Comparative Study on Productive Performance of Domestic Rabbit Hybrids in Different Feeding Systems

Marioara Nicula –Neagu[1*], Ioan Peț[1], Lavinia Ștef[1], Pătruică Silvia[1], Dorel Dronca[1], Mirela Ahmadi[1], Erina Silvia[1], Adela Marcu[1], Calin Julean[1], Iasmina Savescu[1]

[1]*University of Life Sciences "King Mihai I" from Timisoara, Calea Aradului, 119, 300645-Timisoara, Romania*

Abstract

The aim of our study was to establish the existence of differences, but also the size of the differences in terms of bioproductive indices during the growing-fattening period and the meat quality of the F1 domestic rabbit hybrids obtained from ♀Californian x ♂ German Giant that were fed with two different diets after weaning: diet 1-commercial feed (20%) + a concentrates mixture (80%) and diet 2-commercial feed exclusively (100%).

Our findings were: a better growth rate recorded by F1 ♀Californian x ♂German Giant individuals belonging to group 2 during the period 1-60 days, which then decreases until 120 days of ages; significant differences regarding the average daily gain of the rabbits in the two groups during 1-60 days of life, in favor of those fed with pellets; insignificant differences between the individuals of the two groups regarding the chemical meat composition and the commercial characteristics of the carcass; similar productive performance ($p \geq 0.05$) between the experimental groups when replacing part of the pellets with a concentrated mixture compared to feeding exclusively with pellets; higher but insignificant proportion of abdominal fat deposits in individuals fed exclusively with pelleted feed.

Keywords: bioproductive indices, feed, meat chemical composition, rabbits

1. Introduction

Rabbit production is a branch of animal husbandry that lends itself to any exploitation system [1], being able to be practiced in all areas, regardless of altitude or pedo-climatic conditions [2], contributing to raising the income of those who deal with this activity.

Feed is an important aspect of rabbit's production because the cost of commercial feeds usually accounts for about 70 percent of production costs (Ramchurn and Dullull, (2001) [3]; Maertens and Gidenne (2016) [4]).

Most domestic rabbits are given a commercial feed that provides essential nutrients. However, some rabbit farmers prefer to formulate, or home make, their own rabbit ration precisely to reduce the cost of feed. On the other hand, commercial feed provides the required nutrients into a small volume, but is the opposite of the rabbit's natural diet.

Based on this consideration we tried to establish the existence of differences, but also the size of the differences in terms of bioproductive indices during the growing-fattening period and the meat quality of the F1 domestic rabbit hybrids obtained from ♀Californian x ♂ German Giant that were fed with two different diets: commercial pellets 80% replaced with an own concentrates mixture and 2. commercial pelleted feed exclusively.

2. Materials and methods

The research was carried out in a rabbit micro farm from Timis county located 45° 50' 24.5616" N and 21° 18' 46.6236" E in the west of Romania.

* Corresponding author: Nicula-Neagu Marioara
Tel. +40722276322; Email: mnicula@animalsci-tm.ro

Animal and housing

The biological material in the experiment consisted of domestic rabbits from the Californian (CAL) breed as maternal form and German Giant (UGG) breed, as the paternal form that were used to obtain the F1 hybrid generation (Figure 1).

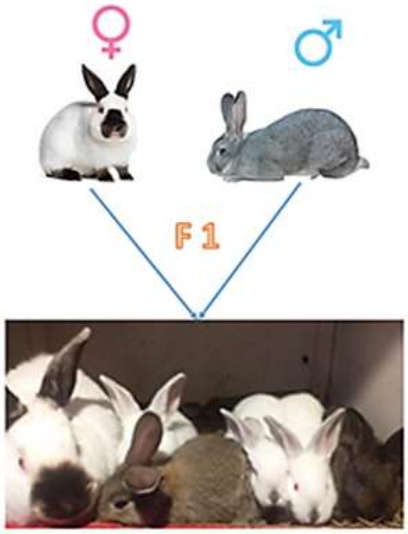

Figure 1. Breeding scheme for obtaining the F1 generation - F1 ♀CAL x ♂UG

Animal feeding

F1 ♀CAL x ♂UG rabbits resulted from two litters were used to constitute 2 groups that benefited of the same housing conditions, in conventional wooden cages and provided with both calving and for individual compartments. Rabbits were fed with different rations after weaning: G1. commercial pelleted feed (20%) to which a concentrates mixture has been added (barley - 50%, corn-15%, sun flower seed-15%), G2. commercial feed exclusively (100%) (Figure 2). All animals had an ad-libitum access to diets and fresh water.

Figure 2. Diet 1-concentrates mixture+pellets

Diet 2-commercial feed

Chemical analyses on diet and meat sample

Dry matter DM was done by heating the samples (5 g) in an oven at 105^{O}C for 5 hours, the loss of weight being considered water and the residue DM.

