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EFFECTS OF MULTI-PHASE FEEDING ON PRODUCTION PERFORMANCE OF BROILERS

DJELOVANJE MULTIFAZNE HRANIDBE NA PROIZVODNE PERFORMANSE BROJLERA

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SUMMARY

The objective of the research was to investigate the effect of multiphase nutrition, i.e. different mixtures used in broiler nutrition, whose protein content was reduced in several phases during the first fattening stage, on production performances of broilers. The investigation was carried out on 1216 individually tagged chickens of Ross 308 strain divided by sex. In the trial period (1st to 42nd day), standard fattening technology was applied, with four nutrition treatments (T1-T4). Chickens of the first group (control) were fed mixture containing 23% of protein in duration from 1st to 21st day, and in remaining three groups protein content during the trial period was reduced in several phases, according to specific program of multiphase nutrition.

Programs of multi-phased nutrition, at the age of 42 days, did not influence the body mass of male and female broilers, meaning that the comparison of the surveyed groups (T2, T3 and T4) with the male and female broilers from the control group (T1) did not reveal any significant differences. The multi-phase nutrition program for the surveyed T4 group showed the most favourable feed conversion with the male broilers (1.870) and female broilers (1.867) in comparison to the representatives of the control group of male broilers (1.918) and female broilers (1.951). Based on results obtained, it can be concluded that multiphase nutrition affected the production performance, i.e. the level of feed utilization, which was in favour of its application, considering that difference in feed conversion could be decisive for realization of the positive economic production performance.

Key words: chickens, multiphase nutrition, sex, production performances

INTRODUCTION

Multiphase broiler nutrition in the function of optimizing nutrition, economic efficiency of production and environment protection, is gaining interest. Multiphase nutrition is based on fulfilling nutritious

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requirements of broilers in specific moments of their life cycle, for the purpose of nutrition optimization, i.e. "fitting" feed components to broiler needs in certain growth stages.

Nutritionists aspire towards maximum adjustment of the intake of nutritious substances by growing chickens to their biological requirements, which is not easy to do in practice, considering that requirements of the chickens vary under the influence of various factors, and also specific differences at the level of genotype are apparent. Indicating the problem of precision in defining the requirements Ferket et al., (2002) state that nutrition requirements are like "moving targets", pointing out considerable genetic variations in growth characteristics, especially in regard to protein retention.

In regard to different broiler fattening periods, special attention is paid to the early fattening period, and nutrition in the starter period is considered critical for achievement of optimal production performances and therefore the topic of research by numerous authors (Teimovri et al., 2005; Baker and Han, 1994; Gomes et al., 2006). In regard to the stated, Belyavinu, (1999) suggests that during growth period more different diets are given to birds, i.e. that the broiler nutrition should be based on program of multiphase nutrition. Research indicates that mixtures with reduced protein content have no effect on body mass and consumption of feed by broilers, but the effect on economic efficiency of fattening is significant (Warren and Emmert, 2000; Saleh et al., 1996).

The objective of the study was to investigate the effect of several programs of multiphase nutrition, i.e. the effect of different mixtures used in broiler nutrition where protein content had been reduced in several phases during the first fattening period, on production traits of fattening chickens.

MATERIAL AND METHODS

The trial was carried out on experimental farm of the Faculty of Agriculture, Novi Sad in Temerin.The investigation was carried out on 1216 chickens, i.e. 608 individually tagged male and female chickens, of Ross 308 strain. Chickens were housed in 32 boxes with 38 chickens in each box (i.e. four boxes for each treatment), divided according to random block system. Standard fattening technology was applied in duration of 42 days. Chicken nutrition was *ad libitum*, with four nutrition treatments:

T1 (control group) – nutrition with mixture containing 23% of protein from 1st to 21st day;

T2 – nutrition with mixture containing 23% of protein from 1st to 7th day, and from 7th to 21st day diet containing 21.5% protein;

T3 – nutrition with mixture containing 23% of protein from 1st to 14th day and from 14th to 21st day diet containing 21.5% protein;

T4 – nutrition with mixture containing 23% of protein from 1st to 3rd day, from 4th to 6th day with 22.55% protein, 7th – 9th day with 22.10% protein, 10th – 12th day diet with 21.65% protein, 13th – 15th day with 21.20% protein, 16th – 18th day with 20.75% protein and 19th – 21st day diet with 20.30% protein.

