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THE INFLUENCE OF FEED PROTEIN LEVEL ON SOME PRODUCTIVE INDICES IN BARRED PLYMOUTH ROCK REARED IN FREE RANGE SYSTEM

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ABSTRACT
The purpose of this paper was to assess the possibility of grow mixed breed broilers in free range system fed according to the slow feeding rate, with nutritional requirements mainly consisting of feed concentrate mixtures starting from the premises that currently there are no nutritional standards especially created for maintenance alternative systems. The experiment for the quantification of impact of nutritional features and of the CM administration intake on bio productive and economic performances of Barred Plymouth Rock avian youth has been reared during 10 weeks on two experimental variants. The elaborated experimental design was intended to assess the effect of a good nutritional start in both variants, but with a different time. Considering the same start, both in V_1 and V_2, by administering an CM with 2960 kcal ME and 22.04% CP, for 14 days in V_1 and 21 days in V_2.V_1 received a tri-phase feeding by using an intermediary „growing" phase during 36 days when CM was administered with 2990 kcal ME/kg and 20.03% CP followed by a finishing phase after 50 days and continued until the end of experiment, when CM was administered with 3000 kcal ME/kg and 17.30% CP. V_2 was intended to establish the effect of a bi-phase feeding, therefore phase II became the „growing-finishing" phase, respectively the administration of a feed concentrate mixture with an energy level of 3000 kcal ME and 17.30% CP. Broilers in V_1, tri-phase fed, had a feed intake comparison with that of broilers in V_2 (bi-phase fed), an average body weight of 1428.60 g with a total increase of 8.3% higher and a better feed conversion (2.66 kg/kg) considering the increased costs per kg of live mass with 1.87% comparing with V_2. Regarding the CP intake, depending on ME intake, the registered values are close in both variants. Based on a mathematic model like: $y = a/(1+bx+cx^2)$, one can assess the fodder feeding costs. The correlation rate between the fodder feeding costs and the CP intake is strongly positive for both variants.

Key words: protein, costs of feeding, free range system, Ross 308

INTRODUCTION

In most developed countries chicken meat production is more and more based on autochthon ecotypes and alternative range systems. In western countries, the militants for animal welfare lead an ample campaign against intensive production (SAVOY, 2003; KINGORI ET AL., 2007).

VERBEKE AND VIANE (2000), BLOKHUIS ET AL. (2000) state that society segments have shown great interest in production systems, animal welfare and quality of life. That led to a guarantee to consumers' choices of new products (FRASER, 2001).

Improvement in the performance of indigenous birds on free-range requires some knowledge of feed available to them under the prevailing system of production (WALKER AND GORDON, 2003). This will allow an evaluation of their nutritional status and a possible formulation of a supplementary package (KINGORI ET AL. 2007).

Regardless of the range system, feeding is a determinant factor in increasing animal production, being greatly responsible for poultry breeding and development, for maintaining them healthy and for achieving the goal for which they are raised, respectively for providing meat or eggs production.

After a comprehensive study, BLAIR (2008) stated that currently there are no nutritional standards especially created for poultry raised in alternative systems. Yet, those standards can derivate from the already existent regulations provided for genotypes with a slow rate of breeding. Many producers use traditional breeds and genotypes of poultry which were not subject to the selection pressure (SIMIZ, 2012).

BLAIR (2008) states that the ARC (1975) system has applicability in the production obtained in alternative breeding systems, due to their basic genotype, but the data are although incomplete. They suggest as basis for setting certain nutritional standards applicable for poultry in order to produce meat worldwide, NRC (1994) regulations.

The application of these nutritional standards aims to provide a balanced diet containing nutritional principles in specific ratios and they do not contain excess nutrients (DRINCEANU ET AL., 2010; SIMIZ ET AL., 2013).

The purpose of this experiment was to assess the possibility of raising mixed breed chickens for meat production in free range system fed according to the slow growing rate, with nutrient requirements mainly consisting feed concentrate mixtures. The Barred Plymouth Rock variety as a biological material was selected starting from the premise that it is very prevalent in our country and in other countries as well, and it is suitable both for industrial rearing as broiler mother (Plymouth Rock, white variety) and for household rearing due to its resistance.

MATERIAL AND METHOD

The experiment for the quantification of the effect of nutritional features and the concentrate mixtures (CM) intake time on bio productive performances of Plymouth Rock avian youth was performed during 10 weeks in a family farm.

