The Influence of Nutritional Characteristics of Feed Administered on the Bioproductive Performance of Broilers Raised in Free-Range System

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Abstract

The coming out of the efficient meat chicken hybrid on the Romanian market and feeder products like the combined feed (CF), the PVM concentrates and the vitamin-mineral premix, make the free-range bird breeders choose a technique intake that provide an avian production (meat, eggs) under profitability conditions. During the proposed research, we followed the economic-productive reaction of meat chickens Ross Hybrid 308, fed with CF, which met the nutritional characteristics specific to intensive system at an experimental variant, and at the other variant they were CF fed with nutritional levels adapted to a slower growth system. Bioproductive indices obtained by meat chickens from the two experimental variants were economically analyzed in order to set the profitability of the two feeding methods. The adaptation of the feeding system of meat chickens to household raising in the family farms using combined feed (with diminished protein levels) proper for a slower growth, determine average body weights of about 4.9% smaller compared to the intensive variant, a CF intake and a feed conversion comparable, but with foraging costs reduced by 12.23% to obtain 1 kg live-weight. This recommends the use of CF whose nutritional characteristics (in certain phases, with protein levels lower up to 2.30 p%) are adapted to a lower growth.

Keywords: protein level, nutrition, broilers, free-range system.

1. Introduction

Nowadays, under the conditions of a globally genuine demographical boom, satisfying the requirement of a rational nutrition needs important and thorough engineering knowledge on agro-biological sciences, to supply the best animal goods and services [1-4].

It has been long time since the provision of the main necessary resources of producing food for human consumption was made randomly and without using the most appropriate bio-engineering and agriculture management means.

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Even the common peasant who raises poultry and pigs knows that by using a quality feed he will be able to raise an animal in a shorter time rather than " throwing them grains…".

The profitability of broiler production, expressed in the simplest way, is the value of the final production minus the production costs. The main component of production costs is the fodder, representing up to 70% of the production costs. Due to the importance of fodder in the broiler meat production, the optimization of fodder recipes is essential both economically and regarding the biological performance [5].

When we deal with an increase of the costs of feed ingredients that causes the increase of fodder price, the first instinct is to find a solution that could stop the financial impact on the finished product, which usually limits to diminishing the levels of nutritional parameters recommended in fodder in order to determine the fodder cost. Before taking a decision, it is important to make an assessment [6].

Feeding is a determinant factor in increasing the animal production. The promotion of modern technologies in animal breeding and exploitation has imposed the need to review the feeding methods. The production of combined feed is a complex activity, based on the acknowledgement of basic food requirements, on the nutritional value of feedstock received, as well as on their form of administration. Beside all these, are added the spices like in any other meal, which are nothing else but nutritional supplements that help us finish a combined feed [7, 8].

Combined feed production is a dynamic activity, which requires a continuous informational flow, appropriate calculation means, able to rapidly process the information.

A modern zootechnics is unconceivable without the use of combined fodders, due to multiple benefits coming from their use [9, 10].

The occurrence on the Romanian market of performing meat chicken hybrids and of fodder products like combined fodders, PVM concentrates, and vitamin and mineral premixes also determine the poultry breeders within the household system to use a technical feeding that ensures an avian production (meat, eggs) under productivity conditions.

A major concern for the modern poultry industry is to reduce feed cost for optimal economic return because feed represents the main component of total production cost, and CP is one of the major cost components of poultry diets [11-13].

The proposed research has been performed in the household farm where it was followed the economical-productive answer of the meat chickens - Ross 308 hybrid -, fed with combined feed, which in an experimental variant met the nutritional characteristics specific to intensive system, and in the other variant were CF fed with nutritional levels adapted to a slower growing system. The bioproductive indicators obtained by the meat chickens within both experimental variants were economically analyzed to set the profitability of the two methods of feeding the meat chickens in a household farm.

2. Materials and methods

The experiment of assessing the productive and economical effect of the combined feed with the nutritional characteristics related to the intensive system, and of the combined feed adapted to a slower growing, has been performed on meat chickens – Ross 308 hybrid, on a period of 8 weeks (1-56 days) in household system at the farm, on a group of 60 Ross 308 hybrid chickens, divided into two experimental variants, as follows:

-V_1 –made of 30 chickens ***triphase*** fed with notified combined feed: CF starter, CF growing and CF finishing, with the nutritional characteristics at the intensive feeding level that are shown in table 1.;

-V_2 –made of 30 chickens ***triphase*** fed with CF starter, CF growing and CF finishing, with the nutritional characteristics adapted to the household system, and which are also shown in table 1.;

Regarding the administration of combined feed, there are three phases of administration of CF in both experimental variants (table 1.), thus:

Phase I: ***Starter*** from 1 day to 21 days;

Phase II: ***Growing*** between 22 and 42 days;

Phase III: ***Finishing*** from 43 to 56 days.

