THE INFLUENCE OF FEED PROTEIN AND ENERGY LEVEL ON THE GROWTH AND SLAUGHTER PERFORMANCES AT „HUBBARD F15" BROILER CHICKENS

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Abstract

In this paper was studied the influence of feed energy-protein level on the growth performance (average daily gain, feed conversion), slaughtering efficiency and participation of the cutting parts in the whole carcasses structure at „HUBBARD F15" hybrid slaughtered at 42 days old. The two groups (control group-Lc and experimental group-Lexp) were given feed mixed with different level of energy and protein (Lc-standard hybrid, Lexp-higher by 10% compared to standard hybrid). In the growth period for each group were made weighings at: 1, 7, 14, 21, 28, 35 and 42 days. After slaughter, at 30 carcasses from each group (15 females and 15 males) was determined the slaughtering efficiency and participation of the cutting parts in the whole carcass structure. For analysis of variance were used Anova and Mann Whitney tests. At the end of the growing period, at Lexp group average body weight was with 6.50% higher compared to Lc group, but the situation is reversed for the feed conversion index. Slaughtering efficiency had higher values at Lexp compared to Lc, registering a decrease from 1.70% up to 1.92% after 24 hours of refrigeration. For participation of the cutting parts in the whole carcass structure at Lexp group were registered the highest values for breast and thighs and at the Lc group for the wings, shanks and other parts (head, neck, back and legs). At the Lexp group the feed with higher protein-energy level had positive influence on the growth and slaughter performances.

Key words: average daily gain, feed conversion index, hybrid, slaughtering

INTRODUCTION

In the context of economic globalization, after the EU membership and the emergence of competitive market, getting chicken meat with a high quality, commercial aspect of the carcasses and providing a competitive price are the essential conditions for development of poultry production in Romania.

Every company producing broiler chicken has elaborated a broiler management guide specifically for each hybrid stating all the necessary technological elements for genetic potential exteriorization in condition of obtaining high economic efficiency [2, 13, 14].

Poultry meat production is under the influence of genetic and technological factors (growing technology, microclimate, nutrition, prevention, ensuring the health and welfare, etc.) [1, 11, 14]. Among technological factors that influencing the growth performance and meat production, broiler nutrition play an very important role [9, 10, 13].

Broilers chickens have specific nutritional requirements to achieve proposed performance criteria and for maximum exteriorization of the productive potential. The feed rations for broilers must be balanced, so as to ensure a proper balance between energy/protein correlated with the stages of development of offspring [2, 9, 12, 13, 14].

Rations with protein deficient, even are not clearly reflected on growth performance, have impacting negatively on the carcass meat percentage [4, 6, 7, 9].

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The manuscript was received: 05.04.2012
Accepted for publication: 12.05.2012

A diet rich in protein quality improves carcass parameters and meat quality (slaughter yield and chemical composition) in „Hubbard F15" hybrid [1, 6, 10, 9].

In this paper was studied the influence of feed energy-protein level on the growth performance (average daily gain, feed conversion index), the slaughtering efficiency and participation of the cutting parts in the whole carcass structure, at the hybrid „Hubbard F15" sacrificed at 42 days old.

MATERIAL AND METHODS

Our research was conducted on broiler chicken belonging to „Hubbard F15" hybrids, sacrificed at the age of 42 days. For this study, comprising two groups of chicks (males and females): control group (Lc) and experimental group (Lexp), reared in the same microclimate. In the growth period (1-42 days) for microclimate factors of the house (air temperature and air relative humidity), the values have been according to the manual „Hubbard F15" hybrid [2]. The growth system was on the permanent litter and a density of 12 chicks/m^2. At the two groups of chickens were given feed mixed with protein and energy levels differently as follows: Lc-protein and energy level as recommended company Hubbard for the „Hubbard F15" hybrid [2], Lexp-protein and energy level higher by 10% compared to standard hybrid. Depending on the age of chicks during growth (1-42 days) for each group were given three fodder recipes (starter, growing, finishing) (table 1) [2, 13, 14].