Kjeldahl's method was used for crude protein determination, Soxhlet's method for crude fat determination, and ash was obtained by burning the sample at 600ºC for 5-6 hours.

According to producers, commercial feed had 15.1% crude protein (CP), 3%, crude fat (CF) 15%, crude fiber (CF), 8%, ash, 1.2% calcium, 0.65% phosphorus (Table 1) and 10.9 MJ/kg calculated digestible energy (DE).

Chemical analyses performed on own concentrates mixture, revealed follow values: 12.7% crude protein (CP), 5.7%, crude fat (CF) 10.75%, crude fiber (CF), 3.62%, ash, 1.1% calcium and 0.53% phosphorus, and a 13.28 MJ/kg calculated digestible energy (DE).

The meat samples (back, hip, and thigh) collected for the laboratory chemical analysis had a weight of approximately 200 g each. The laboratory samples were packed in plastic bags and kept until the next day at a storage temperature of 2ºC.

Treatments

Usual prophylactic treatments - antiparasitic and vaccines against Myxomatosis and hemorrhagic disease were periodically administrated to rabbits.

Periodic weighing (first day of life, 60 days, 90 days and 120 days) were done using an electronic scale.

Statistical analysis

The statistical interpretation of the results was done with the SPSS statistical program, using the non-parametric Man-Whitney U test.

3. Results and discussion

Table 1 and table 2 show the growing-fattening indices obtained.

Thus, Mann - Whitney U test used for the statistical interpretation of the recorded data, highlights the existence of significant differences ($p<0.05$) between the two litters only at parturition; after which these differences are reduced, becoming insignificant ($p>0.05$) at the age of 120 days, when the growth rate has decreased for both groups and as such, the average body mass of the hybrids does not exceed that of the parental breeds (Table 2).

Table 1. Statistical indices regarding the variable body weight of the rabbits in the 2 groups during growing-fattening period (g)

	Day 1	Weaning (60 days)	90 days	120 days
G1 (♀CAL x ♂UG) - concentrates mixture + pellets				
S	428	10780[a]	16960[a]	21500[a]
X	61.16	1540	2423	3071
SD	1.069	60.82	70.40	138.73
G2 (♀CAL x ♂UG) - pellets				
S	440	11180[a]	17550[a]	22130[a]
X	63	1598	2507	3161
SD	1.34	69.21	88.26	117.39
p	<0.05	p>0.05	p>0.05	p>0.05

The statistical analysis of the values obtained establishes the existence of significant differences for the average daily growth variable recorded by the individuals of the two litters ($p<0.05$) in the period 1-60 days, in favor of G2. In the period 60-120 of days, differences obtained place the G2 individuals slightly above the G1 (Table 2).

Table 2. Statistical indices regarding the variable average daily gain of the rabbits in the 2 groups during parturition-fattening period (g)

	1-60 days	60-90 days	90-120 days
G1 (♀CAL x ♂UG) - concentrates mixture + pellets			
S	177[a]	206.01[a]	151.32[a]
X	25.29	29.43	21.61
SD	0.43	0.53	2.94
G2 (♀CAL x ♂UG) - pellets			
S	183.66[a]	212.34[a]	152.67[a]
X	26.23	30.33	21.81
SD	0.86	0.90	1.69
p	p<0.05	p>0.05	p>0.05

Compared to our results, Bucătaru (2002) [5] and Bucătaru and Maciuc (2005) [6], indicate an intense growth rate between 20 days of life and 3 months in the Californian breed, in which the average daily gain was 40 g; after this age, the growth rate decreases, with animals gaining only 16 g/day. Hence the recommendation that

slaughter be done at 3 months. In other breeds, the recorded daily gain is between 23-27 g/day.

Mardari (2018) [7], states that the greatest increase is registered by the young rabbit of the California breed between 30-60 days of life of 31.6-33.5 g/day.

Bura (2012) [8], reports the growth parameters in rabbits from three pure breeds and 2 domestic hybrids, which achieved average daily gains of 16.18-17.99 g/day/head during 1-30 days, and 28.87-32.05 g/head/day during 30-80 days of life.

We obtained these growth performances with a feed conversion ratio of 2.86 kg feed/kg gain for G1 individuals and 2.80 kg feed/kg gain for G2 individuals, respectively. We chose the slaughter age to be approximately 4 months of life for the rabbits in our study, when the chemical composition of the meat registers the highest quality level, as the literature recommends (Mardari, 2015) [9].

The non-parametric Mann-Whitney U test used to establish the statistical differences between the individuals of the 2 groups, for the variables body weight, carcass weight and slaughter yield (Table 3), show that they are insignificant, even though, they had higher values for the G2 individuals. These values are very close to those reported by Tobă et al. (2009) [10].