The experiment was performed on a group of 40 broilers under feeding conditions specific to the free range system. Broilers were divided into two experimental variants, as follows:

– ***V_1*** – consisting of 20 broilers tri-phase fed with concentrate mixtures noted with $CM_{starter}$, $CM_{rearing}$ and $CM_{finishing}$;

– ***V_2*** – consisting of 20 broilers bi-phase fed with $CM_{starter}$ and $CM_{rearing\text{-}finishing}$;

Regarding the concentrate mixtures intake, there are three phases in experimental variant 1 and two phases in experimental variant 2.

Phase I: ***Starter*** from day 1 to day 14 in V_1, and from day 1 to day 21 in V_2 ($CM_{starter}$ with 2960 kcal ME and 22.04% CP);

Phase II: ***Rearing*** from day 15 to day 49 in V_1 ($CM_{rearing}$ with 2990 kcal ME and 20.03% CP), in V_2 this intermediary phase is missing;

Phase III: ***Finishing*** from day 50 to day 70 in V_1, ($CM_{finishing}$ with 3000 kcal ME and 17.30% CP) was administered. In V_2, the **rearing-finishing** phase continued 49 days, from 22 days to 70 days while broilers fed $CM_{finishing}$ feed.

The experimental design intended to assess the effect of a good nutritional start in both experimental variants, but with a different time.

Regarding the structures of concentrate mixtures, there were the following assessments:

- in the general conduct of this experiment, it can be noticed that the energy and protein level of the used feed concentrate mixtures show the use of an intensity of rearing broilers without establishing feed force;

- in the starter phase, it is provided a 3000 kcal ME/kg and 22% CP using 35% corn, 10% wheat, 25% soybean meal, and 5% sunflower oil;
- during the rearing phase, there was used only one concentrate mixture structure, respectively $CM_{rearing}$ which provided 2990 kcal ME/kg and 20.03% CP

that can contribute to the continuity of intensity of rearing during the start phase, following the economic efficiency of such CM;
- during the finishing phase, we wanted to use reduction of protein compounds in the concentrate mixtures and increase metabolizable energy by adding high amounts of corn in CM structure.

Statistical processing of the results was performed by using SPSS 19 IBM program. Bio productive indices were set when the CM structures changed, respectively at the age of 2, 3, 7 weeks, and at the end of experiment (at the age of 10 weeks).

RESULTS AND DISCUSSION

The data regarding body weight (*Table 1*) registered during the growing phase of broilers in V_1 show that it significantly increased, from about 38 g at the age of 1 day to 1428.60 g, and the broilers in V_2 show a body weight increase from about 33 g to 1312.2 g during the 10 experimental weeks.

Table 1. Body weight of chickens belonging to different experimental groups

Item	Age (weeks)	Experimental variants		Difference		Student test
		V_1	V_2	absolute	relative %	
Body weight (g)	2	282.70±7.44	277.70±7.31	5.00	1.77	0.524is
	3	438.40±11.40	444.75±11.6	-6.35	1.45	0.260is
	7	1053.30±26.60	959.50±22.00	93.80	8.91	0.011*
	10	1428.60±38.40	1313.20±36.80	115.40	8.08	0.030*

The data in *Table 1* show that the body weight registered close values in both experimental variants in the first two rearing weeks. During that time the differences between V_1 and V_2 being very small. It was 2.95 g in the first week and 2.05 g in the second week, because CM was administered with the same nutritional features.

In the third week, it is noticed a slight difference between the average body mass of the broilers in the two experimental variants. It was about 1.45% in favour of the experimental variants 2, a group fed with $CM_{starter}$ structure.

Broilers in variant V_1 tri-phase fed began to significantly differ from broilers in V_2 from the fifth experimental week, and that difference maintained until the end of the rearing phase ($p<0.05$).

The result of statistical analyses of body weight differences registered between the two experimental variants during the rearing period are graphically represented in *Figure 1.*

It can be concluded from the analysis of the data on the evolution of body weight recorded during the 10 weeks of growth that the structure and features of concentrates mixtures administered to broilers during that period influenced their evolution. Thus resulted in a significantly higher growth of broilers in the variant fed with three CM structures (V_1) compared with chickens fed with two CM structures (V_2) even if the start period was a week longer.

