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Slaughtering Process, Carcass Yield and Cutting Process in California and Chinchilla Rabbit Breeds

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Abstract: The objective of the present study was to evaluate the effects of sex and breed, on the slaughtering performance, carcass yield and cutting process in rabbits. Eighteen female and male rabbits of the Chinchilla and California breeds were used, animals were sacrificed according to the Official Mexican Norm. No significant differences between breeds and gender for all the variables were observed, except for ham roundness; California does showed the highest value, being significantly different from the males for both breeds. At 70 days, California rabbits showed a greater body development compared with the Chinchilla breed. Also, no significant differences were found between breeds for the primary cuts; although there was a numeric difference between Chinchilla and California rabbits regarding loin cut (291 vs. 273 g, respectively). The carcass yield obtained in this study was 58.51%, the greatest yield was observed in California does. Positive correlations were found between average daily gain and live weight (r= .89); skin weight and hot carcass weight (r=0.90), and live weight with both, skin weight (r= 90) and hot carcass weight (r=0.91).

Key words: Rabbit, carcass yield, carcass dressing, slaughter performance

INTRODUCTION

Rabbits are mainly raised for meat, skin and fur production although they are also used as laboratory animals[1]. Meat composition varies according to the age and feeding system. Compared with that of other animal species, rabbit meat is considered a lean one, with low fat (7.06%) and sodium content, rich in protein (20.78%), and high content of vitamins of the B group as well as vitamin E[2-4]. The carcass quality depends on the animal's weight, carcass yield, cutting yield and muscular mass[5].

Meat from rabbits of any age is highly appreciated for human consumption[6], it is a product that fits any taste, it is tender and of high culinary yield, easy and quick to cook. Due to these characteristics, its consumption frontiers are expanding day by day[7]. Nevertheless, animal production, transportation and slaughter technique may cause detriments in the meat quality, these anomalies diminish the possibility to transform it into meat by-products such as sausages[8].

The objective of the present study was to evaluate the effects of sex and breed on the slaughtering process, carcass yield and cutting process in rabbits.

MATERIAL AND METHODS

The study was carried out at the Meat Workshop of the Animal Production Center, of the Faculty of Higher Studies in Cuatlitlán, from the National Autonomous University of Mexico (FES-C, FMVZ, UNAM) in the State of Mexico, during March of 2005. Animals were brought from the rabbit breeding module of this institution, eighteen female and male rabbits of the Chinchilla and California breeds were used. During the fattening period, animals were fed with a balanced commercial food with the following composition: humidity 12.00%, crude protein 16.50%, fat 2.00%, calcium 0.20%, fiber 14.50%, ashes 9.00%, N. F. E. 46.00% and phosphorus 0.70%.

The study was carried out with 70 days-old rabbits, distributing them by sex at random in the following treatments (Table 1).

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Table I: Experimental design

Group	Chinchilla		California	
Treatments	1	2	3	4
Sex	F	M	F	M
Number	3	6	4	5
Total number of animals	9		9	

The slaughtering method used was the one described by Zoot[9], and in accordance with the Official Mexican Norm (NOM-ZOO-033-1995)[10]. In order to determine the hot carcass yield, slaughter weight was previously determined by a digital scale (Tor Rey type PCL, with capacity of 20 Kg). During the dressing process several weights were taken from red (heart, trachea, lung, liver and spleen) and green viscera (stomach, bowels and guts), as well as offals (skin, and fore- and hind- limbs) with a digital scale (Ohus, GT-8000 model, with capacity of 5 Kg). Carcasses were evaluated determining the following measurements according to the methodology previously described by Becerril-Herrera[11,12].

- Carcass length (from the anterior side of the first rib to the ischeo-pubic symphysis).
- Thorax depth (from the lowest part of the breastbone to the medium part of the back).
- Roundness of the right ham (determined at the widest part of the leg or the height of the femoral-tibia-patelar joint).

Once the dressing process was concluded, hot carcass weight was determined. pH is an indicator of carcass quality, after slaughtering it has a particular influence on the sensorial quality characteristics and on properties of the meat processing[13,14]. A Hanna Instruments Potentiometer (Penetration pH electrode, HI8314, pHmeter membrane, 115V-60Hz. Cod.1.1176), was used to measure the pH values in the hot carcass. The measurement was made in the Biceps femoris muscle, in the right leg, similar to the technique used by Blasco[15] and Hernández *et al.*,[3].

Subsequently, weighing and measurements of the cold carcass were carried out, after a cool period of 22 hours at 0 and 4°C, with the purpose of calculating the dry losses. The cutting yield was determined by weighing the cold carcass and each one of the pieces.

