INVESTIGATIONS ON THE STRUCTURE, CHEMICAL COMPOSITION AND CALORICITY OF THE QUAIL EGGS, DEPOSITED AT THE PLATEAU PHASE OF THE LAYING PERIOD

Anca Prelipcean (Teuşan)[1*], A.A. Prelipcean[1], V. Teuşan[1]

[1] *University of Agricultural Sciences and Veterinary Medicine Iasi, Romania*

Abstract

From domestic quails, aged 105-112 days and body weight 130-145 grams, which were in the plateau of the laying period, were collected 130 eggs, which were studied in terms of weight and their structure, determining the primary chemical composition and the caloricity of the three components (mineral shell, albumen, yolk) and of the whole eggs. As working methods were used that classical methods of analysis: the oven drying method, calcination method, the Soxhlet - Velp method, Kjeldahl – Velp method, La Roche method; Single Factor ANOVA analisys method [5]. The following results were obtained: The average weight of quail eggs produced in the plateau period of laying was 11.17 ± 010 grams, from which, the mineral shell was 32.94% (3.68 ± 0.04 g). The mineral shell contains 1.32% water 89.75% minerals, 8.64% protein and 0.29% carbohydrates. Albumens of the eggs contains: 87.48% water, 0.82% minerals, 9.91% protein, 0.32% fat and 1.744% carbohydrates. Yolk contains: 49.79% water, 2.16% minerals, 16.64% protein, 29.45% fat and 1.96% carbohydrates. For whole eggs the following containing was found: 68.27% water, 8.27% minerals, 12.03% proteins, 9.72% fats, 1.70% carbohydrates and 46.89 mg carotene. These eggs have a caloricity of 18.772 kcal or 78.596 KJ brute energy (BE).

Key words: caloricity, eggs, quail, chemical composition

INTRODUCTION

Most studies up to this date have shown that man needs in his nutrition important amounts of animal protein. These proteins come from meat, milk and especially poultry eggs. Eggs produced by different species of birds breeds and hybrids contain nutrients (proteins, amino acids, lipids, vitamins, minerals) very valuable and with an almost complete digestibility. Among the many species of poultry, reared and exploited by humans in recent decades, is the Japanese quail (*Coturnix coturnix japonica*) [3], [4]. Domestic quail can produce in a year, at least 350 eggs, with an average weight of 10 -12 grams, which means at least 20 to 22 times its body weight (150 grams) [12]. Quail eggs have a very interesting chemical composition, being rich in fat soluble vitamins and B complex; in proteins, amino acids, macro and microelements, but are low in cholesterol [8], [9], triglycerids and saturated fatty acids [10], [11]. Because of its valuable chemical compositions, quail egg is considered to be a true universal panacea, placed 3rd in the Chinese natural medicine after snake venom and Ginseng [3], [8]. Our research can be placed in this context, which is part of a larger study in which we follow more precise knowledge of the chemical composition, structure and caloricity of quail eggs.

MATERIAL AND METHODS

Materials used in these studies were characterized by great diversity, being able to classify them into two groups, namely non-biological and biological materials. In the first group are the quails and the quail eggs taken from them. Thus, the quail were weighing 130-145 g and aged 105-112 days, they being in the plateau period (curve) of laying. Birds were normally developed, healthy, alert, with intact and specifically

*Corresponding author: anca.teusan@yahoo.com
The manuscript was received: 14.03.2012
Accepted for publication: 26.04.2012

colored plumage and a good appetite. From these quails, 130 eggs were harvested, which have been cleaned, individualized, weighed, measured, after which they were broken to determine their chemical structure and composition. Weight of eggs varied between 8.7 and 16.0 grams, and their size had values of 28-38 mm, for the large diameter (longitudinal) and 23 to 28 mm for small diameter (transverse) [8], [9]. The mineral shells of the eggs were intact, without cracks and other defects and with a specific staining (Fig. 1). The non-biological materials were many and represented by various devices (balances, ovens, Superterm C311 calcination oven; Soxhlet – Velp extractor, Kjeldahl – Velp analysis system, Lumix-DMC photo camera); instruments (calipers, forceps, pipettes, measuring cylinders), devices, equipment, reagents, computers. Among the working methods used include: the oven drying method at 65ºC and 105ºC; calcination method; "La Roche" method; "Soxhlet - Velp" method; "Kjeldahl - Velp" method; regression equations and other mathematical methods [8], [9].