Table 1 Features of the mixed feed recipes

Recipe features	Lc	Lexp
Starter 1-14 days		
Crude protein (%)	23.80	26.18
M. E. (kcal/kg feed)	3036	3281
Energy/protein ratio	127.56	125.32
Grower 15-35 days		
Crude protein (%)	21.86	24.03
M. E. (kcal/kg feed)	3142	3439
Energy/protein ratio	143.73	143.11
Finisher 36-42 days		
Crude protein (%)	20.18	22.27
M. E. (kcal/kg feed)	3196	3483
Energy/protein ratio	158.37	156.47

In the growth period for each group were made individual weighing at: 1, 7, 14, 21, 28, 35 and 42 days, to establish the body mass dynamics, the growth gain for each technological period or total period (1-42 days) and the average daily gain.

The feed intake was determined weekly for each group. Data obtained were used to establish: the feed intake during each period, average individual intake/each feed recipe, daily intake (g/day/chicken) and feed conversion index (kg feed/kg weight gain).

At the end of the growing period (42-days), chickens were slaughtered, from each group were sampled 30 carcasses (15 females and 15 males), which were weighed before and after refrigeration (24 hours at +4°C) and was determined the slaughter efficiency for fresh and refrigerated carcasses. Slaughter efficiency is expressed as ratio between fresh or refrigerated carcass weight and live weight. For calculated the slaughter efficiency were used gutted carcasses, with head, neck and legs.

After cutting carcasses, by gravimetric measurements was determined weight of the cutting parts from carcass and was calculated participation of these portions in whole carcass structure. The cutting parts from the carcass are: breast with bone and skin, thighs, shanks, wings and the remnants: head, neck, back and legs.

Raw data obtained from measurements were processing, using methods of biostatistics with Microsoft Excel spreadsheet application. To test the statistical significance of differences between mean values of the characters studied has been applied analysis of variance using Anova and Mann Whitney test of the program MINITAB 14 [3].

RESULTS AND DISCUSSIONS

The values for body mass dynamics at control group (Lc) and experimental group (Lexp) are shown in table 2. Following gravimetric measurements performed it was observed that the values for body weight at 42 days have been between 2233.09±15.08 g (Lc) and 2378.22±14.05 g (Lexp). The coefficient of variation showed a good uniformity of the flock studied (V=6.79 to

12.48%), and presence of highly significant statistical differences (p≤0.001).

Table 2 The body mass dynamics

Specification	Lc (n=300)	Lexp. (n=300)	Lexp. vs. Lc (±%)
Weight at one day $\bar{X} \pm s_{\bar{X}}$ (g)	40.87 ±0.07	40.91 ±0.07	+0.09
V %	2.84	2.77	
Weigh at 14 days	[d]350.32	[a]411.65	
$\bar{X} \pm s_{\bar{X}}$ (g)	±3.67	±2.39	+17.51
V %	17.97	9.97	
Weigh at 35 days	[d]1726.16	[a]1815.59	
$\bar{X} \pm s_{\bar{X}}$ (g)	±11.26	±13.68	+5.18
V %	11.20	12.97	
Weigh at 42 days	[d]2233.09	[a]2378.22	
$\bar{X} \pm s_{\bar{X}}$ (g)	±15.08	±14.05	+6.50
V %	11.60	10.17	

„Anova"-test: [ad]high significant differences p≤0.001

At the Lexp group the feed with higher protein-energy level had positive influence on the growth weight. Thus, at the end of growth (42 days) the average body weight for Lexp group was higher with 6.50% compared with the Lc group

In the table 3 presents the body weight dynamics at studied chickens compared with the standard values for „Hubbard F15" hybrid [2].

Comparing the medium values of the weights of chickens broiler studied with the standard weights specified in the Management manual for the „Hubbard F15" hybrid [2], we can notice the fact that have been obtained lower weights with 3.91% at Lexp. group and 9.77% at control group.

Table 3 The body mass dynamics of studied chickens as compared with standard values

Weight at:	Standard	Lc	Lexp.
one day (g)	40.00	40.87	40.91
Differences (±%)		+2.17	+2.27
14 days (g)	429.00	350.32	411.65
Differences (±%)		-18.34	-4.04
35 days (g)	1894.00	1726.16	1815.59
Differences (±%)		-8.86	-4.14
42 days (g)	2475.00	2233.09	2378.22
Differences (±%)		-9.77	-3.91

Besides this, for each period of growth in part were calculated the individual growth average gain recorded and the daily average gain (table 4).

