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Economic analysis of meat production from two types of Domestic quails

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Abstract. *There are two types of Japanese quails, reared in Europe – dual-purpose and meat. The aim of the present study was to made an economic analysis of fattening quails from the dual-purpose and heavy production types. Three groups were formed – group 1 (dual-purpose), groups 2 and 3 (heavy type), reared in cages. After quails sexing on the 16th day of age, there were formed six subgroups: 1m, 1f, 2m, 2f, 3m and 3f. Fattening period lasted until 35 days of age. For revenues calculation produced meat and edible offal data per m^2, were used. Costs calculation include consumed feed for the period, day-old quail, and other costs. The main production costs were associated with feed and day-old quails: from 80.3 and 82.6% of all costs in the studied groups. The anticipated revenues from produce in group 2 were 10 EUR/m^2 higher than those in group 1, and for group 3 – 10.21 EUR/m^2 higher than group A. The results indicate that meat type quails fattening is the most economically efficient in quail meat production. Producing quail edible offal is still not developed but could be beneficial for efficiency of quail fattening small farms.*

Keywords: Japanese quail, fattening, quail meat, production cost

Introduction

Domestic quails (*Coturnix japonica domestica*) are used as a farm animal for meat and eggs production (Genchev, 2014; Lukanov, 2019). They are also popular as a song, ornamental, fighting, and laboratory birds (Lukanov et al., 2018). Domestic quails have very good laying capacity, they could lay more than 250 eggs per year (Lucotte, 1974; Mandal et al., 1994; Lofti et al., 2012). They are the domestic animal with an earliest sexual maturing, with average age of sexual maturity onset of 38-42 days (Mizutani, 2003). Depending on live weight and productive direction, there are three types of quails: light (egg), dual-purpose (egg-meat) and heavy (meat) type. The light type is farmed mainly in Asia and Africa for egg production. Dual-purpose quails are used mainly in Europe and Brazil as layers. Meat type quails are involved in the global quail meat production, which is concentrated mainly in the European Union (Spain, France, Italy and Portugal) and the USA (Da Cunha, 2009; Lukanov, 2019). Quail meat could be produced from light and dual-purpose birds, it comes from males after sexing and culled females. In fact, most of the worldwide quail meat production comes from such birds, slaughtered annually in China and Brazil (Da Cunha, 2009; Betrechini, 2012).

The aim of the present study was to make an economic analysis of fattening quails from the two production types: dual-purpose and meat-type.

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Material and methods

Experimental design

The study was carried out in the Experimental base of the Poultry Breeding Unit, Department of Animal Science - monogastric and other animals, Faculty of Agriculture, Trakia University. Japanese quails from two production types were used: dual-purpose (group 1) and meat-type (groups 2 and 3). The heavy type quails comprised two genotypes: group 2 and group 3. The experimental design included two stages related to the potential for sexing of quails. In the first stage, 120 one-day-old quails from each group were housed and monitored until 16 days of age. Then, birds were sexed on the basis of plumage colour in the anterior chest region and at 16 days of age birds from each group were weighed. Thirty-three male and female quails with average live weight for each of the groups were selected and monitored from 16 to 35 days of age. During that period, six subgroups were formed – subgroup 1 males (1m), subgroup 1 females (1f), subgroup 2 males (2m), subgroup 2 females (2f), subgroup 3 males (3m) and subgroup 3 females (3f).

Quails were reared in cages according to animal hygiene requirements of the species. The compound and nutritional value of feeds is present in Table 1.