The mineral shell crust was separated from the albumen and yolk (but with the two shell membranes), washed, dried, cooled and finally weighed with a milligram precision. Egg yolk was extracted separately from the mass of albumen, then was measured diameter, height and weighed. The albumen weight was determined by calculation, using the formula: (1) AW = TWE - (MSW + YW), where: AW = albumen weight (g), TWE = total weight of the egg (g) MSW = weight of the mineral shell (g), YW = yolk weight (g). The proportion of the 3 components of the eggs was calculated by the following three mathematical formulas:

(2) $P_{MS}=\frac{MSW \times 100}{TWE}$; (3) $P_Y=\frac{YW \times 100}{TWE}$;

$P_A=\frac{AW \times 100}{TWE}$, where: P_{MS}; P_Y and P_A, is the proportion of mineral shell, the yolk and the albumen (%) [9].

The amount of carotene in egg yolk and from the whole egg was estimated starting from the La Roche color scale notes and then using the relation: (5) $CC_{(mg)}=2 \times nLR +1$, where: CC = amount of carotene expressed in micrograms; nLR = note of color on the "La Roche" scale [10],[11].

The dry substance content (DS) and organic substance (OS) was also determined by calculation, using the following formulas: (6) DS % = 100 – Ut and (7) OS % = DS – Sm, where: Ut = total humidity %; Sm = mineral substances (%) [9]. Carbohydrate content (non-nitrogen extractive substances) (NES) was calculated using the formula: (8) NES % = OS – (BP + BF), where: BP şi BF = brute protein and brute fat (%) [8]. For the whole egg, the primary chemical composition was determined starting from the structure and chemical composition of its three components [8], [9].

The caloricity of quail eggs was calculated using regression equations, using caloricity coefficients for the three categories of organic compounds and the calorigen potential from the chemical content determined in advance. For this purpose we used the formula: (9) BE(kcal) = BP x 5,7 + BF x 9,5 + G x 4,2 , where: BE= brute energy (kcal) and/or the formula: (10) $BE_{KJ}=BE_{Kcal}$ x 4,1868 [8], [9]. All data obtained from weighings, measurements, analysis and calculations were tabulated and statistically computed: mean ($\overline{X}$); standard error of the mean ($s_{\overline{x}}$); standard deviation (s); and coefficient of variation (V %) [5].

RESULTS AND DISCUSSIONS

Our results can be presented and commented on three cognitive poles namely: study results on egg weight and structure; results of their chemical composition and results of their caloricity. Thus, after weighing the 130 eggs studied, we found values between 8.69 and 15.95 grams, their statistical average being 11.17 ± 0.10 g (v = 10.29 %) (Table 1).

Regarding the structure of quail eggs, it is represented by the three major components: mineral shell, egg albumen and yolk, which are not equal as weight or as percentage of whole egg structure [8], [9].

Thus, the mineral shell with the two shell membranes, had weights from 0.36 grams to 1.23 grams and the average statistical values

of the 130 values being 0.009 ± 0.88 g (v = 11.96%) (Table 1). Raported to the whole egg weight, this mineral shell is 6.35% - 9.43%, with a mean of 7.88 ± 0.05% (v = 7.44%) (Table 1) (Fig. 2).

Table 1 Statistics estimators for weight and structure of quail eggs produced during the plateau period of laying

Specification	MU	n	Calculated statistical indicators			Variation limits	
			$\bar{X} \pm s_{\bar{x}}$	s	V(%)	min	max
Weight of whole shell	g	130	11.17±0.10	1.1507	10.29	8.69	15.95
Weight of mineral shell	g	130	0.88±0.009	0.1052	11.96	0.36	1.23
Percent of mineral shell (from TWE*)	%	130	7.88±0.05	0.5861	7.44	6.35	9.43
Albumen weight	g	130	6.61±0.07	0.752	1.37	5.19	9.48
Albumen percent (from TWE*)	%	130	59.18±0.22	2.497	4.23	50.28	68.05
Yolk weight	g	130	3.68±0.04	0.466	12.65	2.74	5.09
Yolk percent (from TWE*)	%	130	32.94±0.21	2.373	7.19	25.45	42.09

*TWE = total egg weight

Regarding the albumen (gross and fluid), it represents the most important constituent of the egg, from a quantitative point of view, having a weight between 5.19 and 9.48 grams, the average of 130 values being 6.61 ± 0.07 grams (v=1.37%) (Table 1).

