodder more often, due to the anatomical, physiological and age-related features of the structure and function of the digestive canal. In particular, the feeding intakes 50–60 times a day, when they are one month-old weans. But the frequency reduces when they become adult (3.5 month-old rabbits) [7–9].

Growth and development of rabbits has age and breed peculiarities. The young rabbits during the first five months, with optimal nutrition, are characterized by the intense growth by seven months [10–13].

Since early age the imbalance diet with vital nutrient content leads to dysbolism and irreversible processes, which further influence the rabbit organism growth and development and the internal organ formation [14–17].

In the rabbit industry, the high profitability can be achieved by properly organized, completed and balanced feeding. The introduction of biological additives, minerals and trace elements can be normalized by the energy content and proteins as well [18–23].

As for the micronutrients and macro elements that are needed for the rabbit organism, the amount of data is insignificant, so this question needs to be studied in more detail.

Analysis of recent research. From domestic and foreign literary sources it is known that the lack of trace elements and macro elements in the farm animals diet indicates a delay in the organism growth and development, a decrease in the immune-biological reactivity of the organism and a decrease in the life expectancy [24–27]. According to some authors, it is noted that the application effectiveness of macro- and microelements in the mammalian diet is not sufficiently studied, and the obtained experimental data are often contradictory and ambiguous [28]. Thus, a number of national authors write that vegetative fodder, which traditionally is the main component of rabbit rations, contain insufficient amount of micronutrient such as selenium [29].

The aim of the study. The purpose of this work is to study the effects of various doses of vitamin and mineral supplements in rabbit feeding of different age on their body growth and development intensity.

Material and methods of research. This research was carried out on the New Zealand breed female rabbits in the breeding farm “Gregut” Ltd., in Kozhanka village of Fastiv district, Kyiv region. On the principle of analogues there were formed with four female groups (one control and three experimental), with 60 animals in each. Rabbits of the control group fed with the standard granulated feed, and the 2nd, 3rd, 4th experimental groups – with the same feed with different doses of vitamin and mineral additives of the Tekro company. Thus, the 2nd experimental group received 3.2 g, the 3rd – 3.5 g , the 4th –3.0 hp per 1 kg of feed. Rabbits were kept in cages, access to feed and water was unlimited. Animals were formed into groups of 45 day old. In the experimental period, every 15 days, by the 45-th, the 60-th, the 75-th and 90-th day they were monitored for growth and development by weighing the control and experimental groups of rabbits with the evaluation of body mass index and average daily gain. During the experiment, the control and experimental animals were slaughtered and evaluated by the mass metric indices of carcasses and internal organs.

Main results of the study. It was found that the rabbit weight varied in experimental groups in comparison with the control ones, depending on mixed fodders feeding with the use of different doses of vitamin and mineral additives. This provided a different increase in the live weight of rabbits.

The research of the organism growth and development dynamics of 60 day-old rabbits showed an advantage by the intensity of animal growth in experimental groups, which diet was enriched with a vitamin-mineral additives (Table 1).

Table 1 – **Dynamics of live weight** (M ± m; n = 60)

Rabbit age, Days	1 control	2 experimental	3 experimental	4 experimental
	live weight, kg	live weight, kg	live weight, kg	live weight, kg
45	1,09±0,05	1,07±0,05	1,05±0,06	1,05±0,04
60	1,58±0,13	1,61±0,12	1,65±0,10	1,60±0,13
75	2,21±0,12	2,28±0,12	2,34±0,13	2,25±0,10
90	2,70±0,05	2,88±0,12	2,94±0,16*	2,75±0,16

Thus, body weight of 60 day old rabbits in the 2nd and the 4th experimental groups was higher as compared with animals of the previous age by 50.5 % and 50.4 %, and as compared with the animals of the control group – by1.90 % and by1.27 %, respectively. The highest body weight value of 60 day-old rabbits was recorded in animals of the 3rd experimental group. This value was 1.57 times higher as compared with the previous animal age, and 1.04 times more in comparing with the control group, which amounted 57.14 % and 4.43 % respectively.