The results showed a linear ascendant trend, from 22.10 g/chicks/day (Lc) and 26.48 g/chicks/day (Lexp) for starter period, at 65.50 g/chicks/day (Lc) and 66.85 g/chicks/day (Lexp) during growing period, respectively up to 72.42 g/chicks/day (Lc) and 80.38 g/chicks/day (Lexp) in finishing period.

For total growth period (1-42 days), the daily average gain was between 52.19 g/chicks/day at Lc and 55.65 g/chicks/day at Lexp.

At Lexp were obtained higher values, with 19.81% in starter period, 2.05% in growing period, 10.99% in finishing period and with 6.62% for total growth period (1-42 days), as compared with Lc.

Table 4 Total growth gain and average daily gain for each technological period

Growth period		*Lc*		*Lexp*		*Lexp.vs. Lc (±%)*
		$\bar{X} \pm s_{\bar{X}}$	V %	$\bar{X} \pm s_{\bar{X}}$	V %	
1-14 days	(g/chicks/period)	[d]309.39±3.61	20.04	[a]370.70±2.33	10.82	+19.81
	(g/chicks/day)	[d]22.10±0.26	20.04	[a]26.48±0.17	10.82	+19.81
15-35 days	(g/chicks/period)	[b]1375.71±7.91	9.88	[a]1403.94±11.66	11.66	+2.05
	(g/chicks/day)	[b]65.50±0.38	9.88	[a]66.85±0.56	14.29	+2.05
36-42 days	(g/chicks/period)	[d]506.94±4.99	16.80	[a]562.63±2.70	8.26	+10.99
	(g/chicks/day)	[d]72.42±0.71	16.89	[a]80.38±0.39	8.26	+10.99
1-42 days	(g/chicks/period)	[d]2192.15±15.02	11.77	[a]2337.27±13.99	10.30	+6.62
	(g/chicks/day)	[d]52.19±0.36	11.77	[a]55.65±0.33	10.30	+6.62

„Anova"-test: [ab] significant differences p≤0.05; [ad] high significant differences p≤0.001

In the table 5, was compared daily average gain obtained for study chickens with standard values for „Hubbard F15" hybrid. Thus, compared to standard values, it was noted that obtained values for daily average gain were lower by 3.26% up to 4.35% at Lexp group, and 6.50% up to 24.39% at Lc group [2].

Table 5 Average daily gain obtained for studied chickens compared with standard values

Growth period	Lc	Standard values	Difference to standard (±%)	Lexp	Standard values	Difference to standard (±%)
1-14 days (g/chicks/day)	22.10	27.49	-24.39	26.48	27.49	-3.81
15-35 days (g/chicks/day)	65.50	69.76	-6.50	66.85	69.76	-4.35
36-42 days (g/chicks/day)	72.42	83.00	-14.61	80.38	83.00	-3.26
1-42 days (g/chicks/day)	52.19	57.98	-11.09	55.65	57.98	-4.19

Feed consumption has been determined for each growth period, thus, using those data was calculated the average individual intake and feed conversion index (table 6).

Table 6 Data referring at feed consumption

Growth period	Specification	Lc	Lexp.	Lexp.vs. Lc (±%)
1-14 days	Average individual intake/period (kg)	0.415	0.453	
	Average weight gain/chicken (g)	309.39	370.70	
	Feed conversion index (kg. feed/kg gain)	1.342	1.223	-8,87
15-35 days	Average individual intake/period (kg)	2.410	2.323	
	Average weight gain/chicken (g)	1375.71	1403.94	
	Feed conversion index (kg. feed/kg gain)	1.752	1.655	-5,54
36-42 days	Average individual intake/period (kg)	1.115	1.163	
	Average weight gain/chicken (g)	506.94	562.63	
	Feed conversion index (kg. feed/kg gain)	2.208	2.067	-6,00
1-42 days	Average individual intake/period (kg)	3.930	3.941	
	Average weight gain/chicken (g)	2192.15	2337.27	
	Feed conversion index (kg. feed/kg gain)	1.794	1.686	-6,02

The data presented in table 6 show that food consumption was more lower in starter period (415g at Lc and 453g at Lexp) and higher in growing period (2410g at Lc and 2323g at Lexp). The overall growth period (1-42 days) was characterised by an average individual consumption of 3930 g at Lc and of 3941 g at Lexp, at live weight 2233.09g, for Lc respectively 2378.22g at Lexp.

Values obtained in this experiment were under limit of 4190g specified by the firm Hubbard for studied hybrid in period 1-42 days and a live weight of 2475g [2].

