Effect of Different Levels of Dietary Protein and Energy on the Growth and Slaughter Performance at „Hybro PN^{+}" Broiler Chickens

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Abstract
In this paper was studied effect of different level of dietary energy and protein on the growth performance (average daily gain, feed conversion), slaughter yield and participation quota of the cut parts from the whole carcasses structure at „Hybro PN^{+}" hybrid, slaughtered at 42 days old. The two groups (control group-Lc and experimental group-Lexp) have received compound feed with different levels of energy and protein. Chickens were weighed at: 1, 7, 14, 21, 28, 35 and 42 days. After slaughter, from each group were sampled 30 carcasses and were determined carcass characteristics using gravimetric measurements. At 42 days, the Lexp group has recorded higher values for the body weight (+7.83%) and average daily gain (+8.70%), compared with the Lc group. This performance has been achieved through an average individual feed intake of 4.162 kg, at Lc and 4.227 kg, at Lexp, meaning a value of 1.701 kg feed/kg gain, at Lexp group and 1.806 kg feed/kg gain, at Lc group. For slaughter yield at fresh carcasses resulted values from 77.22% (Lc) up to 78.21% (Lexp), at female chickens and from 78.55% (Lc) up to 79.12% (Lexp), at male chickens. After refrigeration, the values for this characteristic were decreased by 1.80 up to 1.89%. Participation quota of the cut parts from the whole carcasses structure has registered the highest values in Lexp group for breast and drumsticks, compared with Lc group. At the Lexp group, high levels of dietary protein and energy has significantly influenced: average daily gain, feed conversion ratio, slaughter yield and the participation quota of the cut parts from the whole carcasses structure (breast and drumsticks).

Keywords: „Hybro PN^{+}" hybrid, broiler chickens, average daily gain, feed conversion index, slaughter yield

1. Introduction

To be a profitable activity in the growth of meat chickens is necessary to know the growth characteristics for each hybrid delivered to market. Thus, every company producing of broiler chickens has elaborated a management guide specifically for each hybrid stating all the necessary technological elements for genetic potential exteriorization to obtain high economic efficiency [1, 2]. The modern technologies of broiler growth are aimed to valorization the genetic potential of the hybrids, feed conversion rate and meat production [2, 3].

Poultry meat production and its valorization is influenced by genetic and technological factors (growth technology, microclimate, nutrition, ensuring the health and welfare etc.) [1-5].

Only through a proper nutrition program is possible to express maximum genetic potential [1-6]. The feed rations must be balanced for ensure a proper energy and protein level, correlated with the chickens development stages [4-8]. Rations

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deficient in protein, even if not clearly reflected in the growth performance, have impacting negatively on the carcass meat percentage [9-14].
A diet rich in quality protein improves carcass parameters and meat quality (slaughter yield and chemical composition) at „Hybro PN^{+}" hybrid [15-17].
In this paper was studied effect of different levels of dietary energy and protein on the growth performances (body mass, average daily gain, feed conversion), the slaughter yield and participation quota of the cut parts in the whole carcasses structure at „Hybro PN^{+}" broiler chickens, slaughtered at 42 days old.

2. Materials and methods

This research was conducted on chicken broiler belonging „Hybro PN^{+}" hybrid, which were sacrificed at 42 days old. In this study we had two groups of chickens, of both sex (males females): the control group (Lc) and experimental group (Lexp.), reared in the same environmental condition. In the growth period (1-42 days) for microclimate factors the values have been according to the manual „Hybro PN^{+}" hybrid [3]. The growth system was on the permanent litter, with a density of 12 chickens/m^2. The growth technological system was in accordance with new European Union regulation on animal welfare compulsory from 2012 in all EU members [18].
At the two groups of chickens were received compound feed with different protein and energy levels, as follows: Lc group - protein and energy level was conforming to recommend the company „Hybro BV" for the „Hybro PN^{+}" hybrid [3] and Lexp group - protein and energy level were with 10% higher.
Depending on the age of chickens during the growth period (1-42 days) at each chickens group was given three recipes compound feed, ad libitum: starter, grower and finisher (Table 1).