At the end of the experimental period, there were slaughtered 6 chickens in each group (3 pullets and 3 cockerels), their weight representing about the average weight of chickens in each variant.

Based on the results, there was set the capacity of carcass at slaughtering, and the commercial capacity, for the calculation of which it was taken into account the carcass weight and the weight of the comestible internal organs.

The carcasses, resulted after the slaughtering of the studied chickens, were processed according to the recommendations made by Văcaru Opriş [14]. Thus, the goiter, the head, and the feet were eliminated from the eviscerated organs (from the tibio-tarso-metatarsal joint), and the gizzard (cleaned), the liver (without gallbladder), and the heart (cleaned from coagulum) were inserted into the carcasses where they came from, after being packed in plastic foil.

Carcass carving was performed at the following component parts: breast, legs and wings.

The structure of CF used in the feed of chickens in the experiment is shown in table 1.

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Table 1. Ingredient and nutritional characteristics of the experimental diets for chicken

Item	*CF starter*		*CF grower*		*CF finisher*	
	CF_1	CF_2	CF_3	CF_4	CF_5	CF_6
Maize	46.8	50.8	50.80	55.8	56.80	58.80
Wheat	15	15	15	15	15	15
Soybean meal	27	25	25	22	20	18
Sunflower meal	3	3	3	4	5	5
Fishmeal	5	3	3	-	-	-
$CaCO_3$	1	1	1	1	1	1
Mono sodium phosphate	1	1	1	1	1	1
Sodium chloride	0.2	0.2	0.2	0.2	0.2	0.2
Trace mineral premix	1	1	1	1	1	1
Nutritional characteristics						
ME (kcal/kg)	3100	3150	3150	3200	3250	3250
CP (%)	22.63	20.50	20.50	18.20	17.80	17.10

- *Requirements in vitamins and minerals are provided according to NRC 1994 requests, by using a premix according to regulations in force.*
- *ME –metabolized energy; CP-crude protein.*

Fodder recipes created for chickens in the V_1 provide nutritional levels that correspond to the intensive growing system, meaning 3100 kcal ME/kg CF and 22.63% CP in CF-starter; 3150 kcal ME/kg CF and 20.50% CP at CF-growing, and 3250 kcal ME/kg CF with 17.80% CP at CF finishing. The structures of fodder recipes intended for chickens in V_2 were adapted to a slower growing by reducing the protein level by 2.13 p% at 20.50% CP at CF starter, by 2.30 p% at 18.20 % CP at CF growing, and by 0.70 p% CF to 17.10% CP at CF finishing, the metabolized energy maintaining the comparable levels between the two experimental variants.

3. Results and discussion

Body weight evolution

Using three structures of combined feed specific to the growing phases in the feed of meat chickens in V_1, but with nutritional characteristics at the level of intensive system, i.e. 22.63% CP; 20.50% CP and 17.80% CP and 3100; 3150 and 3250 kcal ME/kg CF, has determined a weight gain from an average of 156.00 g/chicken at the age of 7 days up to 3229.10 g/chicken at delivery, at the age of 56 days. The intensity of the nutritional level of these chickens achieved a body weight mean of the chickens in V_1, at the end of the experiment, in this household system, of about 15% lower than those prescribed in the technological growing books for Ross 308 hybrid.

The same Ross 308 hybrid, fed with combined fodders, with lower protein levels, and thus adapted to a slower growing, respectively in V_2, at the age of 56 days, made the body weight mean of 3070.10 g/chicken be of about 5% lower than the mean set for chickens in V_1.

Combined feed intake, crude protein and metabolized energy in meat chickens within the experiment

Total CF intake for chickens in V_1 during the experiment was of 6950 g/chicken, a consumption of 3% higher compared to the mean of CF intake, of 6750 g/chicken as set for chickens in V_2 where the feed had a comparable energetic density, but the protein level was more reduced up to 2.30 p% CP.