Reported to the whole egg weight, the albumen weight represents 50.28 – 68.05%, with a mean of 59.18±0.22% (v=4.23%) (Table 1) (Fig. 2). Regarding the yolk, the weight varied between 2.74 and 5.09 grams, with a statistical mean of the 130 obtained values of 3.68 ± 0.04 grams (v=12.65%). The share of yolk weight in the whole egg had values between 25.45% and 42.09%, with a statistical mean of 32.94 ± 0.21 % (v=7.19%) (Table 1). As regards the chemical composition of the three primary components of quail eggs, it was different enough, the values found being very interesting. Thus, the mineral shell with the two membranes have very little water (1.322±0.10%; v=20.52%) and lots of dry substance (98.678±0.10%; v=0.28%) (Table 2).

Table 2 Statistical estimators for the chemical composition of mineral shell, from quail eggs produced in the plateau phase of laying period

Specification	MU	n	Calculated statistical indicators			Variation limits	
			$\bar{X} \pm s_{\bar{x}}$	s	V(%)	min	max
Water	%	8	1.322±0.10	0.271	20.52	1.080	1.180
Dry substances	%	8	98.678±0.10	0.271	0.28	98.32	98.92
Mineral substances	% form shell	8	89.746±0.10	0.278	0.31	89.36	90.12
	% from DS* of shell	8	90.95±0.70	0.191	0.21	90.59	91.12
Organic substances	% form shell	8	8.931±0.07	0.196	2.19	8.76	9.31
	% from DS* of shell	8	9.05±0.07	0.191	2.11	8.88	9.41
Proteins	% form shell	8	8.642±0.13	0.362	4.19	8.15	9.13
	% from DS* of shell	8	8.759±0.13	0.359	4.10	8.24	9.24
Carbohydrates	% form shell	8	0.289±0.08	0.225	77.45	0.01	0.63
	% from DS* of shell	8	0.292±0.08	0.229	79.01	0.01	0.64

*DS = dry substance; **Mineral shell with the two membranes (internal and external)

From the dry substances, the largest percent is represented by minarals. The mineral part of the shell has a average of 89.746 ± 0.1% or 90.95 ± 0.07% from the shell dry substance (v = 0.21 – 0.31%) (Table 2) (Fig. 3). The shell of quail eggs also have

organic substances with a mean of 8.931 ± 0.07% (9.05 ± 0.07% from DS) (v = 2.11 – 2.19%) (Table 2). These organic substances are represented specialy by proteins (8.642 ± 0.13%; 8.759 ± 0.13% from DS) (v = 4.10 – 4.19%) and less by carbohydrates (0.289 – 0.292 ± 0.08%) (Table 2).

Regarding the primary chemical composition of the albumen, the hydric content was very high: 87.48 ± 0.07%, (v = 0.22%), the dry substance quantity being low (12.52 ± 0.07%; v = 1.57%) (Table 3). The albumen is poor in mineral substances, these having an average of 0.824 ± 0.01% (v = 3.35%). Reported to the albumen dry substance, the mineral content has a mean of 6.597 ± 0.08% (v = 3.56%) (Table 3).

Table 3 Statistical estimators for the primary chemical composition of albumen, from quail eggs produced in the plateau phase of the laying perion