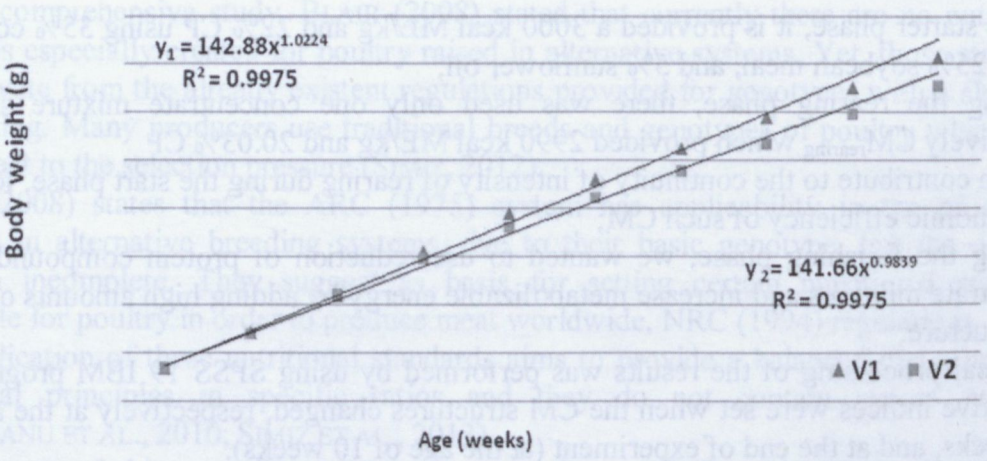

Figure 1. Evolution of body weight of broilers in the two experimental variant

Table 2. Concentrated mixtures intake, feed conversion factor and ME and CP intake in broilers belonging to all experimental variants

Item	Age (weeks)	Experimental variants		Differences	
		V_1	V_2	absolute	relative %
Intake CM (g/head)	2	511.00	516.00	-5.00	0.98
	3	833.00	846.00	-13.00	1.56
	7	2345.00	2296.00	49.00	2.09
	10	3696.00	3586.00	110.00	2.97
FCR (kg CM/kg weight gain)	2	2.09	2.15	-0.06	3.08
	3	2.08	2.08	0.00	0.00
	7	2.31	2.49	-0.18	7.88
	10	2.66	2.81	-0.15	5.80
Intake ME (kcal)	2	118.40	119.25	-0.85	0.71
	3	137.54	141.43	-3.89	2.83
	7	176.41	173.57	2.84	1.61
	10	204.00	195.00	9.00	4.41
Intake CP (g)	2	8.82	8.88	-0.06	0.68
	3	9.21	9.44	-0.23	2.50
	7	11.82	11.59	0.23	1.94
	10	13.12	12.55	0.57	4.34

From the analysis of the data presented in *Table 2*, it can be observed that the intake of concentrates mixture was close in both experimental variants, so at the end of the analyzed period, V_1 recorded a total of 3696 g of CM consumption, about 3% more than in V_2, which recorded a total consumption of 3586 g of CM.

Regarding this indicator, one can say that the administration periods and the nutritional characteristics of concentrate mixtures used did not significantly affect feed intake in broilers belonging to the two groups of the experiment.

According to these data, it is clear that the barred Plymouth Rock avian youth performed feed conversion ratios between 2.66 and 2.81 which are suitable for this rearing system. A percentage difference of 5.80% between V_1 and V_2 may recommend keeping the CM nutritional levels tested in the experiment, which allows maintaining the productive performance of this breed.

Regarding the metabolizable energy intake of broilers in the two experimental variants, according to the data in *Table 2* we can see that the differences between V_1 and V_2 are only

4.41%. Regarding the crude protein intake, the differences between the two versions are 4.34%.

Both in ME and in CP intake the differences identified during the 10 weeks are statistically insignificant ($p > 0.05$).