With the data on individual feed consumption and individual weight gain, was calculated the feed conversion index for each technological period (starter, growing and finisher) and for total growth period of 42 days (table 6).

The result presented in table 6 has showed a linear ascendant trend for this indicator. The best performances were obtained for Lexp group, which have registered values from 1.223 kg feed/kg gain in starter period up to 2.067 kg feed/kg gain in finisher period, compared with Lc group for which the values were higher (from 1.342 up to 2.208 kg feed/kg gain).

For growing period 1-42 days, feed conversion index calculated was of 1.686 kg feed/kg gain at Lexp and 1.794 kg feed/kg gain at Lc. Thus, as compared with standard values for „Hubbard F15" hybrid (1.721 kg feed/kg gain) [2], values obtained were lower for Lexp (with -4.07%) or slightly higher at Lc (+2.08%).

After slaughter, the carcasses obtained were chilled 24 hours at temperature +4°C. Following gravimetric measurements was observed that the values for hot carcass weight (after slaughter) have been from 1638.90 g (females-Lc) to 1895.94 g (males-Lexp) (table 7). The coefficient of variation showed a good uniformity of the flock studied (V=5.63 to 11.01%), the test for analysis of variance has revealed the statistical differences ($p \leq 0.05$) averages obtained between females and males, both before and after refrigeration.

After applying the formula calculated, were obtained values of the slaughtering efficiency for both moments of measurement (fresh and refrigerated carcass) (table 7). Thus, it is noted that the average values obtained from measurements taken immediately after slaughter are higher compared to the yield calculated on the carcasses refrigerated [1, 10].

From the data presented in table 7, follows that at Lexp were achieved the highest values for slaughtering efficiency (from 76.95% at females up to 78.55% at males, on fresh carcass and from 75.49% at females up to 77.19% at males, on refrigerated carcass), while at Lc were recorded the lowest values for both moments of measurement (from 76.70% at females up to 77.79% at males, after slaughter and after chilling, from 75.23% at females up to 76.41% at males) [5, 8, 10]. This reducing trend for carcass weight was due to dehydration process, which occurs normally, during refrigeration period.

Table 7 The values for slaughtering efficiency

Specification	*Lc*				*Lexp*			
	Males (n=15)		Females (n=15)		Males (n=15)		Females (n=15)	
	$\bar{X} \pm s_{\bar{X}}$	V%	$\bar{X} \pm s_{\bar{X}}$	V%	$\bar{X} \pm s_{\bar{X}}$	V%	$\bar{X} \pm s_{\bar{X}}$	V%
Live weight (g)	^{ab}2248.89 ±31.06	5.35	^{b}2135.99 ±43.05	7.81	^{a}2409.81 ±55.06	8.85	^{b}2225.21 ±31.75	5.53
Fresh carcass weight (g)	^{ab}1749.98 ±27.62	6.11	^{b}1638.90 ±34.92	8.25	^{a}1895.94 ±53.90	11.01	^{b}1712.42 ±24.88	5.63
Slaughtering efficiency (fresh carcasses) (%)	^{a}77.79 ±0.29	1.46	^{c}76.70 ±0.63	3.18	^{a}78.55 ±0.61	2.99	^{bc}76.95 ±0.53	2.66
Refrigerated carcass weight (g)	^{ab}1725.78 ±26.97	6.05	^{b}1614.64 ±34.02	8.16	^{a}1869.99 ±52.91	10.96	^{b}1687.30 ±24.41	5.60
Slaughtering efficiency (refrigerated carcasses) (%)	^{a}76.41 ±0.28	1.44	^{c}75.23 ±0.60	3.11	^{a}77.19 ±0.59	2.98	^{b}75.49 ±0.49	2.52

Mann Whitney-test: ^{ab}significant differences $p \leq 0.05$ ^{ac}distinguished significant differences $p \leq 0.01$;

Values obtained in this experiment were at the upper limit of the range specified by the firm Hubbard for hybrid „Hubbard F15", which ensures the achievement of values up to 69% for the slaughtering efficiency at completely drawn carcasses [2].

Values related to the cutting parts weight and of their participation in the whole carcass structure was presented in table 8.