Specification	MU	n	Calculated statistical indicators			Variation limits	
			$\bar{X} \pm s_{\bar{x}}$	s	V(%)	min	max
Water	%	8	87.48±0.07	0.197	0.22	87.16	87.84
Dry substances	%	8	12.52±0.07	0.197	1.57	12.16	12.84
Mineral substances	% from albumen	9	0.824±0.01	0.027	3.35	0.78	0.86
	% from DS of albumen	9	6.597±0.08	0.235	3.56	6.23	6.92
Organic substances	% from albumen	9	11.697±0.06	0.183	1.56	11.34	12.00
	% from DS of albumen	9	93.406±0.08	0.235	0.25	93.08	93.77
Proteins	% from albumen	6	9.908±0.17	0.422	4.26	9.60	10.72
	% from DS of albumen	9	79.187±1.54	3.776	4.77	74.75	86.12
Lipids	% from albumen	8	0.0325±0.002	0.005	14.91	0.0245	0.0376
	% from DS of albumen	8	0.259±0.01	0.037	14.25	0.1967	0.2999
Carbohydrates	% from albumen	6	1.744±0.20	0.489	28.05	0.876	2.366
	% from DS of albumen	6	13.91±1.54	3.766	27.09	7.030	18.44

The organic part from albumen has a average of 11.697 ± 0.06%, when is reported at the whole product (liquid) and one of 93.406 ± 0.08%, when reported to the dry substance (v = 0.183 – 0.235%) (Table 3).

From the organic substances in the quail eggs albumen, on the first place are the proteins, found in proportions between 9.60 and 10.72%, with an average of 0.908±0.17% (v=4.26 %) (Table 3). When the reporting is made at dry substance from albumen, the proportion of proteins has a mean of de 79.187 ± 1.54% (v = 4.77%) (Table 3).

The lipids quantity from the eggs albumen is very low, the statistical mean being of 0.0325 ± 0.002% (0.259 ± 0.01% from DS) (v = 14.25 – 14.91%) (Table 3). The quail eggs content in carbohydrates (NES), varied between 0.876% and 2.366%, with a statistical mean of 1.744 ± 0.20% (v = 28.05%). When the reporting was made at dry substance from albumen, the proportion on carbohydrates had a proportion of 13.91 ± 1.54% (v = 27.09%) (Table 3).

Regarding the primary chemical composition of quail eggs yolk, our obtained values show a hydric content between 48.95 and 51.06%, and the mean is 49.789 ± 0.235% (v = 1.42%) (Table 4). The content in dry substances of yolk had a mean of 50.221± 0.235% (v = 1.41%). The minerals from yolk, varied between 1.95% and 2.40%, with a statistical mean of 2.158 ± 0.05 (v = 7.57%) (Table 4). When the reporting was made at the dry substance from yolk, its mineral content had a average of 4.301 ± 0.12% (v = 8.16%) (Table 4).

Table 4 Statistical estimators for the primary chemical composition of quail eggs, produced in the plateau phase of the laying period

Specification	MU	n	Calculated statistical indicators			Variation limits	
			$\bar{X} \pm s_{\bar{x}}$	s	V(%)	min	max
Water	%	9	49.789±0.235	0.706	1.42	48.95	51.06
Dry substance	%	9	50.221±0.235	0.706	1.41	48.94	51.05
Mineral substances	% from yolk	9	2.158±0.05	0.164	7.57	1.95	2.40
	% from DS of yolk	9	4.301±0.12	0.351	8.16	3.87	4.80
Organic substances	% from yolk	9	48.063±0.26	0.769	1.60	46.73	48.79
	% from DS of yolk	9	95.699±0.12	0.351	0.37	95.20	96.13
Proteins	% from yolk	6	16.643±0.04	0.096	0.58	16.555	16.796
	% from DS of yolk	6	32.894±0.062	0.153	0.47	32.666	33.076
Lipids	% from yolk	8	29.451±051	1.442	4.90	27.16	31.017
	% from DS of yolk	8	58.476±0.87	2.467	4.22	55.50	61.49
Carbohydrates	% from yolk	6	1.964±0.56	1.370	69.92	0.458	3.725
	% from DS of yolk	6	3.875±1.107	2.713	70.03	0.8919	7.3776

The proteic content of yolk from the quail eggs was sizeable, having values between 16.555% and 16.796%, with a statistic mean of 16.643±0.04% (v = 0.58%) (Table 4). When the reporting was made at the dry substance from yolk, the protein percentage varied between 32.666% and 33.076%, with a statistic mean of 32.894±0.062% (v = 0.47%) (Table 4). The yolk content in lipids is higher than the proteins content. Thus, our analyses have revealed the existence (in yolk) of a lipidic content of 27.16 – 31.017%, with a statistic mean of 29.451±0.51% (v = 4.90%) (Table 4). Reported to the dry substances from yolk, the lipidic content had a average value of 58.476±0.87% (v = 4.22%) (Table 4). Regarding the carbohydrates content from quail eggs yolk, this is low, with values between 0.46% and 3.72%, with a statistical mean of 1.964±0.56% or 3.875±1.1% from DS (Table 4).