Statistical analysis: variable results were analyzed at random using the following mathematical model:

$$Y_{ij} = \mu + 4_i + \hat{1}_{ij}$$

I = Treatments 1, 2 j = 1, 2, 3....Repetitions

Where:

Y_{ij} = Variable result
μ = General mean
4_i = Effect of the treatment (sex and breed)
$\hat{1}_{ij}$ = Random error

The Tukey test ($p<0.05$) was used to determine significant differences between the mean of the treatments. Categorical variables were compared between groups by the x^2 test. For comparisons of blood pH values at birth between groups, a Mann-Whitney U test was performed. Pearson correlation analysis was run for some carcass quality traits.

RESULTS

Table 2 shows the results obtained in terms of the means and standard error of the mean of the observed

Table 2: Means and standard error of the mean for the dressing variables according to the breed and sex in rabbits

	Chinchilla (Females) N = 3	Chinchilla (Males) N = 6	California (Females) N = 4	California (Males) N = 5
Dressing variables	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM
Daily weight gain	30.16±1.62^{A}	30.56±1.08^{A}	31.53±0.67^{A}	31.68±1.81^{A}
Live weight (Kg.)	2.11±0.11^{A}	2.13±0.07^{A}	2.20±0.04^{A}	2.21±0.12^{A}
Skin weight (g)	300.63±14.31^{A}	299.5±14.80^{A}	317.67±22.61^{A}	328.68±21.05^{A}
Fore limb weight (g)	23.83±0.69^{A}	23.31±0.81^{A}	22.77±0.91^{A}	25.12±1.20^{A}
Hind limb weight (g)	56.9±1.35^{A}	54.06±1.59^{A}	47.7±4.80^{A}	55.72±1.93^{A}
Green viscera weight (g)	111.46±12.70^{A}	115.3±8.62^{A}	113.02±2.75^{A}	121.12±4.70^{A}
Red viscera weight (g)	32.16±1.47^{A}	31.36±2.11^{A}	26.8±1.61^{A}	34.5±2.18^{A}
Hot carcass weight (g)	1241.6±30.98^{A}	1257.48±49.02^{A}	1313.7±53.42^{A}	1261.6±69.93^{A}
Carcass yield (%)	58.95±1.80^{A}	58.75±0.48^{A}	59.45±1.52^{A}	56.9±0.38^{A}
Carcass length (cm)	30±1.0^{A}	29±0.44^{A}	29.75±0.25^{A}	30±0.31^{A}
Thorax depth (cm)	9.16±0.83^{A}	9.66±0.33^{A}	10±0^{A}	9.8±0.96^{A}
Ham roundness (cm)	16.66±0.33^{AB}	15.83±0.30^{B}	17.75±0.25^{A}	16.2±0.37^{B}
Hot carcass pH	6.56±0.06^{A}	6.51±0.05^{A}	6.27±0.23^{A}	6.55±0.08

$^{AA, B}$ Within a row, values with different superscript letters are significantly ($p<0.05$) different

Table 3: Means and standard error of the mean for the cold carcass variables according to the breed and sex in rabbits

	Chinchilla (Females) N = 3	Chinchilla (Males) N = 6	California (Females) N = 4	California (Males) N = 5
Cold carcass variables	Mean±SEM	Mean± SEM	Mean±SEM	Mean±SEM
Cold carcass weight (gr)	1220.83±71.26[A]	1182.85±38.97[A]	1264.7±51.70[A]	1198.2±75.45[A]
Head weight (g)	107.33±3.07[A]	106.51±2.56[A]	108.6±4.02[A]	108.16±4.55[A]
Kidneys´ weight (g)	16.93±1.43[A]	16.4±0.70[A]	15.17±0.52[A]	17.26±0.47[A]
Liver weight (g)	79.3±12.85[A]	83.58±6.72[A]	83.95±2.88[A]	86.9±4.83[A]
Cold carcass pH	5.86±0.01[A]	5.90±0.03[A]	5.95±0.06[A]	5.85±0.02

[A] Within a row, values with different superscript letters are significantly ($p<0.05$) different.

Table 4:Means and standard error of the mean for the cutting process variables according to the breed in rabbits

Breed	Chinchilla N = 4	California N =5
Cutting process variables	Mean±SEM	Mean±SEM
Left shoulder weight (g)	219.64±10.92[A]	210.4±9.77[A]
Right shoulder weight (g)	140.16±6.66[A]	141.47±11.78[A]
Loin weight (g)	291.3±11.70[A]	273.97±24.38[A]
Left ham weight (g)	187.74±12.06[A]	181.52±11.33[A]
Right ham weight (g)	192.66±5.32[A]	197.32±13.23[AA]

Within a row, values with different superscript letters are significantly ($p<0.05$) different.

variables during dressing of the rabbits. It is important to underline the absence of significant differences between breeds and gender for all the variables, except ham roundness, where California females showed the highest value, being significantly different with the males for both breeds.