Table 1. Features of feed compound recipes for broiler chickens

Growth period	Recipe features	Chicken groups	
		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 chickens group were made individual gravimetric measurements at: 1, 7, 14, 21, 28, 35 and 42 days, to establish the dynamic of body mass, overall gain for each growth period or overall 42 days period and average daily gain.
The feed intake was determined weekly for each chickens group. Obtained data were used to establish the feed intake during each growth period, average individual intake for 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 and 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 yield of fresh and refrigerated carcasses. The slaughter yield is ratio between fresh or refrigerated carcass weight and live weight, in percent expressed. [19]. To calculate the slaughter yield were used carcasses gutted, with: head, neck and legs.
After cutting the carcasses were determined weight of the cut parts, by gravimetric measurements. With this data were calculated the participation quotas of the cut parts in the whole carcasses structure. The cut parts in the carcass were: breast with bone and skin, thighs, drumstick, wings and the remnants consisting of

head, neck, back and legs. The participation quota of the cut parts is ratio of each part weight from carcass and carcass weight, percent expressed [19]. Raw data obtained from measurements were processed, 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 [20].

3. Results and discussion

The values for body mass dynamic at control group (Lc) and experimental group (Lexp) are shown in table 2.

In the growth period (42 days), at each chickens group, the body weight had an upward dynamic; thus, at one day the live weight was 40.84 g (Lexp) and 40.85 g (Lc); at 14 days, 400.27 g (Lc) and 417.72 g (Lexp); at 35 days, 1813.19 g (Lc) and 1940.15 g (Lexp), and at 42 days between 2245.49 g (Lc) up to 2529.05 g (Lexp).

From the table 2, was observed that for the coefficient of variation the values were lower and showed a very good uniformity of the flock studied (V%=2.30 to 10.08%). For the body mass, on the six weeks of growth, between the average values recorded by Lc group and Lexp group, were present highly significant statistical differences ($p \leq 0.001$).

At Lexp group, the feed with higher protein-energy level had significant influence on the body mass dynamic. At the end of growth period (42 days) the average body weight for Lexp group was higher with 7.83%, compared with the Lc group.

Table 2. The body mass dynamic at studied broiler chickens

Specification	Lc			Lexp			Lexp vs. Lc
	n	$\bar{x}\pm S_{\bar{x}}$ (g)	V%	n	$\bar{x}\pm S_{\bar{x}}$ (g)	V%	(±%)
one day	300	40.85±0.05	2.30	300	40.84±0.07	3.06	-0.02
7 days	297	^{b}166.52±0.94	9.44	298	^{a}170.47±0.74	7.51	+2.37
14 days	297	^{d}400.27±1.76	7.60	298	^{a}417.72±1.86	7.70	+4.36
21 days	295	^{d}801.02±4.41	9.45	297	^{a}833.96±4.88	10.08	+4.11
28 days	295	^{d}1290.95±7.38	9.82	297	^{a}1355.57±6.24	7.93	+5.01
35 days	295	^{d}1813.19±9.44	8.94	297	^{a}1940.15±7.82	6.94	+7.00
42 days	295	^{d}2345.45±13.04	9.55	295	^{a}2529.05±12.26	8.32	+7.83

Anova-test: ^{ab} significant differences $p \leq 0.05$; ^{ad} high significant differences $p \leq 0.001$; n-Chickens number; $\bar{x}$-Mean; $\pm S_{\bar{x}}$-Standard error; V%-Coefficient of variation

Table 3 presents the body mass dynamic at studied broiler chickens, compared with the standard values for „Hybro PN^{+}" hybrid [3].

In this case, at the two broiler chickens groups for the growth period 1-42 days, live weight was lower compared with standard values specified in the Broiler Management Manual „Hybro PN^{+}" [3].