Table 1. Gross composition of quail diets

Feed ingredients, %	Starter 1-14 days	Grower 15-21 days	Finisher 22-35 days
Maize	30	34	38
Wheat	26	22.65	2.67
Fish meal, 72%	3.2	1	0
Sunflower meal, 37%	8	8	8
Soybean meal, 48%	28	27	27
Sunflower oil	1	2.96	2.96
Dicalcium phosphate	1.5	1.75	1.7
Calcium carbonate	1.2	1.5	1.45
L-Lysine, 98%	0.25	0.19	0.26
DL-Methionine, 99%	0.1	0.15	0.13
Vitamin & mineral premix 4PS*	0.5	0.5	0.5
Salt	0.25	0.3	0.3
Chemical composition			
Metabolisable energy, MJ/kg	12	12.1	12.4
Crude protein, %	23.9	21.03	18.1
Crude fiber, max %	4.21	4.67	4.42
Calcium, %	1	1.1	1
Available phosphorus, %	0.46	0.45	0.41
Lysine, %	1.45	1.15	1
Methionine, %	0.46	0.5	0.43
Methionine + cysteine, %	0.78	0.85	0.75

*Contain: Vitamin A: 2400000 IU/kg; Vitamin D3: 500000 IU/kg; Vitamin E: 6000 mg.kg; Vitamin K3: 400 mg/kg; Vitamin B1: 400 mg/kg; Vitamin B2: 1000 mg/kg; Vitamin B6: 700 mg/kg; Vitamin B12: 3 mg/kg; Vitamin PP: 7000 mg/kg; di-calcium pantetoate (vit. B5): 2000 mg/kg; Folic acid: 150 mg/kg; Choline chloride: 80000 mg/kg; Biotin: 12 mg/kg; Fe: 7200 mg/kg; Mn: 16000 mg/kg; Cu: 1000 mg/kg; Zn: 11000 mg/kg; Co: 60 mg/kg; J: 200 mg/kg and Se: 40 mg/kg.

Monitored parameters

The live weight at 35 days of age was monitored individually using analytical balance CB2000 with precision of 0.1g. Feed intake was registered as a total basis per group.

The slaughter analysis was done by using the detailed protocol of Genchev and Mihaylov (2008). Twelve birds from all six subgroups (1m, 1f, 2m, 2f, 3m and 3f) with weight average were selected and used for the slaughter analysis. Skinless carcasses were weighed with accuracy 0.01g on KERN EMB 200 balance. The edible offal (neck, heart, gizzard and liver) and testes/ovary were also weighed.

A comparative economic analysis of produce from each subgroup was performed. For calculations, the national and international retail markets of products were investigated and values were averaged. All prices are given in Euro (€) for the sake of universality.

Statistical analysis

All data were analysed with Statistica 13.0 software (Statistica for Windows; Stat-Soft, 2015). Mean (x) and standard error of mean (SEM) values were calculated for each subgroup. The differences were considered statistically significant at $p<0.05$, using Student's t-test, if the data were normally distributed. For the economic analysis MS Excel 2013 was used.

Results and discussion

Figure 1 shows the live body weight and the carcass weight of the six subgroups at the end of the experiment. The highest average live weight by the end of the fattening period was found out in group 2m, and the lowest – in group 1m: 207.50±1.41 g and 161.17±0.95 g, respectively ($p<0.001$). Our data are comparable with those of Bahnas et al. (2009), Sarı et al. (2011) and Narinc et al. (2013) for dual-purpose quails and of Genchev (2014) for heavy type Japanese quails. Other authors reported lower live body weight in dual-purpose quails (Djiuvinov and Mihailov, 2005; Sahin et al., 2008; Bonos et al., 2010) or higher live body weight in meat type quails (Minvielle, 2002; Karthika and Chandirasekaran, 2016; Vargas-Sánchez et al., 2018). These differences are related to a distinct genotype of the quails used. The final live weight of the male and female dual-purpose quails (groups 1m and 1f) shows statistically significant differences than those of the heavy type subgroups ($p<0.001$). Males of the heavy type subgroups show tendency of higher body weight than female subgroups ($p>0.05$). Whereas in the dual-purpose type, there is a higher live weight in females than in males ($p<0.001$).