Table 5 The primary chemical composition of quail eggs, produced in the plateau phase of laying period

Specification	MU	The components of the egg			Whole egg*
		Mineral shell	Albumen	Yolk	
Water	%	1.322	87.48	49.789	68.270
Dry substance (DS)	%	98.678	12.52	50.221	31.730
Mineral substances	% from the product itself	89.746	0.824	2.158	8.270
	% from the DS of product	90.950	6.597	4.301	12.490
Organic substances	% from the product itself	8.931	11.697	48.063	23.460
	% from the DS of product	9.050	93.406	95.699	87.52
Proteins	% from the product itself	8.642	9.908	16.643	12.03
	% from the DS of product	8.759	79.187	32.894	58.38
Lipids	% from the product itself	-	0.0325	29.451	9.72
	% from the DS of product	-	0.259	58.476	19.42
Carbohydrates	% from the product itself	0.289	1.744	1.964	1.70
	% from the DS of product	0.292	13.910	3.875	9.53
Carotene	mg/gram yolk	-	-	12.754	-
	mg/egg*	-	-	-	46.89

Knowing the structure of quail eggs and the chemical content of the three parts, we have calculated the whole egg content, the results being shown in Table 5. Thus, the hydric content of the whole egg was 68.27%, and the dry substance content was 31.73%.

The mineral part of these eggs amounted to a level of 8.27% from the product itself, and

12.49% from the dry substance of the whole egg (Table 5). The organic part from the whole eggs have a medium value of 23.46% (87.52% from DS) and includes proteins, lipids and carbohydrates. Thus the proteic content was 12.03 % from the egg and 58.38% from the dry substance of the egg (Table 5). The lipidic content from the whole quail egg was 9.72% (19.42% from DS), and the carbohydrat content had a average value of 1.70% (9.53% from DS) (Table 5).

The carotene content of yolk had a value of 12.754 micrograms per yolk gram, and for the whole egg (with a average weight of 11.170 grams), the estimated content was 46.89 micrograms (Table 5).

Regarding the quail eggs caloricity, produced in the plateau phase of the laying period, the data obtained are very interesting. First, we affirm that the quail egg with a weight of 11,17 grams has a content of: 7.626 grams water, 1.086 lipids and 0.190 carbohydrates (Table 6). From the entire proteine quantity of the egg (1.344 g), 48.74% are found in albumen; 45.58% in yolk and 5.66% in the mineral shell. From the entire lipidic quantity (1.086 g), 99.82% are found in yolk, and only 0.18% in albumen (Table 6).

The caloricity of the quail eggs was calculated and expressed in kilocalories (kcal), but also in kilojouli (KJ)(Table 7), as brute energy (BE).

Thus, the energetic content of these quail eggs was estimated to be 168.051 kcal BE/100 grams egg mass, or 557,282 kcal BE/100 grams egg dry substance, and if we express it in KJ, we have 703,596 KJ/100 g egg mass, or 2333,229 KJ/100 g egg dry substance (Table 7).

Table 6 The hydric, mineral and organic content of the parts and whole quail eggs, produced in the plateau phase of the laying period

Specification	The components of the egg*						Whole egg*	%
	Mineral shell** (g)	%	Albumen	%	Yolk	%		
Water	0.0116	0.15	5.7824	75.83	1.8322	24.02	7.625	100
Dry substance (DS)	0.8684	24.50	0.8276	23.35	1.8481	52.15	3.544	100
Mineral substances	0.7898	85.50	0.0545	5.90	0.0794	8.60	0.923 8	100
Organic substances	0.0786	3.00	0.7732	29.51	1.7687	67.49	2.620	100
From which: proteins	0.0761	5.66	0.6549	48.74	0.6125	45.58	1.343	100
lipids	-	-	0.0021	0.18	1.0838	99.82	1.085	100
carbohydrates	0.0025	1.31	0.1153	60.72	0.0723	38.07	0.189	100