Diet based on corn-soybean was used and multiphase mixtures for chicken nutrition were obtained by mixing two basic diets, i.e. first mixture containing 23% of protein and 13 MJ/kg of metabolic energy and the second with 20% of protein and 13.3 MJ/kg of metabolic energy. Treatments differed in the level of protein, but also in term of other nutrients, depending on the proportional share of two basic diets, whose ratio changed according to the said feeding program.

After 21st day, all chickens were fed the same way, i.e. in the period from 21st to 35th day, diet containing 20% of protein and in the period from 35th to 42nd day of fattening diet containing 18% of protein.

During the trial period control of body mass was done by individual weighing of all chickens on the first day, and weekly from the 1st to 6th week of age. Based on differences in body mass of chickens established in weekly weighing, data on weekly, i.e. daily gain were calculated. Feed conversion was calculated based on data on feed consumption and gain of chickens at the level of each box, in certain phases and at the end of the trial. Dead chickens were also weighed and considered in the calculations. Mortality was calculated on the basis of box, according to daily records of dead chickens.

Computer program Statistica 5, Statsoft, was used for data processing. Variations of the main factors (poly-food) and their interactions separated were through a variance analysis using the method

for poly-factor experiments. For grading the significance of the main factors and their interactions the F-test was used for group trials, and an LSD test was used for single data comparison.

RESULTS AND DISCUSSION

In Table 1, the assessment of significance of differences in body mass of male and female chickens, perweeks, is presented. At the level of the trial, statistically significant difference between sexes was established, whereas the food had a statistically significant effect on body mass in the sixth week.

During the starter period, i.e. at the end of the third week, no statistically significant differences were established in male and female chickens between control and trial groups (table 1). In data analysis it can be observed that treatment T4 in male chickens resulted in decrease of body mass in the first three weeks, which is in accordance with research by Reazeia et al., (2006) and Gomes et al., (2006) according to which decrease of protein in nutrition, during the first phase of fattening, resulted in decrease of body mass. In female chickens, lower body mass was not concluded before the third week, indicating that female chickens were more tolerant to protein content decrease compared to male chickens.

At the age of 42 days, in chickens of both sex of control (T1) and trial groups (T2, T3 and T4) no statistically significant differences were established, but in male chickens it could be observed that trial group T4 had realized statistically significantly higher body mass compared to chickens from T2 and T3 treatments. Results of this research can be associated with research by Warren and Emmert, (2000) and Nasril (2003) who concluded that multiphase nutrition had no effect on body mass of chickens at the end of the trial.

Table 1. The effect of multiphase nutrition on body mass of chickens, according per weeks
Tablica1. Djelovanje multifazne hranidbe na tjelesnu masu pilića po tjednima