The 75 day old rabbits of control and experimental groups showed a tendency to increase body mass index. In particular, it was the most pronounced index comparison of the experimental and control animal groups. Thus, the experimental groups recorded that the body mass indexes in the 2nd and the 4th groups were larger by 3.17 % and by 1.81 %, respectively, as compared to the control group animals. The highest increase of body mass index as compared to the control group of animals, it was found in animals of the 3rd experimental group and it was characterized 5.88 % or 1.06 times more, respectively.

Additional use of vitamin and mineral additives in the experimental rabbit groups was positively manifested in 90 day old animals. This fact was confirmed by the body weight gain increase of exper-

imental animal groups as compared with the control one. In particular, in the 2nd and the 4th rabbit groups, the body mass indexes were 1.07 and 1.02 times higher than in the control group. Thus, in the 2nd experimental group of animals, the difference in the body mass index was higher 6.67 % times and in the 4th group 1.85 % times more, respectively. The 90 day-old rabbits of the 3rd experimental group recorded the highest body mass index, which in turn was characterized 1.02 and 1.07 times increase as compared with the 2nd and the 4th experimental animal groups. There was also body weight increase in the 3rd animal group 1,09 times as compared with the control group, which was 8.89 % times higher.

Determining the absolute growth, it was found that during the whole experiment, the highest index had rabbits of the 3rd experimental group (Table 2).

Table 2 – **Absolute growth of rabbits** (M ± m; n = 60)

Rabbit age, Days	1 control	2 experimental	3 experimental	4 experimental
	gain, g	gain, g	gain, g	gain, g
45-60	490±8,1	540±4,0	600±4,1	550±6,2
60-75	630±10,1	670±2,0	690±3,9	650±5,6
75-90	490±5,9	600±3,0	600±6,2	500±2,0

The conducted studies showed the high rate of live weight growth dynamics of rabbits in all groups, which was confirmed by the intensive growth of the experimental indexes of daily live weight gain in the 2nd, 3rd and the 4th experimental rabbit groups in the period from 45 to 75 days. (Table 3).

Table 3 – **Average daily gain of rabbits** (M ± m; n = 60)

Rabbit age, Days	1 control	2 experimental	3 experimental	4 experimental
	gain, kg	gain, kg	gain, kg	gain, kg
45-60	32±5,3	36±2,6	40±2,6	36±4,0
60-75	42±0,6	44±1,3	46±2,1	43±3,3
75-90	32±3,3	40±2,0	40±4,0	33±1,3

Thus, in the 2nd experimental rabbit group, the change in average daily gain was found to be 22.2 % as compared with previous figures, in the 4th experimental group 19.4 % times and in comparison with the control animal group 4.8 % and 2.38 % times more respectively. The largest average daily gain was noted in the rabbits of the 3rd experimental group. In particular, the experimental value of daily average rabbit gain of the 3rd experimental group was characterized 4.5 % times increase as compared to the 2nd experimental animal group, the increase 7.0 % times as compared to the 4th experimental animal group and increase 9.5 % times as compared with the animals from control group.

The relative gain of rabbits in all experimental groups in the period from 60 to 75 days was characterized by slight fluctuations (Table 4).

Table 4 – **Relative gain of rabbits**, % (M ± m; n = 60)

Rabbit age, Days	1 control	2 experimental	3 experimental	4 experimental
	gain, %	gain, %	Gain, %	gain, %
45-60	44,95	50,46	57,14	52,38
60-75	39,87	41,61	41,81	40,62
75-90	22,17	26,31	25,64	22,22

The difference between the relative growth rate of young rabbits slightly decreased, due to the general decrease in the growth rate of rabbits in the final research period.

Studying the slaughter quality of rabbit carcasses in the control and experimental groups, it was indicated the most valuable parts: carcass, skin, head, brain, lungs, heart, spleen, liver, kidneys, muscles (Table 5).

It is known that rabbit’s liver in relation to body weight, as compared with other farm animals, is the largest internal organ that ensures constancy of the internal environment of the organism systems. A large number of metabolic processes of biosynthesis and protein splitting occur in the liver cells, which provides the body with necessary energetic and plastic materials. Among the studied groups of

rabbits, the largest liver was observed in animals of the 3rd experimental group – with average weight of 109 g.