Table 8 Participation of the cutting parts in the whole carcass structure

Specification	*Lc*				*Lexp.*			
	Males (n=15)		Females (n=15)		Males (n=15)		Females (n=15)	
	$\bar{X} \pm s_{\bar{X}}$ (g)	$\bar{X} \pm s_{\bar{X}}$* (%)	$\bar{X} \pm s_{\bar{X}}$	$\bar{X} \pm s_{\bar{X}}$* (%)	$\bar{X} \pm s_{\bar{X}}$	$\bar{X} \pm s_{\bar{X}}$* (%)	$\bar{X} \pm s_{\bar{X}}$	$\bar{X} \pm s_{\bar{X}}$* (%)
Breast with bone and skin	^{b}472.59 ±10.43	^{C}27.35 ±0.70	^{b}447.05 ±12.75	^{C}27.63 ±0.76	^{a}533.51 ±20.60	^{A}28.42 ±0.59	^{b}488.16 ±10.60	^{A}28.91 ±0.64
V%	8.55	9.91	11.44	10.71	14.95	8.08	8.41	8.51
Thighs	^{bc}259.02 ±2.79	^{D}15.03 ±0.33	^{b}258.64 ±7.59	^{A}15.98 ±0.48	^{a}283.86 ±6.91	^{D}15.21 ±0.31	^{a}275.36 ±5.89	^{A}16.31 ±0.44
V%	4.17	8.59	11.37	11.64	9.43	7.83	8.28	10.55
Shanks	^{ab}212.66 ±2.75	^{A}12.33 ±0.27	^{d}189.17 ±5.70	^{AD}11.68 ±0.37	^{a}228.67 ±5.95	^{A}12.24 ±0.27	^{d}190.35 ±4.40	^{BD}11.27 ±0.35
V(%)	5.01	8.52	11.86	12.33	10.07	8.41	8.95	12.07
Wings	^{ab}189.99 ±1.33	^{A}11.03 ±0.35	^{d}171.79 ±4.96	^{B}10.67 ±0.34	^{a}200.58 ±4.20	^{A}10.76 ±0.29	^{d}170.30 ±4.56	^{B}10.11 ±0.28
V(%)	2.72	12.15	11.18	12.18	8.11	10.31	10.36	10.68
Back, heat, neck and legs	^{a}591.51 ±9.81	^{A}34.27 ±0.81	^{c}547.98 ±6.06	34.04 ±0.64	^{a}623.37 ±15.78	^{D}33.38 ±0.90	^{c}563.12 ±14.21	^{D}33.41 ±0.69
V(%)	6.42	9.16	4.28	7.23	9.80	10.40	9.78	9.02

Mann Whitney-test: ^{ab,AB}significant differences $p \leq 0.05$;
^{ac,AC}distinguished significant differences $p \leq 0.01$;
$^{ad,\ AD}$high significant differences $p \leq 0.001$
*(%)-% of carcass

The data presented in table 8 show that:

-weight of the breast with bone and skin was from 447.05 g (females-Lc) up to 533.51 g (males-Lexp) and analysis of variance revealed the presence of statistical differences ($p \leq 0.05$). Participation in the whole carcass structure had values from 27.35% (males-Lc) up to 28.91% (females-Lexp), with statistical differences between average values obtained at females and males or between the studied groups;

-for thighs and shanks, were obtained higher values at males compared with females. If we refer to participation in whole carcass structure, the values obtained for the thighs were higher at females compared with males and the situation was reversed for shanks;

-the wings weight was from 170.30 g at female-Lexp group up to 200.58 g at males-Lexp, with statistical differences between average values obtained females and at males. For their participation in the whole carcass structure were slightly higher values at females compared males and for Lexp group compared with Lc group;

-for other components (head, neck, back and legs), the participation in the whole carcasses structure was higher at Lc group compared with Lexp group.

CONCLUSIONS

At Lexp. group, administration of combined feed with high protein and energy levels has determined good growing performances (+6.50% for live weight, +6.62% for average daily gain and -6.02% for feed conversion rate) as compared with Lc. group.

As compared with standard for „Hubbard F15" hybrid, at Lexp group were registered satisfactory values for growth performance, with differences of -3.91% for body mass; -4.19% for average daily gain and -4.07% for feed conversion index.

At the Lexp group the feed with higher protein-energy level had positive influence on the slaughter efficiency (fresh and refrigerated carcasses) and participation of the cutting parts from the whole carcass structure (breast and thighs), which had registred higher values, as compared with Lc group.

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