Treatment Tretman		Body mass, g - Tjelesna masa, g									
		Male chickens -Muški pilići				Female chickens - Ženski pililći				Factor - Faktor	
Week Tjedan		1	2	3	4	1	2	3	4	Sex Spol	Food Hrana
1.	$\bar{x}$	138.14^{a}	137.40^{a}	137.75^{a}	133.56^{b}	133.84	136.64	134.33	134.23	*	NS
	Sd	14.91	15.84	15.81	14.96	16.01	15.39	15.22	15.10		
2.	$\bar{x}$	361.29^{a}	354.83^{a}	356.65^{a}	340.08^{b}	342.04	340.61	339.25	343.51	**	NS
	Sd	41.89	38.25	44.49	46.52	43.50	42.67	42.09	41.26		
3.	$\bar{x}$	723.48	714.54	724.86	705.63	680.66^{ab}	681.84^{a}	660.77^{b}	670.95^{ab}	**	NS
	Sd	82.41	69.76	84.16	88.60	87.91	84.57	85.81	77.64		
4.	$\bar{x}$	1142.45	1130.80	1158.48	1135.34	1086.13	1071.43	1057.30	1064.34	**	NS
	Sd	132.09	127.70	144.32	143.90	124.93	131.31	138.02	122.66		
5.	$\bar{x}$	1607.42^{ab}	1594.96^{ab}	1572.13^{b}	1620.72^{a}	1530.92	1493.95	1500.47	1499.74	**	NS
	Sd	157.91	160.64	167.10	174.20	154.58	162.69	154.31	151.84		
6.	$\bar{x}$	2055.16^{ab}	2025.00^{b}	2020.07^{b}	2092.42^{a}	1963.11	1936.26	1930.02	1961.68	**	**
	Sd	173.15	190.07	199.57	208.55	183.04	188.96	172.34	175.91		

$^{a-b}$ Values within a row per sex without same superscript are statistically significantly different (P <0.05)

Vrijednosti unutar reda po spolu bez istog natpisa statističi se značajno razlikuju (P <0,05)

* Statistically significant (P<0.05) - * Statistički značajno (P<0,05)

** Statistically significant (P<0.01) - ** Statistički značajno (P<0,01)

NS no statistically significant differences - NS nema statistički značajnih razlika

Table 2. The effect of multiphase nutrition on daily gain of chickens, according per weeks
Tablica2. Djelovanje multifazne hranidbe na dnevni prirast pilića, po tjednima

Treatment Tretman		Body mass, g - Tjelesna masa, g									
		Male chickens -Muški pilići				Female chickens - Ženski pililći				Factor - Faktor	
Week Tjedan		1	2	3	4	1	2	3	4	Sex Spol	Food Hrana
1.	$\bar{x}$	14.05^{a}	13.81^{a}	13.84^{a}	13.20^{b}	13.30	13.73	13.39	13.39	*	NS
	Sd	2.11	2.11	2.21	2.04	2.26	2.11	2.18	2.12		
2.	$\bar{x}$	32.39^{a}	31.20^{ab}	31.26^{ab}	30.08^{b}	30.24	29.13	29.89	30.20	**	**
	Sd	5.54	4.31	5.56	5.44	4.92	5.43	5.05	4.58		
3.	$\bar{x}$	52.10	51.09	52.53	51.92	48.06^{ac}	48.70^{a}	45.94^{b}	46.58^{bc}	**	NS
	Sd	9.19	7.03	7.52	7.91	8.42	7.27	8.53	7.60		
4.	$\bar{x}$	59.76	61.77	61.11	61.09	58.10	56.10	56.69	56.47	**	NS
	Sd	12.63	14.80	11.75	10.41	9.15	11.47	10.52	9.99		
5.	$\bar{x}$	66.44^{a}	67.20^{a}	60.23^{b}	69.38^{a}	63.77^{a}	61.20^{b}	63.33^{ab}	62.50^{ab}	**	**
	Sd	12.84	12.07	12.88	10.45	8.25	10.89	8.65	10.27		
6.	$\bar{x}$	64.05^{a}	62.08^{a}	63.99^{a}	67.69^{b}	63.04^{b}	63.30^{ab}	61.21^{bc}	65.99^{a}	NS	**
	Sd	11.60	13.15	13.11	13.88	11.57	9.42	10.70	10.99		

a-b Values within a row per sex without same superscript are statistically significantly different (P <0.05)

a-b Vrijednosti unutar reda po spolu bez istog natpisa statistički se značajno razlikuju (P <0,05)

* Statistically significant (P<0.05) - * Statistički značajno (P<0,05)

** Statistically significant (P<0.01) - ** Statistički značajno (P<0,05)

NS no statistically significant differences - NS nema statistički značajnih razlika

In Table 2 the assessment of significance of differences in gains of male and female chickens, according per weeks is presented. At the level of the trial, statistically significant difference was established in daily gain between chickens of different sex in all weeks of age, except in the sixth week, and that feed had a statistically significant effect in the second, fifth and sixth week.