In table 3, we can notice the fact that, at 42 days for studied chickens have been obtained lower weights from 3.69%, at Lexp group up to 10.68%, at control group.

Table 3. The body mass dynamic at studied broiler chickens, as compared with standard values

Weight at:	Standard (g)	Lc (g)	Lexp (g)	Differences vs. standard	
				Lc (±%)	Lexp (±%)
one day	40	40.87	40.91	+2.13	+2.10
7 days	173	166.52	170.47	-3.75	-1.46
14 days	437	400.27	417.72	-8.41	-4.41
21 days	856	801.02	833.96	-6.42	-2.57
28 days	1387	1290.95	1355.57	-6.93	-2.27
35 days	1982	1813.19	1940.15	-8.52	-2.11
42 days	2626	2345.45	2529.05	-10.68	-3.69

At the Lexp group the recipes feed with high energy and protein level have determined lower differences to standard values, and at control group situation was reverse.

Besides this, for each growth period in part was calculated the average individual growth gain recorded and the average daily gain (Table 4). The results showed a linear ascendant trend, from 25.71 g/chick/day (Lc) and 26.92 g/chick/day (Lexp) for starter period, at 67.25 g/chick/day (Lc) and 72.48 g/chick/day (Lexp) during growing period, respectively up to 76.04 g/chicks/day (Lc) and 83.75 g/chicks/day (Lexp) in finishing period.

For total growth period (1-42 days), the average daily gain was between 54.87 g/chick/day, at Lc and 59.24 g/chick/day, at Lexp.

At Lexp group were obtained higher values, with: 4.71%, in starter period; 7.78%, in growing period; 10.14%, in finishing period and with 7.96%, for total growth period (1-42 days), as compared with Lc group.

From this data, for the coefficient of variation were lower values identified and this revealed a good uniformity of the studied flock (V%=7.08 to 18.15%). For the average daily gain, on the each growth period, between the average values recorded by Lc group and Lexp group, were present highly significant statistical differences ($p \leq 0.001$).

Table 4. Average daily gain for each technological period

Growth period	Lc			Lexp			Lexp vs. Lc
	n	$\bar{x}\pm S_{\bar{x}}$ (g/chick/day)	V%	n	$\bar{x}\pm S_{\bar{x}}$ (g/chick/day)	V%	(±%)
1-14 days	298	$^{d}25.71\pm0.12$	7.97	299	$^{a}26.92\pm0.13$	8.25	+4.71
15-35 days	296	$^{d}67.25\pm0.37$	9.45	297	$^{a}72.48\pm0.30$	7.08	+7.78
36-42 days	295	$^{d}76.04\pm0.57$	12.87	297	$^{a}83.75\pm0.88$	18.15	+10.14
1-42 days	297	$^{d}54.87\pm0.31$	9.69	297	$^{a}59.24\pm0.24$	8.42	+7.96

Anova-test: ^{ad} high significant differences $p \leq 0.001$; n-Chickens number; $\bar{x}$-Mean; $\pm S_{\bar{x}}$-Standard error; V%-Coefficient of variation

In the table 5, were compared with standard values for „Hybro PN^{+}" hybrid, the values for average daily gain obtained at studied chickens. Compared to standard values, it was noted that obtained values for average daily gain was lower by 1.48% up to 5.08%, at Lexp group and by 8.59% up to 11.44% at Lc group [3].

At the Lc group the recipes feed with lower energy and protein levels have determined the higher differences compared to standard values, and for Lexp group was reverse situation.

Table 5. Average daily gain obtained at studied chickens, as compared with standard values

Growth period	Standard values	Lc	Lexp	Difference to standard	
				Lc (±%)	Lexp (±%)
1-14 days (g/chick/day)	28.36	25.54	26.92	-9.34	-5.08
15-35 days (g/chick/day)	73.57	66.80	72.48	-8.59	-1.48
36-42 days (g/chick/day)	85.86	75.53	83.75	-11.44	-2.46
1-42 days (g/chick/day)	60.55	54.50	59.24	-9.38	-2.16

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).