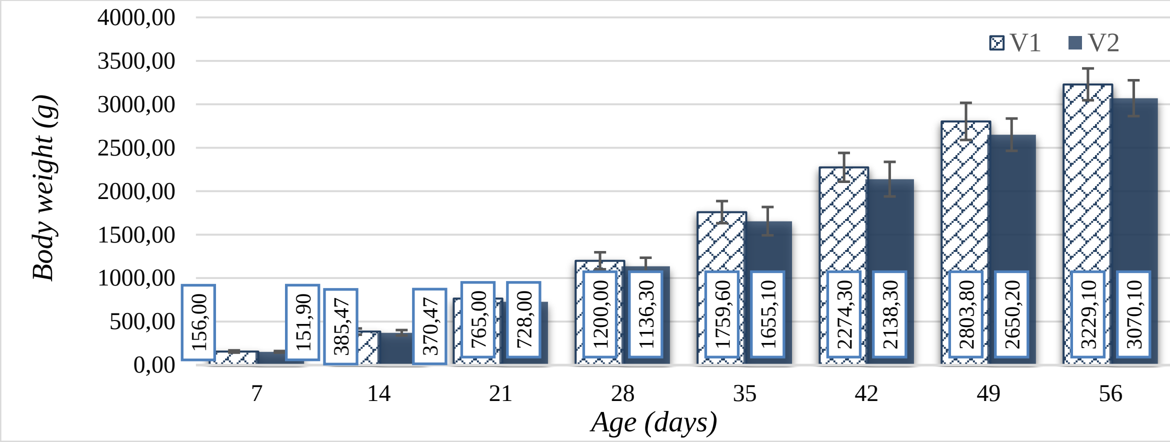

Figure 1. Body weight (BW) evolution at experimental variants

Figure 2 is a graphical representation of the evolution of combined feed consumption in both experimental variants. This shows that a small consumption difference is recorded between the two analyzed variants. Regarding this indicator, one can appreciate that the administration periods and the nutritional characteristics of combined feed used did not significantly influence the feed intake in chickens in the two groups of the experiment.

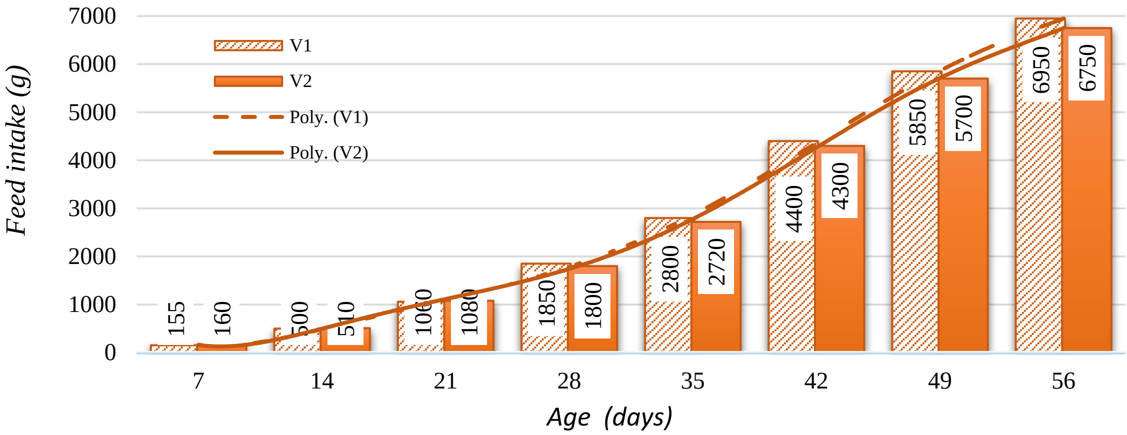

Figure 2. The influence on nutritional characteristics on feed administered on feed intake

The protein levels, more reduced in the combined feed, fed to chickens in V_2, and a feed intake comparable at the two experimental variants determined that the chickens in the group of study (V_2) had a crude protein of 1225.39 g/chicken, by 12.49% lower than those recorded in chickens within V_1 which was of 1378.48 g/chicken.

Under the conditions of administering combined fodders with energy levels expressed in comparable kcal ME to chickens in the two experimental variants, also expecting a feed intake insignificantly differentiated, the total metabolized energy consumptions of 22094 kcal/chicken in V_1, and of 21668.50 kcal ME/chickens in V_2, and at a percentage difference of only 1.97%.

Food conversion ratio _FCR

Following the table values regarding the food conversion in chickens in the two experimental variants, we can observe that FCR from V_1 of 2.18 and of 2.23 in V_2, during the entire research period (1-56 days) shows values that indicate the practice of a technical nutrition in this familial farm.

Table 2. Feed conversion ratio in chickens within the experiment

Period	*FCR*		*Difference (%)*
	V_1	*V_2*	
1-21	1.46	1.57	7.00
1-28	1.60	1.64	2.50
1-42	1.97	2.05	4.06
1-56	2.18	2.23	2.29

Depending on the intensity of feeding with combined fodders, which correspond to the intensive system to which have been administered fodders adapted to a slower growing rate, in both V_1 and V_2, the value differences of the feed conversion indicators are very close between the two experimental variants (the percentage difference is of 2.29%), which allows to assume that the economic factor can be decisive in taking a decision regarding the nutritional characteristics of the combined feed that are to be used in the nutrition of meat chickens raised in household family farms.