* quail egg with a average mass of 11,170 grams; ** mineral shell with membranes

Table 7 The caloricity of quail eggs, produced in the plateau phase of the laying period

Chemical components	Chemical content			Caloricity coefficient	Brute energy (BE)			
	g/100g egg mass	g/100g DS whole egg	g/egg**		Kcal/100g egg mass	Kcal/100g DS* whole egg	KJ/100g egg mass	KJ/100g DS* whole egg
Proteins	12.03	58.38	1.3438	5.70	68.571	332.766	287.093	1393.225
Lipids	9.72	19.42	1.0857	9.50	92.340	184.490	386.609	772.423
Glucides	1.70	9.53	0.1899	4.20	7.140	40.026	29.894	167.581
Total	23.45	87.33	2.6194	-	168.051	557.282	703.596	2333.229

The three parts of the quail egg, with a different chemical composition, the caloricity is also different. Thus, the mineral shell is the most poor in energy, it contains, in our calculations 3.977 kcal (16.652 KJ) BE for 100 grams egg mass and only 0.4443 kcal (1.8601 KJ) in a egg with a average weight of 11.170 grams (Table 8).

Table 8 The caloricity of the components and the whole quail eggs, produced in the plateau phase of the laying period

The eggs components	Brute energy at 100 grams egg				Brute energy in one egg with a mass of 11.170 grams			
	Kcal	%**	KJ	%**	Kcal	%**	KJ	%**
Mineral shell*	3.977	2.37	16.652	2.37	0.4443	2.37	1.8601	2.37
Albumen	37.933	22.57	158.819	22.57	4.2371	22.57	17.7400	22.57
Yolk	126.150	75.06	528.167	75.06	14.091	75.06	58.9962	75.06
Whole egg**	168.060	100.00	703.638	100.00	18.7724	100.00	78.5963	100.00

This quantity of brute energy contained in the mineral shell represents 2.37% from the total energy of the egg. The albumen, being poor in lipids and rich in water, has a energetic value of 37.933 kcal BE/100 grams egg mass, or 4.237 kcal (17.740 KJ) in a egg with a average mass of 11.170 grams. This represents 22.57% from the total (Table 8). Regarding the yolk, this is the richest in lipids and proteins, has a high energetic value of 126.15 kcal BE/100 g egg mass, or 528.167 KJ/100 g egg mass. In the quail eggs produced in the plateau phase of the laying period (with a average weight of 11.170 g), the yolk contains 14.091 kcal (58.996 KJ) BE, which represents 75.06% from the entire egg energy, that is 18.772 kcal (78.596 KJ) BE (Table 8).

Because the three categories of organic substances (proteins, fats and carbohydrates) exist, in quail eggs, in different proportions, and because their calorigen potential it is also different, we calculated their energetical potential from the whole egg. Thus, the proteins from these eggs have an energetic potential of 68.571 kcal BE, which represents 40.80% from total egg (168.051 kcal BE); the fat substances have an energetical potential of 92.340 kcal BE, which represents 54.95% from total egg, and the carbohydrates contribue with 7.140 kcal BE which means 4.25% from total energetical potential of the quail egg din totalul energetic al oului de prepeliţă (Table 9).

Table 9 The share of the three chemical components in the total caloricity of the quail eggs, produced in the plateau pahse of the laying period

Chemical components with energetic potential	Brute energy (BE) expressed:			
	at 100 g egg mass		At 1 egg of 11.170 grams	
	kcal	%	kcal	%
Proteins	68.571	40.80	7.660	40.81
Lipids	92.340	54.95	10.314	54.94
Carbohydrates	7.140	4.25	0.798	4.25
Total organic substances	168.051	100.00	18.772	100.00

CONCLUSIONS

1. The quail eggs produced in the plateau phase of the laying period, with a weight of 11.170 grams have the following structure: 7.88% minerall shell; 59.18% albumen and 32.94% yolk.

2. The mineral shell of these eggs contain: 1.32% water; 89.75% mineral substances; 8.64% proteins and 0.29% carbohydrates.