The data presented in table 6 show that food consumption was lower in starter period (480 g, at Lc and 445 g, at Lexp) and higher in growing period (2469 g, at Lc and 2545 g, at Lexp). The overall growth period (1-42 days) was characterised by an average individual consumption of 4162 g, at Lc group and of 4227 g, at Lexp group, and the live weight was 2345.45 g, for Lc group respectively 2529.05 g, at Lexp group.

The average individual consumption values obtained in this experiment were under limit specified the Hybro BV company, for studied

hybrid in period 1-42 days (4562 g feed, for at live weight of 2583 g) [3].
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 showed a linear ascendant trend for this indicator. The best performances were obtained for Lexp group, which have registered values from 1.181 kg feed/kg gain in starter period up to 2.114 kg feed/kg gain in finisher period, compared with Lc group for which the values were higher (from 1.333 up to 2.297 kg feed/kg gain).
For growing period 1-42 days, feed conversion index calculated was of 1.701 kg feed/kg gain at Lexp and 1.806 kg feed/kg gain at Lc.
Thus, at Lexp group the recipes feed with high energy and protein level had influenced positively values for feed conversion index, which was lower with -5.81%, for 1-42 days period, compared with Lc group.

Table 6. Data referring at feed consumption

Growth period	Specification	Lc	Lexp.	Lexp.vs. Lc (±%)
1-14 days	Chickens number	298	299	
	Average individual intake/period (kg)	0.480	0.445	
	Average weight gain/chicken (g)	360.01	376.85	
	Feed conversion index (kg feed/kg gain)	1.333	1.181	-11.40
15-35 days	Chickens number	296	297	
	Average individual intake/period (kg)	2.469	2.545	
	Average weight gain/chicken (g)	1412.25	1522.15	
	Feed conversion index (kg feed/kg gain)	1.748	1.672	-4.35
36-42 days	Chickens number	295	297	
	Average individual intake/period (kg)	1.222	1.239	
	Average weight gain/chicken (g)	532.27	586.22	
	Feed conversion index (kg feed/kg gain)	2.297	2.114	-7.97
1-42 days	Chickens number	297	297	
	Average individual intake/period (kg)	4.162	4.227	
	Average weight gain/chicken (g)	2304.53	2488.15	
	Feed conversion index (kg feed/kg gain)	1.806	1.701	-5.81

In the table 7, were compared with standard values for „Hybro PN^{+}" hybrid, the values for feed conversion index obtained at studied chickens.
In this case, at the two broiler chickens groups for the growth periods starter, growing, finishing and total growth period, values for feed conversion index were compared with standard values specified in the Broiler Management Manual „Hybro PN^{+}" [3]. In table 7, we can notice that, for total growth period (1-42 days) at studied chickens have been obtained slightly higher values at Lc group (+0.67%) and lower values at Lexp group (-5.18%).

Table 7. Feed conversion index obtained at studied chickens, as compared with standard values

Growth period	Feed conversion index (kg feed/kg gain)			Difference to standard	
	Standard	Lc	Lexp	Lc (±%)	Lexp (±%)
1-14 days	1.224	1.333	1.181	+8.91	-3.51
15-35 days	1.758	1.748	1.672	-0.57	-4.89
36-42 days	2.261	2.297	2.114	+1.59	-6.50
1-42 days	1.794	1.806	1.701	+0.67	-5.18

At the Lexp group the recipes feed with high energy and protein level had influenced positively values for feed conversion index, with differences of -3.51%, in starter period; -4.89%, in growing period; -6.50%, in finishing period and -