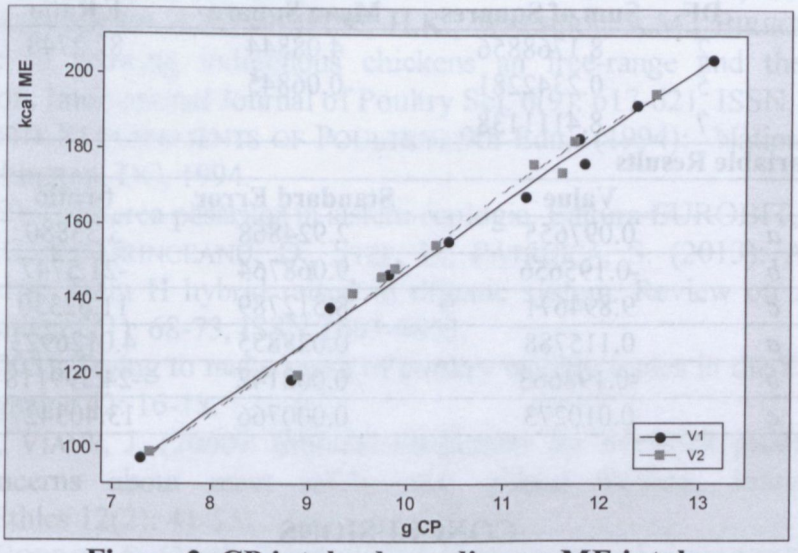

Figure 2. CP intake depending on ME intake

The graphical representation of the consumption of crude protein depending of the metabolizable energy intake shows that the recorded values were very close in both experimental variants (*Figure 2.)*.

The analyses of feeding cost established throughout the growth by acquisition price of CM feed and growth phases (*Table 3*).

As expected, according to the information in *Table 3* the highest feed costs are the broilers of V_1 with 1.53 euro / head, but in the case of relative costs per kg live weight, it can be observed that the broilers of V_1 such costs are only 1.87% higher than V_2 which allows the recommendation of a tri-phase feeding with nutritional values of CM and economy aspects as well.

Table 3. Fodder feeding costs of broilers in the experimental variants

Item	Experimental variants		Differences	
	V_1	V_2	absolute	relative %
Feeding cost/head (EUR)	1.53	1.37	0.16	10.45
Feeding cost/kg body weight (EUR)	1.07	1.05	0.02	1.87

Starting from the idea that the higher costs used for poultry rearing are registered for fodder feeding, using Data fit, an informational software, it was obtained a mathematic pattern that can predict the fodder feeding costs depending on CP intake.

The pattern: $y = a/(1+bx+cx^2)$ is shown in *Table 4*.

The correlation coefficients between the expenses incurred by fodder feeding (y) and crude protein intake (x) on *Table 4* show that there exists a strong positive correlation, as follows: 0.958 (in V_1) and 0.980 (in V_2).

This mathematical equation can assess the fodder feeding costs for Plymouth Rock chickens reared in free range system under similar conditions in which this experiment is conducted, based on the determination of crude protein intake.

Table 4. The assessment of fodder feeding costs depending on CP (g) intake

Model Definition: $y = a/(1+bx+cx^2)$,
where: y=CF, x=intake CP(g)

Variance Analysis					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**	**Probe (F)**
Regression	2	8.1768856	4.08844	87.2748	**0.0001**
Error	5	0.2342281	0.06845		
Total	7	8.4111138			

Regression Variable Results					
Variable		**Value**	**Standard Error**	**t-ratio**	**Probe (t)**
V_1	*a*	0.097655	2.924868	3.33880	**0.020**
$R^2=0.972$	*b*	-0.195656	9.068764	-21.5747	**0.000**
$r=0.958$	*c*	9.894671	8.512789	11.62330	**0.000**
V_2	*a*	0.115788	0.028855	4.0126923	**0.010**
$R^2=0.976$	*b*	-0.198663	0.008142	-24.399118	**0.000**
$r=0.980$	*c*	0.010273	0.000766	13.403427	**0.000**

CONCLUSIONS

In family farms of broiler rearing, including of the broilers belonging to mixed breeds (Plymouth Rock), there is an intention to simplify the feeding technology by reducing the number of structures of concentrates mixtures adapted to different rearing phases of avian youth. From this point of view, it has been analyzed the production and economic indicators performed in two experimental variants where the broilers were fed in tri-phase and bi-phase feeding system and with the nutritional AC features provided in the organization of the experiment.

Experimental data obtained allowed the following conclusions:

-broilers in V_1 tri-phase fed with CM $_{starter}$, CM $_{rearing}$ and CM $_{finishing}$ obtain during the experimental period a feed intake comparable with that of the broilers in V_2, an average body mass of 1428.60 g with a total increment higher with 8.3% and a better feed conversion (2.66 kg/kg) due to higher costs per kg body weight of livestock by 1.87% comparing with V_2;

-broilers in V_2 CM starter fed and CM rearing-finishing fed compared with V_1 registered an insignificant less feed intake (3586 g CM/broiler) a significantly less ($p<0.05$) average body mass of 1313.20 g and a weaker feed conversion of 2.81kg/kg (-5.6%), but by 1.87% smaller feeding costs per kg livestock than V_1.

- correlation coefficients between the costs registered with fodder feeding (y) and crude protein intake (x) show that there is a strongly positive correlation between them, thus: 0.958 (in V_1) and 0.980 (in V_2).

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