At 70 days, California rabbits showed a greater body development compared with the Chinchilla breed. It is important to mention that these differences were only numeric and statistically not significant, therefore in the other variables the same trend was observed.

Results of the mean and standard error of the measured variables in cold carcasses are given in Table 3. There were no significant differences between the variables; it is important to state that variables regarding carcass, head, kidneys and liver weight are not indicative of meat quality, but of the productive system. Cold carcass weight in this stage usually loose from 2 to 4%, 24 h after cooled at 0 to 4°C. The mean and standard error of the mean from variables related to the cutting process are shown in Table 4. Again, results indicate no significant differences between breeds for the primary cuts; although there was a numeric difference between Chinchilla and California breeds regarding loin cut (291 vs. 273 g, respectively).

Table 5 shows the correlations between the dressing variables; positive correlations were found between average daily gain and live weight; skin weight and hot carcass weight, and live weight with both, skin weight and hot carcass weight.

DISCUSSION

In rabbits, carcass quality depends on weight and carcass yield, in average carcass yield represents 55 to 61% of the live weight[5]. The carcass yield obtained in this study was 58.51%, the greatest yield was observed in California females.

Choudhury *et al.*,[16], in a study carried out in Chinchilla rabbits reported the following results: at 90 days-old a slaughtering weight of 2.73 ±0.10 Kg, hot carcass weight of 1.70±0.070 Kg, carcass percentage, 62.26±1.08; liver weight, 80.31±4.39 g; kidney weight, 22.86±1.87 g, and loin weight of 344.71±16.59 g.

The differences found in the present study are a consequence of weight and age at slaughter, which are dependent on the level of consumer's acceptance. Sthaly[17] points out that the slaughter weight is increased by age, and at higher slaughtering weight, higher carcass yields.

Table 5: Correlations* between dressing variables in rabbits

	ADG	LW	SW	FLW	HLW	RVW	GVW	HCW	CL	TD	HR
ADG	1.000										
LW	0.89	1.000									
SW	0.9036	0.9034	1.000								
FLW	0.5297	0.5296	0.6077	1.000							
HLW	0.2466	0.2464	0.1849	0.3027	1.000						
RVW	0.5514	0.5517	0.4677	0.4721	0.1867	1.000					
GVW	0.2726	0.2726	0.2540	0.5153	0.5030	0.5454	1.000				
HCW	0.9191	0.9191	0.9086	0.4207	0.0280	0.4173	0.0721	1.000			
CL	0.1106	0.1110	0.0968	0.4040	0.0944	0.2657	0.2104	0.0322	1.000		
TD	0.3460	0.3459	0.3179	0.2488	0.1662	0.0228	0.0641	0.3189	0.0284	1.000	
HR	0.1843	0.1845	0.2898	0.0296	0.2553	0.0882	0.0146	0.3086	0.2015	0.0117	1.000

ADG: Average daily weight gain; LW: Live weight. Skin weight. FLW: Fore limb weight. HLW: Hind limb weight. RVW: Red viscera weight GVW: Green viscera weight. HCW: Hot carcass weight. CL: Carcass length. TD: Thorax depth. HR: Ham roundness

*Pearson correlation analysis

Pla *et al.*,[18], in 63 days-old hybrid rabbits, ranging from 2,000 to 2,100 g of live weight, observed pH values of 5.71, lower than the values (5.81) obtained in the present study. It is important to mention that the final pH value is highly related to slaughtering techniques, which in turn depend on the geographical region and regional slaughtering center, thus the comparisons make us conclude that there is no established method for slaughtering.

Blasco and Piles[14] obtained hot carcass weights of 1,224 g, and cold carcass weights of 1,206 g; which represent a reduction of 18 g in 69 to 71 days-old slaughtered hybrid rabbits. In the same study these authors obtained carcass and meat pH values of 6.60 and 5.77, respectively. Similarly, Hernández *et al*.,[3]. reported pH values of 5.73 in meat of 63 days hybrid rabbits. In the present study a reduction of 56 g was obtained in the Chinchilla and 57 g in the California breed; these reductions are inferior in hybrids as a consequence of the genetic improvement for the carcass characteristics. With regard to the pH values in carcass and meat, both studies show similar values.

CONCLUSION

No significant differences between breed and gender were observed for the slaughter performance variables in the present study, except for ham roundness; females were statistically different from the males ($p<0.05$).

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