3. The albumen of these eggs contain: 87.48% water; 0.82% mineral substances; 9.91% proteins; 0.033% lipids and 1.74 carbohydrates.

4. The yolk of these quail eggs contain: 49.79% water; 2.16% mineral substances; 16.64% proteins; 29.45% lipids and 1.96% carbohydrates.

5. The whole quail eggs, produced in the plateau phase of the laying period contain: 68.27% water; 8.27% mineral substances; 12.03% proteins; 9.72% lipids; 1.70% carbohydrates and 46.89 mg carotene.

6. The caloricity of these eggs is 168.051 kcal BE/100 grams egg mass or 703.596 KJ BE/100 g egg mass.

7. The quail eggs produced in the plateau phase of the laying period with an average

mass of 11.170 grams, contain 18.772 kcal BE (78.586 KJ), from which: 2.37% from the mineral shell; 22.57% from albumen and 75.06 % from yolk.

8. From the total caloricity of quail eggs (18.772 kcal), with a average mass of 11.170 grams, 40.80% are from proteins; 54.95% are from lipids and 4.25% from carbohydrates, these confirms that the quail eggs are very balanced not just energetically.

ACKNOWLEDGMENTS

This paper was cofinanced from the *European Social Fund through Sectoral Operational Programme Human Resources Development* 2007 – 2013, project number POSDRU/89/1.5/S/62371 "Postdoctoral schole in Agriculture and Veterinary Medicine Area".

REFERENCES

[1] Bălăşescu, M.; Micloşanu, Elena, 2001, *Creşterea prepeliţelor, o afacere profitabilă*, Pub. Fermierul, Bucureşti, aprilie, nr.102

[2] Hartmann, C.; Stranberg, F.; Razdhmer, L.; Johfansson, K., 2000, *Egg composition and material effects on hatchling weight*, XXI Worlds Poultry Congress, Montreal, august, 20 – 24, Canada

[3] Polen, T.; erman, V, 2007, *Sfaturi utile despre creşterea prepeliţelor*, Colecţia Rev. Ferma, Editura Worldpress, Timişoara

[4] Roşu, G, 2003, *Creşterea şi exploatarea prepeliţelor: hobby, satisfacţie, sănătate*, Rev. de Zootehnie şi Medicină Veterinară nr.2, Bucureşti

[5] Sandu, Gh., 1995, *Metode experimentale în Zootehnie*, Editura Coral-Sanivet, Bucureşti

[6] Teuşan, Anca; Vacaru-Opriş, I., 2008, *Aspecte privind unii indici morfologici ai ouălor de prepeliţă domestică (Coturnix coturnix japonica)*, Lucr. Ştiinţ. Stud. USAMV Iaşi,

[7] Teuşan, Anca; Vacaru-Opriş, I.; Teuşan, V., 2008, *Aspects regarding some morphological values of the domestical quail eggs*, Lucr. Ştiinţ. Seria Zootehnie, USAMVB Timişoara, vol. 41 (1,2), ISSN 1221-5287, pg. 709-716

[8] Teuşan (Prelipcean), Anca, 2010, *Contribuţii la cunoaşterea calităţilor de incubaţie ale ouălor de prepeliţă (Coturnix coturnix japonica) şi a dezvoltării embrionare la această specie*, Teză de Doctorat, USAMV Iaşi, Facultatea de Zootehnie

[9] Teuşan (Prelipcean), Anca; A.A. Prelipcean; V. Teuşan, 2011, *Research regarding the structure, chemical composition and caloricity of quail eggs (Coturnix coturnix japonica), depozited at the beginning phase of laying*, Lucr. Ştiinţ. USAMV Iaşi, Seria Medicină Veterinară

[10] Vacaru-Opriş, I. şi col., 2000; 2007, *Tratat de Avicultură*, vol. I, Editura Ceres, Bucureşti

[11] Vacaru-Opriş, I. şi col., 2002, *Tratat de Avicultură*, vol. II, Editura Ceres, Bucureşti

[12] Van. I; Marin, Gh.; Cofas, Vl.; Damian, A.; Covaşă, Ana-Maria; Custură, Dana, 2003, *Creşterea prepeliţelor domestice pentru carne şi ouă*, Editura Ceres, Bucureşti.