

## RESEARCH ARTICLE

**(Open Access)****The effect of rearing season and feeding on the performance evaluation of a local rabbit population**

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The aim of research was to study the effect of rearing season and feeding on the performance evaluation of a local rabbit population. Five small scale family farms with rabbits of local breed were included in the study. Two groups of rabbits per farm were fattened during summer and winter seasons. One group was fed in usual way with feeds produced in farm consisted mainly of alfalfa dry or fresh depending on season and family residues. The feeding of the other group was daily supplemented with 25 g concentrate feedstuffs (17% protein) bought in the market. Supplementation with concentrate feedstuffs showed to improve meat production from rabbits in both seasons. Live weight at the end of fattening was increased with 216.9 g and 371.6 g respectively during winter and summer season. The factors that affect the differences in live weight realized were feeding regime, sex of rabbit ( $P < 0.001$ ) and season of fattening ( $P < 0.01$ ).

The effect of these factors depended on their interaction effect like as "feed ration x season" ( $P < 0.01$ ), and "feed ration x sex" ( $P < 0.05$ ). Approaching growth curves with theoretical one of Gompers showed that concentrate adding in feed ration improved daily weight gain. It did not affect the dynamics of body weight change. It affects the gradient of quantity of daily gains of rabbits. Concentrate supplementation of daily feeding during fattening period increased up to 15.5 % the meat production as well as net income of the farm.

The rabbits feeding with daily supplementation, showed better slaughtering results than the another group; carcass percentage respectively 55.3% vs. 49.8 %; 61.2% vs. 51.8% ( $P < 0.01$ ); good performance of the region's most puncture respectively (20.4 % vs. 18.4 %; 22.6% vs. 19.1 %) ( $P < 0.01$ ); and had also the highest bone ratio of hind leg; 3.6 vs. 3.2 and 4 vs. 3.39 ( $P < 0.01$ ) respectively during winter and summer seasons

**Key words:** rabbit, local breed, fattening, feed supplementation, carcass,

**Introduction**

In our country Rabbit management in small family farm is done as an alternative productive activity to improve daily feeding and incomes from meat selling of family farm. Rabbits are of local breed and reared in extensive conditions. Geographically are more widespread in the regions of Berati, Korca, Lushnja, Lezha, Fier. The rabbits are kept in simple housings build up with native tools. The farmers do not implement any veterinary or zoonoprophylactic protocol and sanitary hygienic conditions are low. The rabbit feeding is mainly based on farm products and family residues. Concentrate feedstuffs are bought in the market. The rabbit feeding is mainly based on farm products and family residues. Concentrate feedstuffs are bought in the market. They

are mainly used for mature rabbits during intensive reproductive period. The fattening period of rabbits starts from weaning up to 101 days and no concentrate feedstuffs is used for their feeding. The summer and winter are considered as most difficult seasons for rabbits growing [1,2,5] as consequence the rabbit meat production is low. It is supposed that rabbits produce under their genetic capacities. To verify this hypothesis, to realize an added value in meat production from rabbits in fattening and to evaluate the main features of carcass of local rabbit this experiment was undertaken. Five different farms located in different communes were included in experiment. A comparative study of two different feeding regimes with and without concentrate feedstuffs of rabbits born and fattened during winter and summer seasons was developed.

## Material and methods.

Five family farms in Berati and Lushnja region were included in the experiment. Two groups of rabbits per farm were established to prove the effect of feeding regime in two different seasons on meat production performances. After weaning period the control group was fed in traditional way with feeds produced in farm consisted mainly of alfalfa dry or fresh depending on season and family residues. The feeding of the other group was daily supplemented in average with 25 g per head concentrate feedstuffs bought in the market during the fattening period. (12.5% crude protein, oil extracts 3.3%, 7.9% crude cellulose). Alfalfa hay given ad-libitum. The rabbits were born and fattened during summer and winter seasons. The rabbits of each group of farm were born from the same 2-3 does in both seasons. The young rabbits of each litter were equally divided in two groups to distribute uniformly the effect of the does. It was paid attention to have nearly the same sex ratio per group. 75 heads of rabbits, 35 (f) and 42 (m) for winter season and 65 heads of rabbits, 28 (f) and 36 (m) for summer season were included in the experiment. The rabbits were weighted every 7 days starting from 31 days of weaning age up to 101 days of fattening period. The rabbits belonged to a local breed. The average daily gain were calculated from weekly weightings and the live weight at the end of fattening period.

