Growth Parameters Of Heavy-Breed Avian Youth Fed Organic System

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Abstract
The experiment on the assessment of development parameters in the case of heavy-breed young poultry was carried out in concordance with the common legislation, with the provision of feeding and maintenance conditions specific to the organic system. The experiment lasted for 84 days (150 chickens); in this period, we used two structures of concentrate mixtures: CM_1 (from 1 day to 42 days), with the following characteristics 3003 kcal EM, 19.91% CP, 1% lysine, 0.57% methionine + cystine, 1.08% Ca and 0.62% P and CM_2 (from 43 to 84 days) with 2981 kcal EM, 16.03% CP, 0.73% lysine, 0.47% methionine+cystine, 1.06% Ca and 0.58% P. During the experiment, we recorded the growth performances (body weight, growth, daily gain) and the CI. The body weight recorded at 84 days was 1623.10±37.0 g, with a daily mean growth of 19.32 g and a specific intake of: 3.68 kg AC, 11261.28 kcal EM, 635.35 g CP, 31.03 g lysine and 19.02 g methionine+cystine/kg growth. We determined a mathematical model for body mass prediction depending on energy and protein ingestion, generating an equation of this type: $y=a+b*\ln(x_1)+c*\ln(x_1)^2+d*x_2+e*x_2^2$, with a multiple determination coefficient $R^2=0.99$ and an error percentage at the end of the growth period of 0.02%, beetwen predicted and experimental values.

Keywords: organic system, heavy-breed poultry, growth parameters

1. Introduction

Organic farming can be defined as an approach to agriculture in which the aim is to create integrated, humane, environmentally and economically sustenable agricultural production system [1].
Organic refers to the way livestock and agricultural products are raised and processed, avoiding agrichemicals such as synthetic pesticides and fertilizers [2]. Organic production focuses on animal health and welfare, good environmental practices and product quality. In contrast, conventional production focuses on reducing costs and maximizing production through weight gain, feed efficiency and more [3].

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Organic table birds and layers must be produced in accordance with the standard practices set out by the European Council Regulations and monitored by the certifying bodies in each country [4, 5].
The organic system requires that birds should be slow-growing so that they can be slaughtered at a later age than conventional birds [6]. In the biological breeding of heavy-breed chicken, too, the nutritionist's intervention is necessary in order to balance food in terms of its components [7]. Like all other animals, poultry require five components in their diet as a source of nutrients: energy, protein, minerals, vitamins and water. A nutrient shortage or imbalance in relation to other nutrients will affect performance adversely. Poultry need a well-balanced and easily digested doet for optimal production of eggs and meat and are very sensitive to dietary quality because they

grow quickly and make relatively little use of fibrous, bulky feeds such as lucerne hay or pasture [1].
An absolute requirement for energy in terms of kilojoules per kilogram of diet cannot be stated because poultry adjust their intake to obtain their necessary daily requirements [8].
Protein and AA requirements vary according to the age and stage of development. Growing meat birds have high AA requirements to meet the needs for rapid growth and tissue deposition.
For optimal performance the diet must provide adequate amounts of EAA, adequate energy and adequate amounts of other essential nutrients [6, 9].
In terms of increasing the number of breading poultry farms in organic system, in our country is necessary as well to establish production rating parameters, in certain periods, to predict the degree of achievement of proposed technical objectives.
This paper proposes to set the growth parameters of heavy-breed avian youth, fed according to slow rate-of-rise, with nutritional requests supplemented by organic fodder components.