Table 3. Slaughter performance and organs percentage of F1 individuals

Variable	G1 ♀CAL x ♂UH		G2 ♀CAL x ♂UG		p
	X	DS	X	DS	
Body weight (g)	3072[a]	1.14	3161[a]	1.88	>0.05
Carcass weight (g)	1717[a]	4.1	1758[a]	1.21	
Digestive tract %	560[a]	2.07	590[a]	2.4	
Liver %	108[a]	0.9	115[a]	1.02	
Lung %	37[a]	5.5	33[a]	4.92	
Heart %	8[a]	0.87	8[a]	1.94	
Kidney %	21[a]	1.92	20[a]	2.57	
Spleen %	3[a]	2.01	3[a]	1,99	
Slaughter yield %	51.25[a]	1.10	51.71[a]	176	

Even in terms of the weight of the viscera, the reported differences were not significant. Our results are comparable to those published by Ojebiyi et al. (2015) [11]. Individuals of group 2, fed exclusively with commercial pellets, showed a higher but insignificant proportion of abdominal fat deposits (Figure 3). We supposed that this fact can be attributed to the participation of molasses and palm kernel extruded in the composition of the pellets. But, Nguyen et al., 2021) [12] stated that had no effect on carcass composition nor on meat quality when rabbits fed diets was supplemented with molasses. Palm kernel oil instead contains saturated fats (lauric acid c:12, myristic acid c:14, palmitic acid c:16 [13]. Hanim et al. (2020) [14] found that extrusion increased crude fat by 20% as compared to the untreated kernel palm cake, but not GE content of them. In chicken for example body fat deposition depends on the net balance among absorbed fat, endogenous fat synthesis and fat catabolism [15]. Higher body fat storage in G2 group, even insignificant, should be due to a lower rate of fat catabolism, higher rate of hepatic lipogenesis, or both as previous authors suggested. While low fat meat contents is demanded by human consumers of rabbit meat [16], there are authors, who have established that abdominal fat deposits can be benefic for animal. And that because it is positively related to maternal ability and a longer life time [17]. Supplementary, fat storage can serve in metabolic processes such as lipolysis and β-oxidation for energy production [18] when animal is forced to mobilize their fat deposits.

Figure 3. Carcasses and viscera of 2 individuals belonging to the two groups (G1 - up; G2 - down)

The chemical analysis of the meat samples collected from the back, hip and thigh region in order to determine the content in water, crude protein, crude fat and ash, revealed extremely close values, and as such, significant differences between the two experimental groups Table 4).

The results of our study on the chemical composition of the meat of F1-G1 and G2 are very close to that reported by Mardari (2015) [9] for the meat of rabbits slaughtered at the age of 4 months, with the exception of the fat content, on which we found higher. According to Mardari. (2015) [9], rabbit meat reaches the highest level of quality at the age of 4 months, when the water/dry matter ratio is 3.09/1. The same author found that the fat content of rabbit meat varies between 3.15% at 2 months and 12.6% at 7 months of life; after the age of 4 months, fat deposits increase to the detriment of protein synthesis, influencing meat quality. According to the aforementioned author, the protein content is 19.41% at the age of 4 months.

Table 4. Chemical composition of meat samples of F1 individuals

Variable	G1 ♀CAL x ♂UG	G2 ♀CAL x ♂UG	p
Back			
DM %	30.04[a]	30.09[a]	>0.05
CP %	20.63[a]	20.42[a]	
CF %	6.80[a]	7.31[a]	
Ash %	1.37[a]	1.08[a]	
Hip			
DM %	27.20[a]	27.49[a]	>0.05
CP %	18.50[a]	18.67[a]	
CF %	5.98[a]	7.11[a]	
Ash %	1.19[a]	1.07[a]	
Tigh			
DM %	27.00[a]	29.20[a]	>0.05
CP %	19.24[a]	19.69[a]	
CF %	6.09[a]	5.73[a]	
Ash %	1.17[a]	1.26[a]	

4. Conclusions

- a better growth rate recorded by F1 ♀Californian x ♂German Giant individuals belonging to litters 2, during the period 1-60 days, which then decreases until 120 days of ages;
- significant differences regarding the average daily gain of the rabbits in the two litters during 1-

60 days of life, in favor of those fed with pellets after weaning;
- insignificant differences between the individuals of the two groups regarding the chemical meat composition and the commercial characteristics of the carcass;
- higher proportion of abdominal fat deposits in individuals fed exclusively with granulated feed.
- in the feeding of this hybrid rabbit we can replace a part of pellets with concentrates mixture because de productive performances are the same ($p \geq 0.05$).

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