In the first fattening phase, i.e. in the first two weeks of the starter period (table 2), in male chickens, average daily gain of chickens in T4 treatment was statistically significantly lower compared to control group (T1), which was not established in female chickens. In female chickens during the first two weeks no statistically significant differences in daily gain between control (T1) and trial groups (T2, T3 and T4) were established. However, in the third week, when in T3 trial group new multiphase mixture had been introduced with reduced nutrient content, statistically significantly lower gain compared to control and trial group T2 was established.

In the second fattening phase, in male chickens, the highest gain in the 5th and 6th week was realized by group T4 compared to control (T1), T2 and T3 groups, which in the 6th week was statistically significantly higher compared to other treatments. In female chickens, T4 group also had the highest gain in the 6th week and statistically significantly higher only in relation to T1 and T3 treatment.

In table 3 the feed conversion and mortality of chickens are presented.

Table 3. The effect of multiphase nutrition on conversion of diets and moratlity of chickens
Tablica 3. Djelovanje multifazne hrannidbe na konverziju hrane i smrtnost pilića

Treatment / Tretman / Period / Razdoblje	Male chickens - Muški pilići				Female chickens - Ženski pilići			
	1	2	3	4	1	2	3	4
Corvension - Konverzija kg/kg								
1-21	1.530 $^{a\,b}$	1.645 ^{b}	1.573 $^{a\,b}$	1.468 ^{a}	1.609	1.586	1.632	1.509
1-42	1.918 $^{a\,b}$	2.005 ^{a}	1.970 ^{a}	1.870 ^{b}	1.951	1.960	1.991	1.867
Mortality (%) - Smrtnost (%)								
1-42	3.95	2.63	4.61	3.95	3.29	4.61	3.29	3.95

a-b Values within a row per sex without same superscript are statistically significantly different (P <0.05)
a-b Vrijednosti unutar reda po spolu bez istog natpisa statistički se značajno razlikuju (P <0,05)

Feed conversion in starter period and at the level of the whole trial (table 3) varied between groups, precisely in favour of application of multiphase broiler nutrition. Namely, feed conversion in chickens of both sex of trial group T4 was the most favourable compared to T1 and T2 which is in accordance with research on the program of multiphase nutrition by Rezaeia et al., (2006) and Nasril (2003). However, statistically significant differences in feed conversion for the whole trial were established only in male chickens, between treatments T4 and T2.

The programs of multiphase nutrition influenced the mortality of chickens (table 3). Mortality in chickens of male sex varied within limits of 2.63% to 3.95%, i.e. in female chickens from 3.29% to 4.61% in trial groups, which is within the allowed limits of technology.

CONCLUSION

Multiphase nutrition included application of several mixtures during fattening, with the aim to adjust the composition of feed in the best possible way in order to meet the requirements of broiler chickens and in this way improve the utilization of food, i.e. increase the economic efficiency of production.

Based on results obtained it can be concluded that applied programs of multiphase nutrition have resulted in different influences on production performances. Application of multiphase nutrition had no statistically significant effect on body mass and mortality in male and female chickens, i.e. reduction of protein level in mixtures used in broiler nutrition did not result in significant decrease of body mass. At the same time, program of multiphase nutrition (T4) resulted in the most favourable feed conversion in both sex, which is in favour of the application of multiphase nutrition, considering that difference in feed conversion can be crucial for realization of positive economic production perfor-mance.