5.18%, for 1-42 days period, compared with standard for „Hybro PN^{+}" hybrid.
The control group, received compound feed, with protein and energy level, which was conforming to recommendation of the company „Hybro BV" for the „Hybro PN^{+}" chicken, the feed conversion index was slightly higher or lower than standard values (Table 7).
After slaughter, the carcasses obtained were chilled 24 hours, at temperature +4°C. Following gravimetric measurements was observed that the values for fresh carcasses weight (after slaughter) have been from 1683.22 g, at females, in Lc group up to 2012.11 g, for males, in Lexp group (Table 8). The coefficient of variation showed a good uniformity of the studied flock (V%=6.03 to 10.33%), and the test for analysis of variance has revealed statistical differences for p≤0.05 or p≤0.001, both before and after refrigeration.
After applying the formula calculated, were obtained values of the slaughter yield for both moments of measurement (the fresh and refrigerated carcasses) (Table 8). Thus, it is noted that the average values obtained from measurements taken immediately after slaughter are higher compared to the yield calculated on refrigerated carcasses [12-17].

Table 8. The values for slaughter yield

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)	^{a}2495.94 ±63.11	9.79	^{bc}2178.88 ±45.58	8.10	^{a}2542.87 ±39.80	6.06	^{ad}2312.09 ±34.82	5.83
Fresh carcass weight (g)	^{a}1961.49 ±52.30	10.33	^{bd}1683.22 ±37.73	8.68	^{a}2012.11 ±33.39	6.43	^{ad}1808.56 ±28.64	6.13
Slaughter yield (fresh carcasses) (%)	^{a}78.55 ±0.32	1.57	^{d}77.22 ±0.66	3.33	^{a}79.12 ±0.29	1.40	^{ab}78.21 ±0.49	2.42
Refrigerated carcass weight (g)	^{a}1933.75 ±51.36	10.29	^{bd}1658.66 ±37.01	8.64	^{a}1982.34 ±32.50	6.35	^{ad}1781.78 ±27.76	6.03
Slaughter yield (refrigerated carcasses) (%)	^{a}77.14 ±0.30	1.51	^{d}75.76 ±0.64	3.26	^{a}77.64 ±0.26	1.31	^{ab}76.73 ±0.46	2.33

Mann Whitney-test: ^{ab} significant differences p≤0.05; ^{ad} high significant differences p≤0.001; n-Carcass number; $\bar{x}$-Mean; $\pm S_{\bar{x}}$-Standard error; V%-Coefficient of variation

From the data presented in table 8, follows that, at Lexp group were achieved the highest values for slaughter yield (from 78.21%, in females up to 79.12%, in males, on fresh carcasses and from 76.73%, in females up to 77.64%, in males, on refrigerated carcasses), while at Lc group were recorded the lowest values for both moments of measurement (from 77.22%, in females up to 78.55%, in males, after slaughter and after chilling, from 75.76%, at females up to 77.14%, at males) [12, 13, 14]. This reducing trend for carcass weight was due to dehydration process, which occurs normally, during refrigeration period.
The coefficient of variation showed a very good uniformity of the carcasses studied (V%=1.31 to 3.33%). The test for analysis of variance has revealed statistical differences, both before and after refrigeration, between males and females (p≤0.05, at Lc group and p≤0.001, at Lexp group) and at female chickens from Lc group with Lexp group (p≤0.001).
Values obtained in this experiment were at the upper limit of the range specified by the company „Hybro BV" for hybrid „Hybro PN^{+}", which ensures the achievement of values between 69.90 to 72.00% for the slaughter yield at completely drawn carcasses (without head, neck, legs and abdominal fat) [3].
On slaughter yield, the different levels of dietary protein and energy, had determined statistical differences between female chickens from Lc group and Lexp group, while at male chickens, the differences between Lc group and Lexp group were not proved statistically.
Values related of the participation quota of the cut parts in the whole carcasses structure have presented in table 9, and this data show that:

-for the breast with bone and skin were values from 28.84%, in male chickens from Lc group up to 29.60%, in female chickens from Lexp group, and analysis of variance revealed the presence of significant statistical differences ($p \leq 0.05$) between average values obtained at Lc group and Lexp group from each sex;
-for thighs, were obtained higher values at female chickens (16.03%, at Lc group and 16.17%, at Lexp group), compared with male chickens (15.55%, at Lc group and 15.23%, at Lexp group). Analysis of variance revealed the presence of high significant differences ($p \leq 0.001$), between average values obtained of female chickens and male chickens, for each group;
-the drumsticks had registered higher values at male chickens (13.16%, at Lc group and 13.41%, at Lexp group) and lower values at female chickens (13.08%, at Lc group and 13.40%, at Lexp group). Analysis of variance revealed the presence of high significant differences ($p \leq 0.001$) between average values obtained of male chickens and significant differences ($p \leq 0.05$) between average values registered at female chickens;
-the participation quota of the wings in the whole carcasses structure has registered values from 8.77%, at female chickens from Lexp group up to 9.65%, at male chickens from Lc group. After apply the test of variance analysis were present various stages of statistical significance ($p \leq 0.001$, between males and females or $p \leq 0.01$, between female chicken groups);
-for other components (head, neck, back and legs), the participation quota in the whole carcasses structure was higher at Lc group compared with Lexp group. The test of variance analysis not revealed presence of statistical differences.
If we compared the female chickens with male chickens for each group or the two groups of chickens (Lexp and Lc), in terms of participation quota of cut parts in the whole carcasses structure was observed that there are differences in both plus and minus.
At the two groups of chickens (Lc and Lexp), were found statistical differences for breast ($p \leq 0.05$), drumsticks ($p \leq 0.001$) and wings ($p \leq 0.05$), which were determinate of different protein and energy levels from the feeds compound.

Table 9. Participation quota of the cut parts from the whole carcasses structure

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%
Breast with bone and skin	$^{b}28.84 \pm 0.63$	8.46	$^{b}29.13 \pm 0.54$	7.17	$^{a}29.38 \pm 0.52$	9.53	$^{a}29.60 \pm 0.53$	6.92
Thighs	$^{d}15.55 \pm 0.29$	7.27	$^{a}16.03 \pm 0.37$	9.04	$^{d}15.23 \pm 0.28$	7.16	$^{a}16.17 \pm 0.33$	8.02
Drumsticks	$^{d}13.16 \pm 0.26$	7.75	$^{b}13.08 \pm 0.33$	9.78	$^{a}13.41 \pm 0.26$	7.53	$^{a}13.40 \pm 0.32$	9.25
Wings	$^{a}9.65 \pm 0.27$	10.68	$^{ad}9.01 \pm 0.22$	9.32	$^{a}9.64 \pm 0.25$	9.85	$^{cd}8.77 \pm 0.25$	11.18
Back, head, neck and legs	32.80 ± 0.58	6.79	32.73 ± 0.75	8.83	32.34 ± 0.66	7.86	32.05 ± 0.78	9.42

Mann Whitney-test: ^{ab} significant differences $p \leq 0.05$; ^{ac} distinguished significant differences $p \leq 0.01$; ^{ad} high significant differences $p \leq 0.001$; n-Carcass numbers; $\bar{x}$-Mean; $\pm S_{\bar{x}}$-Standard error; V%-Coefficient of variation

4. Conclusions

At Lexp group, administration of combined feed with high protein and energy levels has determined good growing performances (+7.83% for live weight, +7.86% for average daily gain and -5.81% for feed conversion index) as compared with Lc. group.

At the Lexp group the feed with higher protein-slaughter yield (fresh and refrigerated carcasses) and participation quota of the cut parts in the whole carcasses structure (breast and drumsticks), which had registered higher values, compared with Lc group.

As compared with standard for „Hybro PN^{+}" hybrid, chickens from Lexp group are characterized by satisfactory performance, at growth and slaughter, with highest values for: body mass, slaughter yield, breast yield, drumsticks yield, and lowest values for feed conversion index, while at chickens from Lc group chickens the situation was reversed.

If we refer to the participation quota of the cut parts in whole carcasses structure, the values obtained at female chickens were higher for breast and thighs, as compared with male chickens that had yield higher for other cut parts from carcass (drumstick, wings and carcass remnants consisting of head, neck, back and legs).

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