Table 5 – **Slaughter qualities of the control and experimental rabbit groups** (M ± m; n = 60)

Age, Days	1 control	2 experimental	3 experimental	4 experimental
	90	90	90	90
before slaughter mass, g	2700,01±0,05	2780,03±0,12	2840,05±0,60	2750,02±0,16
carcass, g	1502,69±54,34	1800,44±47,56	1850,22±47,56	1720,41±47,56
skin, g	355,23±25,02	372,11±28,10	385,52±36,15	362,36±32,10
head, g	147,05±5,52	148,56±3,49	158,19±4,55	150,68±4,18
brain, g	7,61±0,25	8,02±0,45	8,56±0,53	8,29±0,39
lungs, g	13,36±0,68	14,75±0,70	15,90±0,75	15,01±0,62
heart, g	6,75±0,39	7,03±0,32	7,44±0,46	6,92±0,42
spleen, g	1,51±0,06	1,78±0,09	1,98±0,13	1,76±0,10
liver, g	77,12±2,19	100,06±9,67	109,02±9,67	99,87±8,25
kidneys, g	16,83±0,55	18,02±0,11	18,41±0,17	17,92±0,09
muscle, g	8,85±0,62	9,80±0,30	10,53±0,38	10,05±0,26
slaughter output %	55,62±1,93	64,74±1,56	65,14±0,69	62,54±1,60

There was noted higher value of rabbit carcasses in experimental groups as compared with the control one. These indicators can be explained by the positive influence of vitamin and mineral additives on metabolic processes in the rabbits of all experimental groups. The slaughter output in rabbits of the experimental groups did not change significantly and was the highest in animals of the 2nd and the 3rd groups as compared with control one.

The average value of percentage ratio of the rabbit carcass components in the 3rd experimental group was higher: fresh meat – 23.1 %, muscle – 19.3 %, skin – 8.5 %, liver – 41.4 %, kidney – 9.5 %, lungs – 19.5 %, heart – 10.4 %, spleen – 26.7 %, head – 7.5 %, brain – 11.8 % as compared to the control group indicators.

Comparative analysis of the study results of the rabbit skin mass of experimental groups showed higher mass metric indices than that of control group animals. Thus, the skin mass index of animals in the 2nd and the 4th groups was 4.8 % and 2 % times higher, respectively, as compared with the control group animals. The largest skin weight was recorded in animals of the 3rd experimental group and the difference was 8.5 % times higher than that of the control group animals.

The analysis of the mass metric indices of the slaughter output showed that the animals of the 3rd group were characterized by the highest slaughter output as compared with other groups. It was found that the highest percentage of slaughter output had rabbits of the 3rd experimental group as compared with the rest groups. In particular, the slaughter output value of the 3rd experimental group of rabbits was 2.6 % times higher than that of the 4th experimental group and it was 0.4 % times higher than in the 2nd experimental animal group and it was 9.5 % times higher than that in the control animal group.

Thus, the obtained data on the organism growth, the mass metric indices of the carcass and the internal organs of the experimental rabbit groups after slaughter can indicate the positive effect of the vitamin and mineral supplements use and the intensity of the organism and some internal organs development, which contributes the increased flow of metabolic processes and building of a greater body mass in the experimental animal groups. It is obvious that feeding the New Zealand breed rabbits of experimental groups with vitamin-mineral additives, during 45 days contributed to a better transformation of fodder nutrients into products.

Conclusion. There was found the highest body mass value, which differed 8.89 % times in comparison with the control group, in the 3rd experimental group on the 90th day.

The average daily gain in the 3-rd experimental group was 4.54 % time more than in the 2nd experimental group. It was 6.97 % times more than in the 4th experimental animal group. The increase was 9.52 % times more in comparison with the control group of animals.

The slaughter output of rabbit carcass was 2.6 % times higher in the 3rd experimental group as compared to the 4th experimental group animals, and it was 0.4 % time higher than in the 2nd experimental animal group and as compared to the control animal group – 9.5 % times more.

Thus, the use of additive in the amount of 3.5 g per 1 kg of fodder increases the growth rate of New Zealand breed rabbits during the 45th day and provides a significant increase of slaughter weight and slaughter output and gives possibility to the body of better nutrients transformation from fodder into animal products.

The further research perspective is to study the mass metric indices of different breeds of rabbits.

