PROCEEDINGS OF THE 11th WORLD RABBIT CONGRESS

Qingdao (China) - June 15-18, 2016
ISSN 2308-1910

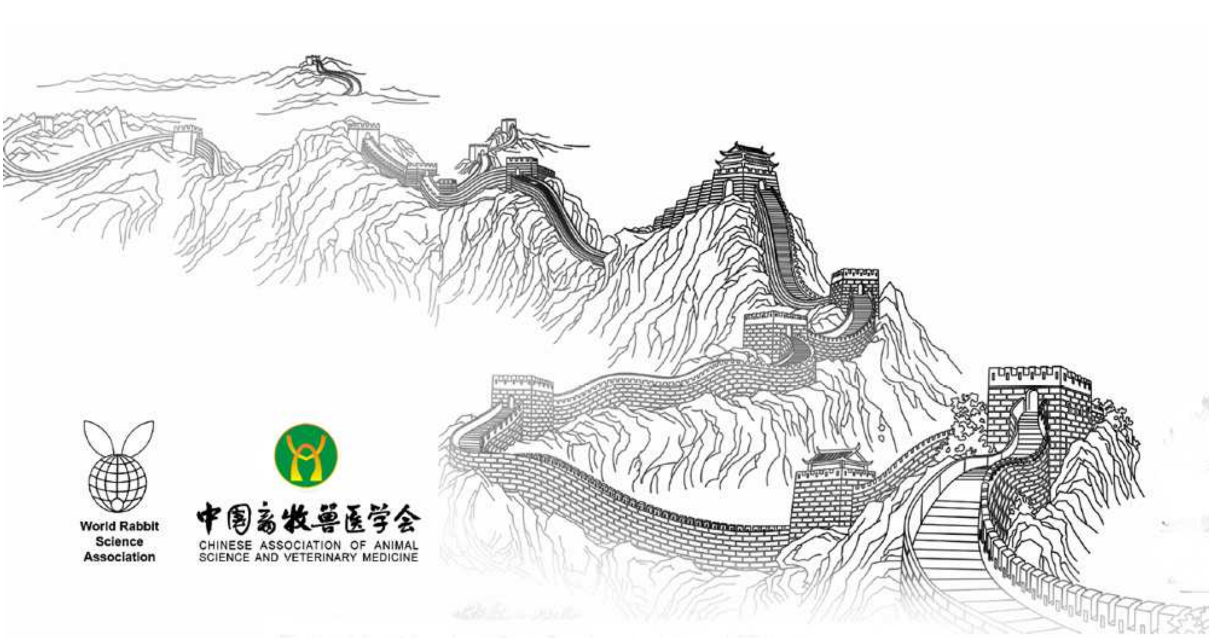
Session
Quality of products

North M.K., Nkhabutlane P., Hoffman L.C.

THE EFFECT OF AGE AND BREED ON CARCASS COMPOSITION AND PORTION YIELD IN RABBITS.

Full text of the communication

How to cite this paper :
North M.K., Nkhabutlane P., Hoffman L.C., 2016 - The effect of age and breed on carcass composition and portion yield in rabbits. *Proceedings 11th World Rabbit Congress - June 15-18, 2016 - Qingdao - China, 773-776*
.



World Rabbit Science Association

中国畜牧兽医学会
CHINESE ASSOCIATION OF ANIMAL SCIENCE AND VETERINARY MEDICINE

THE EFFECT OF AGE AND BREED ON CARCASS COMPOSITION AND PORTION YIELD IN RABBITS

North M.K., Nkhabutlane P., Hoffman L.C. *

[a]Department of Animal Sciences, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch 7602, South Africa
* Corresponding author. Tel.:+27 21 8084747; fax: +27 21 8084750. E-mail address: lch@sun.ac.za (L.C. Hoffman)

ABSTRACT

Rabbits provide a potential method of improving food security in developing countries; however, in order for rabbit farming to succeed production must be optimised for these specific conditions. This study investigated the carcass component yields of two rabbit breeds (Californian and hybrid Dutch red X Californian), with five rabbits of each breed being slaughtered every two weeks throughout the study period (9-17 weeks) to evaluate the effect of age on these traits. One-way ANOVA's performed using the GLM procedure of SAS version 9.3 were used to determine the effect of breed (per age) and age (per breed). Slaughter weight, dressing percentage, portion yield, percentage meat yield and skin weight increased significantly with age, while percentages of full gastrointestinal tract, liver, head and feet decreased. This is likely a reflection of the early-maturing nature of bone and viscera. These results indicate that delaying slaughter, particularly to 13 weeks, tends to improve yields for valuable carcass components. The Californian had a significantly higher total meat yield at 11 and 17 weeks and higher portion meat yields at 11 (hind leg and fore part) and 13 (fore leg) weeks than the hybrid. The Californian may therefore be preferable to the hybrid for meat production.