To evaluate the effect on live weight of rabbits at the end of fattening period (101 days) of feed supplementation the data were analyzed according the general linear model (GLM) as follow:

$$Y_{ijkln} = \mu + a_i + b_j + c_k + f_l + s_n + (ac)_{ik} + (af)_{il} + (cf)_{kl} + e_{ijklnm}$$

Where:

$Y_{ijkln}$  - live weight at the end of fattening period.

$\mu$  - Theoretical average

$a_i$  - feed ration effect of (i=1,2)

$b_j$  - litter effect (j=1,14)

$C_k$  - season effect i (k=1,2)

$f_l$  - farm effect (l=1,5)

$s_n$  - sex effect (n=1,2)

$(ac)_{ik}$  - interaction effect of "feed ration and season"

$(as)_{in}$  - interaction effect of "feed ration x sex"

$(cf)_{kl}$  - interaction effect of "season x farm"

$e_{ijklnm}$  - residual effects

Growth curves were build according to Gompers model for two season (summer and winter) and feeding regime (with or without concentrate feedstuff adding), using estimates for the averages of live weight of rabbits in different phases of fattening period. The average live weights were calculated from periodic weightings during fattening period.

$$y = k \exp(-\exp(-b(t-c)))$$

Where  $y$  - live weight of the rabbit

$t$  - age (in days) of rabbit

$k$  - asymptote of live weight growth curve.

$b, c$  - parameters adjust both slope and inflection point of growth live weight curve.

To estimate the effect of feed ration supplementation with concentrate feedstuffs in reducing the effect of season, corresponding curves of season effect on live weight at the end of fattening period of rabbits were compared. The curves were estimated for each sex.

The data of 36 rabbits grown in four season (5 males and 6 females per season) were used to evaluate the carcass features. The live weights of rabbits before slaughtering were recorded. Carcass performance, measurements and weighing, were studied by the Belasco's Methodology [8]. According to the methodology, the weights of: blood, skin, the terminal part of the tail, extremities of front and rear legs, gastrointestinal and euro genital tracts, head, liver, kidney heart, lung, esophagi, trachea were included in hot carcass weight. The carcass was divided according to the WRSA Rate [11]. The weights of front parts (shoulder and front legs) and rear parts (rounds and rear legs) were expressed as the percentage to reference carcass weight. The killing out was

estimated as a ratio of the weight of reference carcass and live weight before slaughtering.

**Results and discussions.**

The data of Table 1 show that there is no significant difference between respective average live weights of females and males rabbits of control and experimental group at weaning period. Within each group there is significant difference between average live weights of females and males (P<0.05). That

proves the analogy between control and experimental groups concerning live weight at the beginning of experiment. So to study the variance of live weights of rabbits at slaughter age with General Linear Model (GLM) it was not necessary to include the covariance component that reflect the stochastic relation between live weight at weaning and live weight at slaughter age.

**Table 1.** Estimations of average live weights of rabbits at weaning (37 days)\* and at slaughter age (101 days)\*

Season	At weaning age			
	Control group		Experimental group	
	Females	Males	Females	Males
Winter	592.3±4.2 <sup>a</sup>	648.4±5.9 <sup>b</sup>	587.5±5.0 <sup>a</sup>	624.2±4.8 <sup>b</sup>
Summer	590.4±5.1 <sup>a</sup>	675.1±4.3 <sup>b</sup>	605.4±5.1 <sup>a</sup>	714.3±5.4 <sup>c</sup>
At slaughter age				
Winter	1873.3±32.6 <sup>a</sup>	2080.4±30.8 <sup>bc</sup>	2098.05±32.2 <sup>bc</sup>	2289.5±33.3 <sup>d</sup>
Summer	1986.2±28.7 <sup>b</sup>	2123.2±31.2 <sup>cd</sup>	2312.2±30.1 <sup>d</sup>	2540.4±28.9 <sup>e</sup>

\*a-d means within a column with no common superscript, differ significantly (P<0.05)

Verification of statistical hypothesis (t-Student) shows that there are significant differences of average live weights at slaughter age in both cases between sexes within each group or between the same sexes in different groups. (P<0.05). There are significant differences between average live weights at slaughter age of rabbits grown in different seasons (P<0.05). These results are also found from previous studies. [4,7].

These results show that the hypotheses of meat production increasing from feed ration supplementation rabbits in small scale family farm conditions could be proved. To verify this hypothesis the multivariate analyses according to the request of General Linear Model was done.

The results of variance analyses (STATGRAF Centurion XVI.) are given in Table 2.