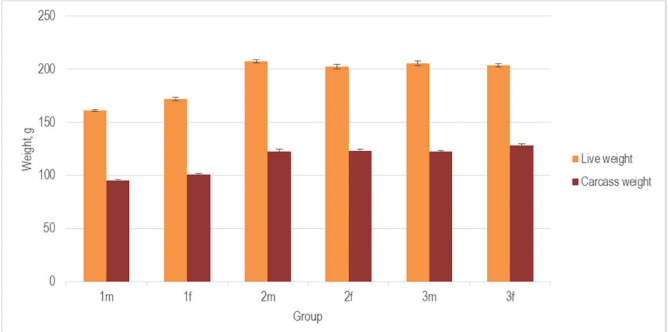

Figure 1. Live weight and carcass weight of the quails

The average carcass weight varied between 95.08±1.22 g (subgroup 1m) and 128.61±1.28 g (subgroup 3f) with good conformation for both productive types. Similar results for the skinned quail carcass weights as carcass yield were reported (Genchev et al., 2008; Mahaparta et al., 2016; Genchev et al., 2018). Meat type quails showed more muscled carcasses than the dual-purpose type. Average female carcass weights were significantly higher than those in the reciprocal male subgroups ($p<0.01$), which cannot be linked to the live body weight tendency.

Feed consumption per bird for the entire fattening period varied from 637 g (subgroup 1m) to 752 g (subgroup 3f) (Figure 2). The most efficient feed transformation showed meat type subgroups (from 3.52 g feed for g body weight in subgroup 2m to 3.68 g feed for g body weight in subgroup 3f). Dual-purpose male and female subgroups presented higher needs for feed for production of one g body mass, 3.95 g and 3.88 g feed for g body weight, respectively. Our data are in agreement with those presented by Bahnas et al. (2009) and higher than other available (Bonos et al., 2010; Inci et al., 2015). Figure 2 showed total feed consumption by subgroups and the share of the different feed phases. It could be summarized that dual-purpose quails, used in this experiment, consumed 159 g starter, 150.5 g grower and 343 g finisher phase of compound feed. Meat type quails consumed 200 g of starter feed, 213 g grower feed and 322.75 g of finisher feed total.

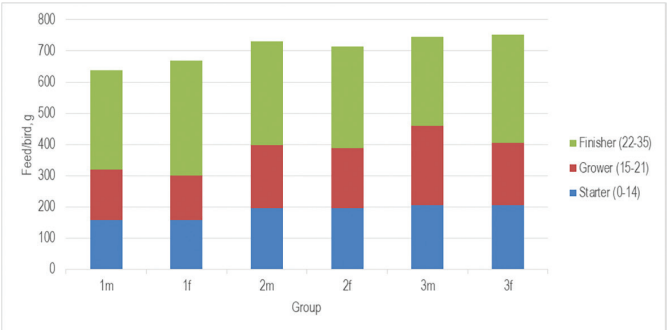

Figure 2. Feed consumption (g/bird)

Survival rate has direct effect on the economical results of the quail farms. All groups showed good survival rate, between 94.2% (group 1) and 96.6% (group 3) for the tested period. Mortality cases were registered only during the starter period of the quail fattening, where the most important feed costs are less, than those in the other grower and finisher phase. Nanda et al. (2015) reported similar results for the survival rate of fattening quails until 35 days of age.

Table 2 presents estimates of revenues and costs, and the possible profitability that could be achieved from rearing quails from the three populations for meat. In the results calculated, the mortality reported in each group was taken into account. It should be noted that economic results can vary substantially depending on the fattening system – in cages or on floors and the market situation. In our case, the most popular technology of quail farming (in cages) was used. The results suggested that the highest amount of meat from m^2 could be produced from fattening female golden strain quails (subgroup 3f) – 10.29 kg, and the lowest amount – from males of group 1 (subgroup 1m) – 8.56 kg. If sex was disregarded, the largest amount of meat could be obtained from group 3 (10.04 kg per m^2), followed by group 2 (9.84 kg per m^2), and the least amount - from group 1 (8.82 kg per m^2). Marketing quail carcasses with skin increases their mass by about 5% (Genchev et al., 2008). Expectedly, quails from the heavy meat type yielded more produce per m^2 compared to light dual-purpose birds. Compared to group 1, marketing of meat could bring 7.16 EUR/m^2 more from group 2 and 8.58 EUR/m^2 more from group 3.