Keywords: Californian rabbit; Carcass yield; Dutch red rabbit; Meat production

INTRODUCTION

With the continued concern of food security, particularly in developing countries such as South Africa, many role-players are looking at rabbit meat production as one way of meeting the demand for meat (Baruwa, 2014; Blaga & Burny, 2014; Lukefahr & Cheeke, 1991). Rabbits have the advantage of being farmed intensively while also being able to utilise relatively poor quality feed (Lukefahr & Cheeke, 1991; Serem *et al.*, 2013). They are renowned for their prolificacy and rapid growth rates, allowing for high selection pressures and early slaughter (Baruwa, 2014; Serem *et al.*, 2013). However, in order for any farming venture to be viable, production must be optimised (Lukefahr & Cheeke, 1991). The breed and rearing conditions used can influence growth rate and carcass conformation changes, effecting the optimum slaughter age.

The Californian rabbit is popular in intensive modern systems because of its large litter sizes, good mothering abilities, good growth characteristics and high meat to bone ratio (Serem *et al.*, 2013). However it is necessary to identify the ideal breed for South African conditions (Lukefahr & Cheeke, 1991). The Dutch red/Californian hybrid is readily available in some areas of South Africa and takes advantage of the possible effects of heterosis (Bura *et al.*, 2015).

The aim of this study was to compare the carcass yields of the Californian and the hybrid as well as investigating the optimum slaughter age (9–17 weeks) for these breeds and conditions.

MATERIALS AND METHODS

Fifty Californian and hybrid (Californian x Dutch red) rabbits consisting of 13 female Californian, 12 male Californian, 12 female hybrid and 13 male hybrid, were used. These were purchased at 8 weeks old from nearby farms and transported to Welgevallen experimental farm near Stellenbosch in the Western Cape of South Africa. The 25 rabbits of each breed were randomly allocated to individual cages equipped with metal feeders and automatic nipple water supply systems. The house was equipped with a fan for cooling, with an average environmental temperature during the trial period of 26–37 °C recorded. The rabbits were fed a commercial diet formulated for calves that is commonly used by rabbit farmers in South Africa due to the lack of a readily available commercial rabbit feed. The diet contained 160 g protein, 150 g crude fibre, 120 g moisture, 25 g fat, 8 g calcium and 3.5 g phosphorus per kilogram and was supplied ad libitum.

Five randomly selected rabbits per breed were slaughtered at 9, 11, 13, 15 and 17 weeks of age. The rabbits were fasted for 24 hours and weighed prior to slaughter (slaughter weight). Slaughtering followed national regulations and carcasses were prepared as described by Blasco *et al*. (1993). The weights of the full gastrointestinal tract, skin, head, feet, liver and kidneys were recorded, with the thymus, trachea, oesophagus, lungs and heart being recorded as a single weight (lung-heart). The reference carcass weight (carcass excluding head and all viscera) was recorded after chilling the carcasses at 2-4 °C for 24 hours and was used in the calculation of the dressing percentage. The carcasses were divided using cut points number 2, 4 and 5 as described by Blasco *et al.* (1993), with the hind legs, fore legs and fore part (excluding fore legs and their muscle insertion points in the chest) being weighed. All weights were converted to percentages of the slaughter weight and the meat yield was calculated as the sum of the hind leg, fore leg and fore part meat yields.

The experiment was performed in a completely randomised design, with five replications per breed per age and each rabbit carcass as an experimental unit. Levene's test was used to test for homoscedasticity and the Shapiro-Wilk test for normality. The General Linear Model (GLM) procedure was used to perform the one-way analysis of variance (ANOVA), testing for significant differences between breeds for each age and between ages within each breed. Bonferroni's test was used to determine which individual ages differed from one another. Statistical tests were performed using SAS® version 9.3 statistical software and statistically significant differences were established at the 5% confidence level to compare treatment means.

RESULTS AND DISCUSSIONS

Effect of age

The slaughter weight and dressing percentage increased with age, as reported in literature (Dalle Zotte, 2002), with the latter stabilising at 13 weeks (Table 1). The 13 week slaughter weights appeared to be within the norms reported in literature, as did the dressing percentages when similar carcass types were used (Bura *et al.*, 2015; Chodová *et al.*, 2014; Dalle Zotte *et al.*, 2015; Gómez *et al.*, 1998). The plateau in the dressing percentage concurs with the findings of Dalle Zotte (2002) and Szendrö *et al*., (1998). It also supports the commercial practice of slaughtering at 13 weeks old.