**Table 2.** The study of phenotypic variance of “live weight at slaughter age”.

Source of variance	Shall	MMS	F
Effect of feed ration	1	80163	8,22***
Effect of litter (doe)	13	8484	0,87
Effect of season	1	62608	6.42**
Effect of farm	4	29451	3,02*
Effect of sex	1	78211	8.02***
Interaction effect of “feed ration x season”	1	66509	6.82**
Interaction effect “ feed ration x sex”	1	38423	3.94*
Interaction effect “season x farm”	4	11020	1.13
Residual effects.	116	9752	

\* P<0.05, \*\*P<0.01, \*\*\*P<0.001

Analyses of variance shows that the factors with higher effects on general phenotypic variance of live weight of rabbits at the end of fattening period could be listed as follow: feed ration, sex of rabbit, (P<0.001) and growing season (P<0.01). According

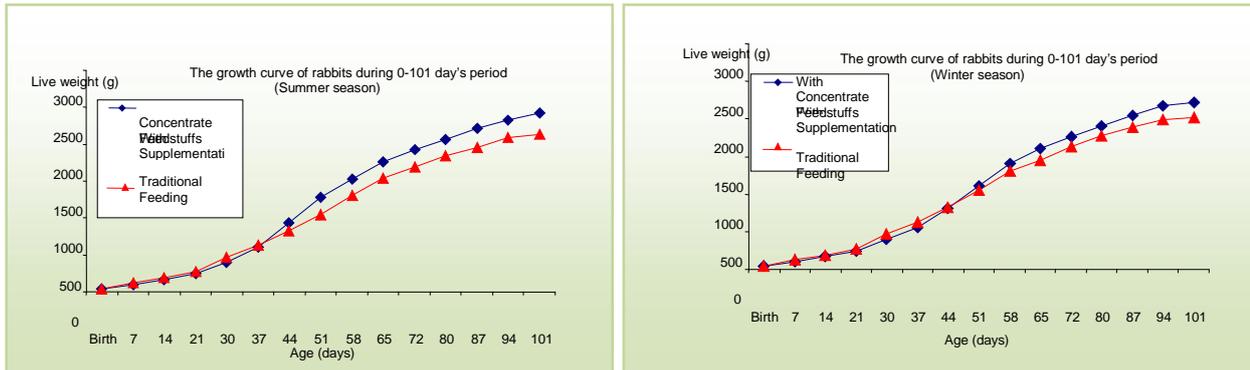
the variance analyses there are statistically significant the interaction effect of “feed ration and season” (P<0.01) and “feed ration and sex” (P<0.05). It means that:

(I) The rabbit's responses to changes of feed ration are not the same at different seasons, winter or summer.

(ii) The animals of different sexes, respond in different way to changes in feed ration during fattening period.

This result is comparable with that found from [1, 3, 4, 8,10 ] relating to the effect on growth

rate and live weight at the end of fattening period of feeding, season of growth, the sex and their reciprocal interaction effect. Using the average live weights of rabbits every 7 days of weightings starting from birth up to slaughter weight for both two groups and seasons the growth curves were estimated. The growth curves were estimated as Gompers model (Fig. 1).