2. Materials and methods

The experiment regarding the heavy-breed avian youth development in order to achieve poultry meat has been made on a number of 150 heavy-breed chickens, according to communitarian legislation, being provided feed and maintenance conditions specific to organic system, following the minimum statutory 81 days duration).
Avian youth included in the experiment has been stadially fed with a concentrate mixture (CM) with different nutritional characteristics, as follows:
one day-6 weeks: 3003 kcal EM, 19,91% PB, 1% lysine, 0,57% methionine + cystine, 1,08%Ca and 0,62% P;
7 weeks-12 weeks: 2981 kcal EM, 16,3 % PB, 0,73% lysine , 1,6% Ca and 0,58%P;
Heavy-breed avian youth bio-productive performances have been evaluated on the base of the following indicators:
CM ingestion, fortnightly set and expressed by CM daily average consumption (kg/period/chicken) and by the mean daily intake (mdi);
Body mass evolution, set on the base of individual weighting fortnightly made;
The conversion index (CI) in kg. CM/body weight kg;
Energy consumption (kcal EM/live weight kg) and protein (g/kg live weight).
Primary data registered have been statistically processed using SPSS 19 calculation program. On the basis of an international soft DataFit 9, have been set prediction equations of body weight for a less studied bird category. From the issued equations it has been selected the model with the higher multiple determination coefficient R^2 and with the less diminished error percent. The resulted equation is of type:
$y=a+b*\ln(x_1)+c*\ln(x_1)^2+d*x_2+e*x_2^2$
For the body weight prediction in growth periods there have been taken into account only the energy ingestion and protein, excepting the amino acids (lysine and methionine + cystine), because, between the protein and amino acids ingestion, there is a powerful positive correlation, over 0.99% (according to data notified in table 1).

Table 1 Pearson correlation between protein and essential amino acids ingestion

Specificare	P	Lis	Met+cys
P	1		
Lis	0.999684	1	
Met+cys	0.99999	0.999564	1

3. Results and discussion

The experiment regarding heavy-breed avian youth has as a purpose the evaluation parameters of heavy-breed avian youth bred under ecologic systems and under the specified terms and has as the following results:
Concentred mixture intake (CM):
Data referring to CM intake are shown in the table 2.

Table 2. The evolution of fodder consumption by heavy-breed avian youth raised in ecologic system

Age (days)	fodder consumption (g)		mean daily intake (mdi) (g)	
	/period	cumulated	/period	cumulated
14	475	475	33,93	33,93
28	728	1205	52,00	42,96
42	867	2070	61,93	49,29
56	950	3020	67,86	53,93
70	1365	4385	97,50	62,64
84 days	1580	5965	112,86	71,01

According to data from table 2 we notice a total consumption of 5965 g CM per the entire growing period, with a daily average consumption between 33.93 g in the first period and 112.86 g in the last growing period. During the entire experimental period, from one day to another, the mean daily intake of 71.01 g CM.

Castellini and col. (2003) [10] has achieved after a study regarding chickens growing performances (very slow-growing *Robusta maculata*) a consumption of 5686 g fodder with a daily average consumption of 66,5 g (for females) and 73,9 (for males).

Evolution of body weight.

The main data regarding the body weight, statistically operated, are shown in table 3. On the basis of those data could be determined the total growing increase as well as the daily mean growth (dai), registered by heavy-breed avian youth for meat production, bred under organic systems (table 3).

Table 3. Statistical indices of the main bioproductive indicators, in heavy-breed young poultry, bred under ecologic systems

Age (days)	Body weight		Growing increase		Daily mean growth	
	$\bar{x} \pm Sx$	CV	/period	cumulated	/period	cumulated
one day	40.00±0.36	8.70				
14	250.60±5.96	13.03	210.6	21.6	15.04	15.04
28	509.10±1.5	12.40	258.5	469.1	18.46	18.18
42	778.7±16.0	11.28	269.6	738.7	19.26	18.54
56	1060.6±28.3	14.59	281.9	1020.6	20.14	18.94
70	1355.60±28.9	11.68	295.0	1315.6	21.07	19.37
84	1623.10±37.0	12.47	267.5	1583.1	19.11	19.32

The data shown in table 3 regarding the body weight of the experimented avian youth show that they have increased their body weight of about 40 times, reaching a body weight of 1623.10±37.0 g in the scarification day of 84 days. The variability coefficient of that bio-productive indicator has registered average values along the growing period, reaching a variability coefficient of 12.47% at the end of growing period.

During the entire growing period, heavy-breed avian youth had registered a total increase of 1583,1 g, with a daily average increase of 19.32 g.