The increased dressing percentage is likely a reflection of the significant decrease in the gastrointestinal tract, liver, head and feet with age (Table 1). This decrease is due to their early-maturing nature, which leads to a decline in the allometric coefficients of growth with age (Dalle Zotte, 2002; Pascual *et al.*, 2008). There was no significant change in the percentages of the kidneys and lung-heart group, which were both low (kidneys: 0.78-1.10%; Table 1). The contribution of the skin increased significantly with age, which likely reflects its higher growth rate relative to the body as a whole (Szendrö *et al*., 1998).

The percentage of the hind leg, fore leg and fore part portions increased significantly with age, although the degree of this increase differed between portions. This reflects differences in the age at which maximum maturity of each portion is achieved (Szendrö *et al*., 1998). There were concomitant increases ($P<0.01$) in the meat content of the portions (Table 1), as well as the total meat yield, while the bone content decreased in the hind and fore legs. This overall increase in the meat content of the carcass is likely a reflection of the early-maturing nature of bone and later maturation of muscle and fat (Pascual *et al.*, 2008).

Effect of breed

The Californian had a higher slaughter weight and dressing percentage at 9 weeks of age (Table 1). However, the hybrid was heavier at the commercial slaughter age of 13 weeks, suggesting that it had a greater growth rate during this critical period. This may be due to the effects of heterosis or may reflect differences in the rate of maturation of the two breeds (Bura *et al.*, 2015; Tumová *et al.*, 2014).

Table 1: The effect of age and breed on the proportion (percentage of slaughter weight) of different carcass components in rabbits (Mean±SE)