The analysis of feeding costs

Analysis of feeding costs was set for the entire growing period according to the feed purchase price and to the CF structure on growing phases.

The experimental variant (V_1) registered the highest feeding costs, given the high weight of vegetal protein feed (soybean meal and sunflower meal) and of animal protein feed (fishmeal) in the structure of combined feed.

The economic analysis of the costs made with the fodder feeding for the chickens of both experimental variants reveals an intensive feeding applied in the household system in chickens within V_1, the costs for the achievement of 1 kg livestock are of 0.847 euro, i.e. 12.23% higher compared to the other variant (V_2) where the combined feed have been formulated for a slower growing, and where the costs with the feed to accomplish 1 kg of livestock were of 0.7555 euro.

Carcass quality rates

At the end of the experimental period, according to the submitted protocol from the chapter „Material and methods” there have been performed measurements of the performance of chickens at slaughtering, there has been set the weight of certain anatomical parts (breast with skin and bone, legs and wings) of the carcasses weight.

The results regarding the performance at slaughtering, submitted in the two forms: carcass yield and commercial yield (which also includes the weight of eatable organs), are shown in table 3.

Table 3. Carcass yield and commercial yield in meat ROSS 308 chickens

Item	**V_1**	**V_2**
	X±Sx	X±Sx
Body weight (g)	2317.63±101	2217.05±96.2
Carcass weight (g)	1694.19±78.55	1598.49±58.33
Carcass yield (%)	**73.10±0.834**	**72.10±0.955**
Percentage differences	100	98,63
Commercial yield (%)	**78.20±0.85**	**77.06±0.97**
Percentage differences	100	98.54

Carcass yield, which represents carcass weight out of live weight is between 72.10 % (V_2) and 73.10% (V_1), thus it is noticed a small increase of commercial performance (1.37%) in the reference experimental variant, which a registered the best bioproductive performances.

The same situation is shown in the case of commercial yield, which, except the weight of the carcass, includes the weight of the eatable internal organs (heart, gizzard, liver) reported at live weight. The commercial yield was about of 78.20% in V_1, and of 77.06% in V_2.

It is notice that the experimental variant, which was fed with combined feed proper for the intensive growing system also registers a performance at slaughtering, meaning a commercial yield higher than the experimental variant V_2, which benefited of CF structures proper for a slower growing rate, but the

differences registered, regarding the carcass yield, are also statistically insignificant (p>0.05).
After the carcass carving into component parts (breast with skin and bone, legs and wings) there were obtained the results synthetically shown in table 4.

Table 4. The weight of the main carved pieces in Ross 308 chickens

Item		V_1 X±Sx	V_2 X±Sx
Breast with bone and skin	(g)	408.30±34.30[A]	378.05±25.10[A]
	% of carcass	24.10±1.08[a]	23.65±0.956[a]
	Percentage differences	**100**	**98.13**
Legs	(g)	549.76±33.69[A]	510.88±26.40[A]
	% of carcass	32.45±0.455[a]	31.96±0.559[a]
	Percentage differences	**102.76**	**98.51**
Wings	(g)	204.99±9.60[A]	195.82±8.42[A]
	% of carcass	12.10±0.111[a]	12.25±0.189[a]
	Percentage differences	**100**	**98.77**

[a-a; A-A] p>0.05.

The data shown in table 4 reveal that both the weight of the breast with bone and skin, and of the legs and wings is higher in the variant where the chickens that received the combined feed in the intensive feeding system (V_1) thus: 408.30 g – breast with bone and skin; 547.76 g – legs and 204.99 g – wings. The variant where the chickens were fed with combined feed adapted to a slower growing (V_2) registered smaller weights of the analyzed carved piece, the registered pieces are not statistically significant (p>0.05).
Regarding the weight of the breast with bone and skin, and of the legs coming from the weight of carcass, there are small differences of about 1.5%, statistically insignificant (p>0.05), in favor of variant V_1, the weight of wings was of 1.23% higher than in variant V_2 compared to V_1 (p>0.05).
We can assess that both the weights of the carved pieces and their weight show insignificant differences between variants V_1 and V_2, which reconfirms the possibility of applying a feeding adapted to a slower growing rate in the case of Ross 308 chickens raised in household system, under economic conditions.

4. Conclusions

Considering the economic pressure for raising the meat chickens (Ross 308 hybrid,) on a family farm with a household system, it is recommended to use the combined feed (with protein levels reduced in certain phases with up to 2.30p%) that are adapted to a slower growing rate, as they can reduce the fodder feeding costs with up to 12.23% to obtain1 kg of livestock.

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