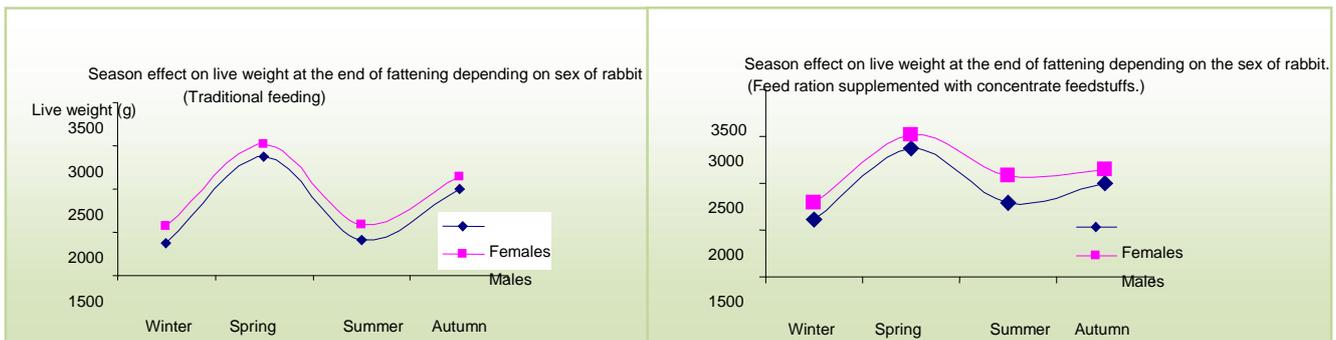


**Figure 1.** The effect of feeding on rabbit fattening (Winter, summer – seasons)

In both seasons the type of curves are almost the same and they do not depend by the feed ration. Gompers model as a theoretical approximation reflect very well the growth curves of rabbits. ( $0.72 R^2 0.86$ ). This is because of local breed of rabbits is used in experiment, which have high genetic capacities to cope with extensive conditions [6]. Due to this fact the differences in feeding or the effect of season do not significantly disturb the growth physiology. The differences between empiric growth curves and theoretical ones provided by growth model of Gompers are not statistically significant ( $P < 0.05$ ). Some concentrate feedstuffs adding in daily feed

ration improved daily weight gain. It did not affect the dynamics of body weight change during different periods of fattening. The experimental data shows that the gradient of growth has higher values at the first phases of fattening, 37-72 days period. After that period the values start to stabilize with some small fluctuations around a certain value. It is estimated to be around 16-17 g/day and 20-21 g/day respectively for winter and summer season.

The curves that represent the dynamic of season effect on live weight at the end of fattening period depending on sex in each of feeding ways are given in Fig. 2.



**Figure 2.** Reduction of the effect of season on the rabbits fattening

The curves were estimated using the average "least square" data for live weight at the end of fattening period of female and male rabbits grown in summer and winter season, estimated by Gompers model. For two other seasons, Autumn and Spring the averages of live weight at the end of fattening period (101 days) were taken from previous study [2]. The figure 2 shows that the season effect is stable no matter feed ration is supplemented or not with concentrate feedstuffs. Live weights at the end of fattening period are higher during autumn and spring

season. Concentrate feedstuff supplementation alleviate the season effect. Rabbit fed with concentrate feedstuff supplementation were 216.9 g and 371.6 g heavier than the rabbits without supplementation, respectively in winter and summer season.

Means of live weights of rabbits before slaughtering, hot carcass %, reference carcass %, carcass length and weight of legs, puncture region %, total fat %, bone ratio of hind leg %, are given in tables 3& 4. Coefficients of Variation (CV) were estimated for all these indicators.

**Table 3:** Means of carcass performance

	Body weight (g)			
	Control group		Experimental group	
	Stati.indica Cv %		Stati.indica Cv %	
Winter	8.84	1976.85	9.81	2193.7
Summer	9.1	2054.7	10.85	2426.3
Weight of Front parts of carcass (g)				
Winter	5.45	119.67	6.04	132.80
Summer	5.66	124.39	6.64	145.88
Weight of rear parts of carcass (g)				
Winter	8.37	372.93	9.29	413.84
Summer	8.70	387.62	10.27	457.72
Carcass length (g)				
Winter	6.39	34.83	7.09	38.65
Summer	6.64	36.20	7.85	42.75

**Table 4:** Means of carcass performance

	Hot carcass %	
	Control group	Experimental group
Winter	49.8 %±0.2	55.3 %±0.3
Summer	51.8 %±0.3	61.2 %±0.4
Refer. Carcass %		
Winter	43.9±0.3	48±0.3
Summer	45.2±0.3	51.9±0.3
Puncture region %		
Winter	18.4	20.4
Summer	19.1	22.6
Total fat %		
Winter	0.88±0.24	0.98±0.27
Summer	0.92±0.25	1.50±0.45
Bone ratio of hind leg %		
Winter	3.2 %	3.6 %
Summer	3.39 %	4.0 %

(P <0.01)

As seen in table (3&4), the rabbits feeding with daily supplementation, showed better slaughtering results than the another group; carcass percentage respectively 55.3% vs. 49.8 %; 61.2% vs. 51.8% ) (P <0.01); good performance of the region's most puncture respectively (20.4 % vs. vs. 18.4 %; 22.6% vs. 19.1 % ) (P <0.01); and had also the highest bone ratio of hind leg; 3.6 vs. 3.2 and 4 vs. 3.39 (P <0.01) respectively during winter and summer seasons.

### Conclusions

- In extensive conditions or rabbit rearing there is possible to increase the live weight at the end of fattening period supplementing the feed ration with some concentrate feedstuff.
- The rabbit's responses to changes of feed ration are not the same at different seasons, winter or summer.
- The animals of different sexes, respond in different way to changes in feed ration during fattening period.
- The rabbits feeding with daily supplementation, showed better slaughtering results than the another group fed in usual way depending on season and family residues [9].

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