Gordon and Charles (2002) [11] have also achieved comparable results after a study made on difference genotypes; thus, at 81 days old – modern commercial hybrid (*Ross-308, Ross 508*) weighted 4.5 kg; fast-moderate-growing hybrid (*ISA 1756, Redbro and Master Gris*) weighted 3.3 kg moderate-slow growing hybrids (*ISA Gris Barre*) weighted 3.0 kg and traditional breeds (*Light Sussex, White Sussex*) weighted 1.5 kg.

The conversion index (CI)

Conversion index (CI), with fortnightly determinations is shown in table 4 and graphically shown in figure 1.

Table 4. Conversion value evolution

Specification	Conversion index	
	/period	cumulated
14	2.26	2.26
28	2.82	2.36
42	3.22	2.66
56	3.37	2.85
70	4.63	3.23
84 days	5.91	3.68

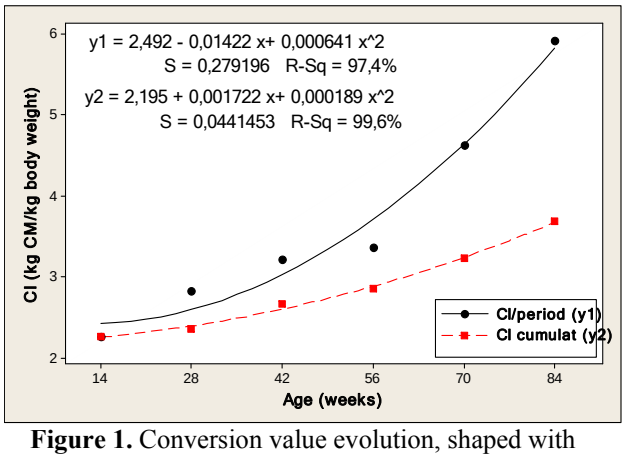

Figure 1. Conversion value evolution, shaped with polynomial regression of second grade

The data of table 4 and of graphic show that the conversion index was between 2.26 and 5.91, dependent on the growing period. During the

entire growing period of the avian youth bred for meat production under organic system the conversion index was of 3.68 kg CM/kg body weight.

The determination figure (R^2) of polynomial regression equation of second grade of the conversion value depending on bird age was high (97.4% for CI calculated for growing period and 99.6% for CI cumulated for the entire growing period).

Castellini and col. (2003) [10], in their study made on very slow growing youth have achieved similar results, an CI of 3.45 kg CM/kg body weight.

Daily average energy and protein ingestion is shown in table 5.

The daily average energy metabolized ingestion had values between 101.89 kcal and 336.44 Kcal, and during the growing period has been registered a total ingestion of 17827.74 kcal EM, then running back a caloric ingestion of 10983.76 kcal/kg live weight.

Gross protein ingestion has been between 6.72 g and 18.09 g on average a day, and on the entire growing period a bird has ingested on average 1034.32 g PB, running back about 637 g PB/kg live weight.

Table 5. Energy and protein ingestion during the avian youth growing period, bred under organic system

Age (days)	Energy.(Kcal EM)		PB (g)	
	average daily	cumulated	average daily	cumulated
14	101.89	1426.46	6.72	94.08
28	156.16	3612.7	10.30	238.28
42	185.98	6216.42	12.26	409.92
56	202.29	9048.48	10.88	562.24
70	290.65	13117.58	15.63	781.06
84	336.44	17827.74	18.09	1034.32

The efficient and economical feeding of the monogastric farm animals can only be done with diet formulations developed on computer using the mathematical models for energy and protein metabolism simulation [12].

Koops (1989) [13] makes a growing model not only depending on time, but also depending on ingested food quantity (EM, PB). End others authors have made researches on the relationship between synthesized protein and protein and EM ingestion at different species among which the avian youth [14].

Emmans (1987) [15] has reported the necessary of energy for chickens' maintenance in relation with the cumulated protein quantity kg/day from hatching up to cull, and he presented them in logarithmic form, and concluding that the presentation of energetic necessary should be made in relation with the protein quantity and not in relation with body weight.

There has been analyzed the elaboration of some equations to predict body weight depending on energy and gross protein ingestion. With the help of informational soft Data fit 9.0, there have been achieved several mathematic models of which we chose to present the equation with the higher value of multiple determination R^2 and with the little error percent during the entire experimental period.

