ESTIMATION OF THE PROCESS OF SYNTHESIS OF MEAT BROILER THROUGH MODERN METHODS

ESTIMAREA PRIN METODE MODERNE A PROCESULUI DE SINTEZĂ CORPORALĂ LA PUII BROILER

MONICA PĂRVU¹, R. BURLACU², IOANA ANDRONIE¹, VIOLETA SIMION¹, ADRIANA AMFIM

¹University Spiru Haret, FMV, Bucharest, monica_parvu@yahoo.com
²University of Agriculture Science and Veterinary Medicine Bucharest

In vivo experiments on broilers were conducted in order to elaborate a mathematical model for body synthesis, the experimental data being processed with Gompertz time functions and linear functions. The experiment used 166, Ross 308 day-old chicks through an experimental period of 42 days. The broilers received diets according to the growth period (1 – 14, 15 – 28, 29 – 42 days). The dietary energy and nutrient supply for group 1 (control) were according to the recommendation of Ross Breeders. The birds had free access to the feed. Group 2 received 90% and group 3 received 80% of the amount of feed received by group 1; the dietary energy supply was 90% in group 4 and 80% in group 5, also related to group 1. Mathematical modelling was used to evaluate the evolution of the body chemical composition (water, protein and lipid content), starting from the protein content at hatching.

Keywords: mathematical modelling, broiler, corporal synthesis

Materials and Methods

Biological material was represented by 166 of chicken Ross 308, in the age of one day, accommodated in batteries. Experimental period was 42 days. The group L1 (control) was feeding ad libitum, the diets rules providing energy and nutrients recommended by the firm Ross Breeders 2007. The group L2, the administration has been feeding 90% of the group L1. The group L3 level management of food was 80% of the lot L1. The lots L4 and L5 levels in energy and protein were 90% and 80% of the lot L1.

The process of body synthesis was pursued through technical comparative slaughter carried out at hatching, 14, 28 and 42 days (10 chicken/lot). Biological samples were analyzed according Weende scheme, using the methods in use.

Experimental data were analyzed using Gompertz time function and the regression equations, which have generated equations on the basis of which can simulate the process of synthesis body.
Results and Discussion

In table 1 is presented data on the report (R) net of body weight (Wn) and alive body weight (Wa).

<table>
<thead>
<tr>
<th>Age</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 days</td>
<td>Wa</td>
<td>460.33</td>
<td>443.27</td>
<td>425.61</td>
<td>453.78</td>
</tr>
<tr>
<td></td>
<td>Wn</td>
<td>452.96</td>
<td>434.84</td>
<td>417.94</td>
<td>446.51</td>
</tr>
<tr>
<td></td>
<td>R%</td>
<td>98.4</td>
<td>98.1</td>
<td>98.2</td>
<td>98.4</td>
</tr>
<tr>
<td>28 days</td>
<td>Wa</td>
<td>1415.82</td>
<td>1343.17</td>
<td>1250.33</td>
<td>1372.28</td>
</tr>
<tr>
<td></td>
<td>Wn</td>
<td>1387.50</td>
<td>1314.96</td>
<td>1220.32</td>
<td>1348.95</td>
</tr>
<tr>
<td></td>
<td>R%</td>
<td>98.0</td>
<td>97.9</td>
<td>97.6</td>
<td>98.3</td>
</tr>
<tr>
<td>42 days</td>
<td>Wa</td>
<td>2690.22</td>
<td>2437.48</td>
<td>2196.51</td>
<td>2511.03</td>
</tr>
<tr>
<td></td>
<td>Wn</td>
<td>2614.09</td>
<td>2391.16</td>
<td>2156.97</td>
<td>2465.83</td>
</tr>
<tr>
<td></td>
<td>R%</td>
<td>97.2</td>
<td>98.1</td>
<td>98.2</td>
<td>98.2</td>
</tr>
</tbody>
</table>

It was found that the ratio of net weight and live weight was not influenced by the age of birds, the values being obtained between 97.2% - 98.7%.

In table 2 are presented data on protein content, from the comparative slaughter.