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Вплив вітамінно-мінеральної добавки на інтенсивність росту та забійні показники кролів

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Досліджено вплив на ріст і розвиток організму кролів новозеландської породи 45-, 60-, 75- та 90-добового віку вітамінно-мінеральної добавки фірми Текроу в кількості 0,35 г на 100 г корму, яка містить у своєму складі ряд макро- і мікроелементів, вітамінів, амінокислот. Для оцінки впливу вітамінно-мінеральної добавки на організм кролів використовували зоотехнічні методи дослідження (жива маса, абсолютний, відносний і середньодобовий приріст, забійні якості кролів) і статистичні. Проведено порівняльний аналіз позитивної динаміки приростів та живої маси дослідних кролів за впливу вітамінно-мінеральної добавки.

Встановлено міжгрупові відмінності за передзабійною масою тіла і масою тушки у кролів, які споживали різну дозу вітамінно-мінеральної добавки. У кролів 90-добового віку, під впливом вітамінно-мінеральної добавки, відбулось підвищення показників маси тіла на 8,89 %, що перевищувало показники тварин контрольної групи. Крім того, було визначено масометричні показники тушки і внутрішніх органів кролів 45-, 60-, 75- та 90-добового віку після забою. Одержані дані росту організму, масометричні показники тушки та внутрішніх органів кролів дослідних груп після забою можуть свідчити про позитивний вплив вітамінно-мінеральної добавки на інтенсивність розвитку організму та окремих внутрішніх органів, що сприяє посиленому перебігу обмінних процесів і нарощуванню більшої маси тіла у тварин дослідних груп. Згодовування вітамінно-мінеральної добавки кролям дослідних груп новозеландської породи впродовж 45 діб сприяло кращій трансформації поживних речовин корму в продукцію.

Зафіксовано, що застосування вітамінно-мінеральної добавки в раціоні кролів новозеландської породи підвищує інтенсивність росту організму впродовж 45 діб і забезпечує можливість кращої трансформації поживних речовин корму в продукцію, з метою нарощування маси тіла тварин.

Ключові слова: кролі, вітамінно-мінеральна добавка, маса тіла, маса внутрішніх органів, приріст, абсолютний приріст, середньодобовий приріст, тушка кролів, внутрішні органи, забійний вихід.

Влияние витаминно-минеральной добавки на интенсивность роста и убойные показатели кроликов

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Исследовано влияние на рост и развитие организма кроликов новозеландской породы 45-, 60-,75 и 90-суточного возраста витаминно-минеральной добавки фирмы Текроу в количестве0,35 г на 100 г корма, которая содержит в своем составе ряд макро- и микроэлементов, витаминов, аминокислот. Для оценки влияния витаминно-минеральной добавки на организм кроликов использовали зоотехнические методы исследования (живая масса, абсолютный, относительный и среднесуточный прирост, убойные качества кроликов) и статистические. Проведен сравнительный анализ положительной динамики приростов и живой массы опытных кроликов при воздействии витаминно-минеральной добавки.

Установлены межгрупповые различия по предубойной массе тела и массе тушки у кроликов, которые потребляли разную дозу витаминно-минеральной добавки. У кроликов 90-суточного возраста под влиянием витаминно-минеральной добавки произошло повышение показателей массы тела на 8,89 %, что превышало показатели животных контрольной группы. Кроме того, были определены массометрические показатели тушки и внутренних органов кроликов 45-, 60-, 75- и 90-суточного возраста после забоя. Полученные данные роста организма, массометрических показателей тушки и внутренних органов кроликов опытных групп после убоя могут свидетельствовать о положи-

тельном влиянии витаминно-минеральной добавки на интенсивность развития организма и отдельных внутренних органов, что способствует усиленному протеканию обменных процессов и наращиванию большей массы тела у животных опытных групп. Скармливание витаминно-минеральной добавки кроликам опытных групп новозеландской породы в течение 45 суток способствовало лучшей трансформации питательных веществ корма в продукцию.

Зафиксировано, что применение витаминно-минеральной добавки в рационе кроликов новозеландской породы повышает интенсивность роста организма в течение 45 суток и обеспечивает возможность лучшей трансформации питательных веществ корма в продукцию с целью наращивания массы тела животных.

Ключевые слова: кролики, витаминно-минеральная добавка, масса тела, масса внутренних органов, прирост, абсолютный прирост, среднесуточный прирост, тушка кролика, внутренние органы, убойный выход.

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