The last rows of Table 2 are the most important part of the economic analysis of meat production from the three genotypes in a cage rearing system. They show that the expected revenues range significantly from 1.66 to 14.62 EUR/m^2, depending on the sex and production type. The corresponding figures show that the expected revenues of produce from group 2 are 10 EUR/m^2 or 370.37% more vs the dual-purpose type (group 1), while the produce from group 3 is 10.21 EUR/m^2 or 378.35% more compared to group 1.

If edible offal (liver, heart, neck, gizzards) could be produced and sold, revenues from each group could be almost reciprocally increased. These are market niches that are still not developed but could be beneficial for the efficiency of quail fattening farms. The realization of these additional slaughter products could give additional revenues from 1.81 to 2.16 EUR/m^2, depending on the fattened genotype. Testes are an interesting culinary product (Montagné, 1938) whose potential could be used in fattening male quails. The average testicular mass of males in the three groups is 3.48 g, which is 1.87% of the live weight. Dual-purpose type males (group 1m) show the best development of the testicles ($p<0.001$), with an average mass of 4.1 g and a relative proportion of 2.5%, which equates to about 0.37 kg of testicles produced per square meter. Another valuable product could be quail manure and/or biogas produced from it (Oyewole, 2010; Onursal et al., 2011; Elasri et al., 2016).

The structure of costs shows clearly that main expenditures were associated to feed and day-old quails – between 80.3 and 82.6% of all costs in the six subgroups. This is confirmed by similar studies (Siddique and Mandal, 1996; Chitrambigai et al., 2016; Sathia et al., 2017). The most variable are “miscellaneous” costs, as they are highly influenced by the labour market, farm size, electricity price, the use or not of alternative fuel for heating, the production system, etc. In our analysis, other costs amounted to 0.7 EUR/kg live weight equal to live weight per m^2.

Table 2. Economic analysis of profitability of quail meat production from the three evaluated genotypes

Parameter		Subgroup					
		1m	1f	2m	2f	3m	3f
Birds per m^2	n	90	90	80	80	80	80
Produced meat per m^2	kg	8.56	9.07	9.80	9.87	9.79	10.29
Produced meat per m^2	%	100.00		+11.60		+13.90	
Revenues							
Produced meat/m^2	EUR*	59.90	63.52	68.63	69.10	68.56	72.02
Whole carcass price/unit	EUR	0.67	0.71	0.86	0.86	0.86	0.90
Edible offal/m^2	EUR**	1.81	2.02	2.12	2.16	1.76	1.99
Total revenues/m^2	EUR	61.72	65.54	70.75	71.26	70.31	74.01
Total revenues/m^2	%	100.00		+11.60		+13.42	
Costs							
Feed/m^2	EUR	25.80	27.04	26.33	25.72	26.89	27.08
Day-old quails/m^2	EUR	23.80	23.80	20.85	20.85	20.68	20.68
Miscellaneous costs***/m^2	EUR	10.45	10.96	11.57	11.30	11.55	11.64
Total costs/m^2	EUR	60.05	61.80	58.75	57.87	59.11	59.39
Total costs/m^2	%	100.00		-4.30		-2.75	
Projected profit							
Projected profit per m^2	EUR	1.66	3.74	12.00	13.39	11.20	14.62
Projected profit per m^2	EUR	2.70		12.69		12.91	
Projected profit per m^2	%	100.00		+370.37		+378.35	

1 EUR = 1.09 USD (2020.01.22); *wholesale price of 7 EUR/kg; **expected prices; ***electricity, remuneration, depreciation of equipment, slaughterhouse costs, etc.

Less revenue could be realized from fattening male birds than from females. This comes from the poorer feed conversion, especially during the last week related to sexual maturity. That is why the marketing of male broiler quails at a younger age, e.g. about 28-30 days of age without the skin could be investigated. For this reason, the possibility of automating the quail skin removing process must be explored. While culled females could be fattened until the 6th week of age marketed with the skin. Thus, the efficiency of meat production would increase and two different products could be offered: carcass without skin and carcass with the skin.

Conclusion

In conclusion, under the used experimental conditions, the fattening of quails from the light dual-purpose type was less economically efficient than that of heavy quails. Some products as edible offal and manure could be used as an additional source of revenue for the quail farms.

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