The evolution of content in total protein (Pt), g

<table>
<thead>
<tr>
<th>Pt</th>
<th>1 day</th>
<th>14 days</th>
<th>28 days</th>
<th>42 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>6.86</td>
<td>100.10</td>
<td>306.64</td>
<td>652.93</td>
</tr>
<tr>
<td>L2</td>
<td>6.80</td>
<td>98.31</td>
<td>296.39</td>
<td>570.68</td>
</tr>
<tr>
<td>L3</td>
<td>6.83</td>
<td>88.82</td>
<td>258.82</td>
<td>509.47</td>
</tr>
<tr>
<td>L4</td>
<td>6.89</td>
<td>97.34</td>
<td>294.07</td>
<td>581.13</td>
</tr>
<tr>
<td>L5</td>
<td>6.81</td>
<td>94.05</td>
<td>286.21</td>
<td>524.69</td>
</tr>
</tbody>
</table>

Based on these data was established equations simulation chemical composition of the body, using Gompertz functions.

\[
Pt[g] = 6.80 \times e^{0.1502 \times e^{-0.0248 \times t}} \quad \text{[equation 1]}
\]

\[
Pr[g/zi] = \frac{dPt}{dt} = 0.1502 \times Pt \times e^{-0.0248 \times t} \quad \text{[equation 2]}
\]

On the equation 1 is estimated the total protein content, content from the age of one day (mathematical model of choosing the lowest value of the database,
group 2). The free term 6.80 represents the minimum value obtained in the experiment, as regards the content of protein from hatching chicks.

The equation 2 estimated daily protein retained meat (average daily increase of protein), the amount being important in determining metabolizable energy production.

Table 3 present the content of meat in water.

Table 3

<table>
<thead>
<tr>
<th>Wt, g</th>
<th>1 day</th>
<th>14 days</th>
<th>28 days</th>
<th>42 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>29.77</td>
<td>317.08</td>
<td>971.25</td>
<td>1882.14</td>
</tr>
<tr>
<td>L2</td>
<td>29.53</td>
<td>305.32</td>
<td>920.47</td>
<td>1722.34</td>
</tr>
<tr>
<td>L3</td>
<td>29.68</td>
<td>293.16</td>
<td>854.23</td>
<td>1593.34</td>
</tr>
<tr>
<td>L4</td>
<td>29.88</td>
<td>312.56</td>
<td>944.27</td>
<td>1776.30</td>
</tr>
<tr>
<td>L5</td>
<td>29.53</td>
<td>296.56</td>
<td>902.51</td>
<td>1623.42</td>
</tr>
</tbody>
</table>

Based on the values presented to the following equation:

\[
Wt [g] = 3.572 \times Pt^{0.9814} \quad [equation 3]
\]

The content in water may be estimated from protein content, the value of 3.572 being the free term of the regression equation.

The daily water gain (\(\Delta Wt\)) was obtained deriving equation above, in relation to age:

\[
\Delta Wt[g/zi] = dWt/dt = 0.9814 \times (Pr/Pt) \times At \quad [equation 4]
\]

The report between the slim gain (water + protein) and protein (\(\alpha\)) was correlated with the net weight (Wn), according to \(\alpha\) protein:

\[
\alpha = 7.678 \times Wn^{-0.0752} \quad [equation 5]
\]

The value of 7.678 is the term free of the regression equation.

Burlacu (2006) have established a methodology for calculating this report, based on the total protein, according equation:

\[
\alpha = 9.6716 \times Pt^{-0.14}
\]

The equation proposed in the paper is basic on net weight and the methodology of calculation is easily applied.

The amount of fat retained in the body (body + feather) was calculated according to the mathematical model, based on the equation:

\[
Lt[g] = 0.119 \times Pt^{1.039} \quad [equation 6]
\]

\[
Lr[g/zi] = dLt/dt = 1.039 \times (Pr/Pt) \times Lt \quad [equation 7]
\]

Based on mathematical simulation model of the chemical composition body, the fat content is determined on the basis of protein content through an equation of regression. The content of fat in daily retained (Lr) is important for determining metabolizable energy production.
Conclusions

3.1 The evolution of the net weight may be estimated with the Gompertz functions, based on the net weight since hatching.

3.2 Through mathematical modeling can predict the evolution of body weight chemical composition (in water content, protein and fat), based on protein content from hatching.

References