The equation is:

$y= a+b*\ln(x_1)+c*\ln(x_1)^2+d*x_2+e*x_2^2$, where*:*

y- body weight,

x_1- energy metabolized ingestion (kcal EM),

x_2- gross protein ingestion (g).

The resulted mathematic model factor and its statistic values are shown in table 6.

Table 6. The statistic factors and values of mathematic equation for body weight prediction depending on metabolized energy ingestion and gross protein

Coefficient	Value	St. error	t-ratio	Prob(t)
a	20939.81	1147.64	18.25	0.035*
b	-5970.34	333.03	-17.93	0.035*
c	435.78	24.70	17.64	0.036*
d	-3.42	0.34	-9.97	0.064
e	8.51E-04	9.43E-05	9.03	0.070

$y = 20939.81+-5970.34*\ln(I_{EM})+435.782*\ln(I_{EM})^2+-3{,}423*I_{PB}+0.000851*I_{PB}^2$

Variance Analysis

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob(F)
Regression	4	1340208	335052.1	111821.2	0.0022**
Error	1	2.99632	2.99632		
Total	5	1340211			

Values x_1	Values x_2	Values y	Calculated y	Residual	% error	Abs residual
1426.46	94.08	250.6	250.73	-0.125	-0.050	0.125
3612.7	238.28	509.1	508.55	0.548	0.108	0.548
6216.42	409.92	778.7	778.91	-0.212	-0.027	0.212
9048.48	562.24	1060.6	1061.64	-1.036	-0.098	1.036
13117.58	781.06	1355.6	1354.41	1.194	0.088	1.194
17827.74	1034.32	1623.1	1623.47	-0.370	-0.023	0.370

The result of that mathematic equation can predict the body weight of heavy-breed avian youth bred under organic system, under conditions similar to this experiment development (table 6).

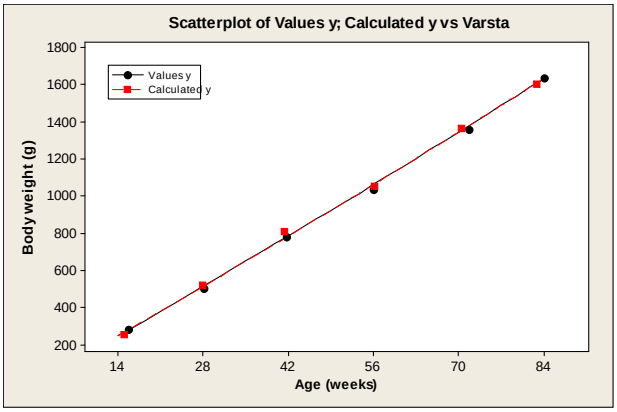

Figure 2. Graphical presentation of body weight experimentally achieved and graphical presentation of predicted body weight for heavy-breed avian youth bred under organic system

The analyzed data show that the calculated values (predicted body weight) are close to those experimentally achieved during the 84th days. Model's error is little, observing an error percent less than 0.1%, at the end of growing period the registered error percent being of 0.023%, aspect confirmed in figure 2, as well, where is graphically shown the experimentally achieved body weight and the body weight predicted by the mathematic model depending on heavy-breed avian youth age bred under organic system during the experiment development.

4. Conclusions

Organic feeding of heavy-breed avian youth with a slow rate of rise at a nutritional level of 3003 kcal EM/kg AC and 19.91% PB in a day -6 weeks period; I of 2981 kcal/kg AC and 16.03%PB, has allowed the setting of the following growing parameters:

CM ingestion on the entire growing period was of 5965 g, with a daily average consumption of 71.01 g;

Body weight of heavy-breed avian youth was of 1623.10 ± 37.00 g at 84th day age;

Conversion index (CI) was of 3.68 kg CM/kg body weight.

Depending on energy and protein ingestion has been set an equation for body weight prediction of the following type:

$y=a+b*\ln(x_1)+c*\ln(x_1)^2+d*x_2+e*x_2^2$

Between the body weight predicted values and those experimentally achieved the differences are

insignificant, at the end of growing period the registered error percent being of only 0.023%.

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