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REFERENCES

1. Baker, D. H., Han, Y. (1994): Ideal amino acid profile for chicks during the first three weeks post hatching. Poult. Sci. 73(9):1441-1447.
2. Belyavin, C. G. (1999): Nutrition management of broiler programs. Pages 93-105 in ances in Animal Nutrition. Nottingham University Press, Leicestershire, Recent Adv UK.
3. Ferket, P. R., Van Heugten, E., Van Kempen, T. A., Angel, R. (2002): Nutritional strategies to reduce environmental emissions from non-ruminants. J. Anim. Sci., 80, 168-182.

4. Gomes, G. A., Araujo, L. F., Prezzi, J. A., Barbosa, L. C. G. S., Savietto, D., Filho Cren, A. W. (2006): Period of feeding a pre starter diet on performance up to 42 days of broilers of different body weights at housing. Book of Abstracts, XII European Poultry Conference, Italy, 298-299.
5. Nasril, B. S. (2003): Continuous multi-phase feeding of broiler chickens. A Dissertation, Texas.
6. Rezaei, M., Teimouri, A., Pourreza, J., Sayyahzadeh, H., Waldroup, P. W. (2006): Effect of diet dilution in the starter period on performance and carcass characteristics of broiler chicks. Journal Central European Agriculture, 7, 1, 63-70.
7. Saleh, E. A., Warkins, S. E., Waldroup, W .P. (1996): Changing time of feeding starter, grower, and finisher diets for broilers.1. Birds grown to 1kg. J. Appl. Poult. Res. 5, 269-275.
8. Teimouri, A., Razaei, M., Pourreza, J., Sayyahzadehh, H., Waldroup, P. W. (2005): Effect of diet Dilution on the starter Period on performance and Carcass Characteristics of Broiler Chicks. International Journal of poultry Science 4,12,1006-1011.
9. Warren, W. A., Emmert, J. L. (2000): Efficacy of phase-feeding in supporting growth performance of broiler chuck during the starter and finisher phases. Poult. Sci. 79, 764-770.

SAŽETAK

Cilj istraživanja bio je istražiti utjecaj multifazne hranidbe, odnosno različitih smjesa za hranidbu brojlera u kojima je sadržaj bjelančevina smanjen višefazno, na proizvodne osobine tovnih pilića. Istraživanje je izvedeno na 1216 individualno obilježenih pilića, provenijence Ross 308, razdvojenih po spolu. U pokusnom razdoblju (1. do 42. dana) primijenjena je standardna tehnologija tova, s četiri tretmana hranidbe (T1-T4). Pilići prve skupine (kontrolne) hranjeni su smjesom s 23% bjelančevina u trajanju od 1. do 21. dana, a u ostale tri skupine sadržaj bjelančevina je tijekom pokusnog razdoblja smanjen višefazno, prema određenom programu multifazne hrandibe. Programi multifazne hranidbe, u uzrastu 42 dana, nisu utjecali na tjelesnu masu pilića muškog i ženskog spola, odnosno usporedbom pokusnih (T2, T3 i T4) skupina kod oba spola, s kontrolnom skupinom (T1) pilića muškog (2055,16 g) i ženskog (1963,11 g) spola nisu utvrđene statistički značajne razlike. Program multifazne hranidbe za pokusnu T4 skupinu rezultirao je najpovoljnijom konverzijom hrane kod pilića muškog (1,870) i ženskog spola (1,867) u usporedbi s kontrolnom skupinom pilića muškog (1,918) i ženskog spola (1,951).

U provedenom istraživanju multifazna hranidba imala je pozitivan utjecaj na proizvodne performanse, odnosno na stupanj iskorištenosti hrane, što ide u prilog njene primjene, s obzirom da razlika u konverziji hrane može biti ključna za ostvarenje pozitivnog ekonomskog djelovanja proizvodnje.

Ključne riječi: pilići, multifazna hranidba, spol, proizvodne performanse