	Breed	Age (weeks)					
		9	11	13	15	17	Prob.
Slaughter weight (g)	California	$1161^{a}_{E}\pm30.6$	$1605_{D}\pm42.6$	$2018^{b}_{C}\pm30.7$	$2514_{B}\pm21.3$	$3061_{A}\pm107.2$	<0.01
	Hybrid	$1060^{b}_{E}\pm30.5$	$1578_{D}\pm11.1$	$2110^{a}_{C}\pm25.1$	$2571_{B}\pm27.7$	$3133_{A}\pm131.3$	<0.01
	Prob.	0.05	0.55	0.05	0.14	0.68	
Dressing percentage (%)	California	$44.5^{a}_{C}\pm1.57$	$50.7_{B}\pm1.00$	$55.0_{A}\pm0.61$	$54.6_{AB}\pm0.58$	$53.7_{AB}\pm0.38$	<0.01
	Hybrid	$40.0^{b}_{C}\pm0.82$	$48.2_{B}\pm0.79$	$54.1_{A}\pm0.25$	$54.2_{A}\pm1.09$	$52.6_{A}\pm0.72$	<0.01
	Prob.	0.03	0.10	0.19	0.73	0.1932	
Meat Yield	California	$21.4_{C}\pm1.07$	$29.0^{a}_{B}\pm0.76$	$30.7_{B}\pm0.78$	$30.8_{AB}\pm0.27$	$34.0^{a}_{A}\pm0.63$	<0.01
	Hybrid	$19.8_{C}\pm0.55$	$25.8^{b}_{B}\pm0.63$	$30.3_{A}\pm0.75$	$30.0_{A}\pm0.98$	$31.5^{b}_{A}\pm0.44$	<0.01
	Prob.	0.22	0.01	0.75	0.50	0.01	
Hind leg meat	California	$13.11^{a}_{B}\pm0.52$	$14.52^{a}_{AB}\pm0.11$	$14.83_{A}\pm0.32$	$14.95_{A}\pm0.17$	$15.81_{A}\pm0.32$	<0.01
	Hybrid	$11.42^{b}_{C}\pm0.32$	$13.04^{b}_{B}\pm0.39$	$14.59_{AB}\pm0.48$	$15.02_{A}\pm0.21$	$15.51_{A}\pm0.30$	<0.01
	Prob.	0.03	0.01	0.69	0.82	0.51	
Hind leg bone	California	$4.10_{A}\pm0.13$	$4.10_{A}\pm0.13$	$4.47_{A}\pm0.13$	$4.29^{b}_{A}\pm0.06$	$3.29_{B}\pm0.14$	<0.01
	Hybrid	$4.32_{A}\pm0.16$	$4.44_{A}\pm0.18$	$4.63_{A}\pm0.16$	$4.45^{a}_{A}\pm0.03$	$3.11_{B}\pm0.16$	<0.01
	Prob.	0.32	0.17	0.45	0.05	0.43	
Fore leg meat	California	$5.44_{B}\pm0.33$	$5.82_{B}\pm0.27$	$6.62^{a}_{B}\pm0.29$	$6.63_{B}\pm0.10$	$8.80_{A}\pm0.45$	<0.01
	Hybrid	$4.76_{C}\pm0.31$	$5.57_{BC}\pm0.08$	$5.89^{b}_{BC}\pm0.13$	$6.29_{AB}\pm0.30$	$7.49_{A}\pm0.39$	<0.01
	Prob.	0.17	0.40	0.05	0.31	0.06	
Fore leg bone	California	$1.60_{A}\pm0.09$	$1.52_{AB}\pm0.05$	$1.77_{A}\pm0.03$	$1.68^{b}_{A}\pm0.03$	$1.31_{B}\pm0.08$	<0.01
	Hybrid	$1.82_{AB}\pm0.08$	$1.57_{BC}\pm0.03$	$1.69_{ABC}\pm0.05$	$1.84^{a}_{A}\pm0.04$	$1.51_{C}\pm0.08$	<0.01
	Prob.	0.11	0.41	0.20	0.01	0.12	
Fore part meat	California	$2.80^{b}_{B}\pm0.27$	$8.64^{a}_{A}\pm0.45$	$9.19_{A}\pm0.79$	$9.16_{A}\pm0.23$	$9.40_{A}\pm0.17$	<0.01
	Hybrid	$3.58^{a}_{C}\pm0.15$	$7.21^{b}_{B}\pm0.29$	$9.82_{A}\pm0.36$	$8.71_{AB}\pm0.61$	$8.51_{AB}\pm0.39$	<0.01
	Prob.	0.04	0.03	0.49	0.52	0.07	
Fore part bone	California	$1.40_{B}\pm0.09$	$1.59_{AB}\pm0.13$	$1.74_{AB}\pm0.12$	$1.84_{A}\pm0.06$	$1.61_{AB}\pm0.05$	0.04
	Hybrid	1.52±0.08	1.83±0.05	1.72±0.08	1.76±0.05	1.53±0.13	0.06
	Prob.	0.38	0.12	0.91	0.31	0.57	
Full gastrointestinal tract	California	$24.0_{A}\pm1.52$	$18.9_{B}\pm1.14$	$16.4_{BC}\pm0.35$	$15.0_{BC}\pm0.62$	$14.6_{C}\pm0.44$	<0.01
	Hybrid	$26.9_{A}\pm2.14$	$20.9_{B}\pm0.98$	$16.7_{BC}\pm0.90$	$16.4_{BC}\pm1.20$	$14.7_{C}\pm0.57$	<0.01
	Prob.	0.31	0.22	0.80	0.34	0.83	
Lung-heart	California	1.5±0.07	1.3±0.03	1.2±0.14	1.1±0.08	$1.3^{a}\pm0.04$	0.05
	Hybrid	1.2±0.11	1.3±0.10	1.2±0.10	1.1±0.10	$1.1^{b}\pm0.03$	0.38
	Prob.	0.05	0.68	0.79	0.95	0.01	
Liver	California	$3.4_{A}\pm0.45$	$3.0_{AB}\pm0.18$	$2.5^{b}_{AB}\pm0.08$	$2.4_{B}\pm0.11$	$2.4_{B}\pm0.06$	0.01
	Hybrid	$3.2_{AB}\pm0.11$	$3.4_{A}\pm0.12$	$2.7^{a}_{BC}\pm0.07$	$2.7_{BC}\pm0.17$	$2.5_{C}\pm0.19$	<0.01
	Prob.	0.66	0.12	0.03	0.20	0.66	
Head	California	$6.1^{b}_{A}\pm0.11$	$5.9_{AB}\pm0.17$	$5.7_{ABC}\pm0.13$	$5.0_{BC}\pm0.30$	$4.9_{C}\pm0.20$	<0.01
	Hybrid	$7.3^{a}_{A}\pm0.26$	$6.0_{B}\pm0.04$	$5.5_{BC}\pm0.30$	$5.6_{BC}\pm0.16$	$5.0_{C}\pm0.20$	<0.01
	Prob.	<0.01	0.46	0.58	0.10	0.77	
Feet	California	$3.3_{A}\pm0.11$	$3.2_{AB}\pm0.19$	$2.7_{BC}\pm0.07$	$2.4_{C}\pm0.11$	$2.1^{b}_{C}\pm0.13$	<0.01
	Hybrid	$3.5_{A}\pm0.09$	$3.4_{AB}\pm0.20$	$2.5_{BC}\pm0.06$	$2.8_{C}\pm0.17$	$2.7^{a}_{C}\pm0.16$	<0.01
	Prob.	0.23	0.46	0.06	0.07	0.03	
Skin	California	$12.9^{a}_{C}\pm0.41$	$14.7_{ABC}\pm0.63$	$14.3_{BC}\pm0.42$	$16.4^{a}_{A}\pm0.23$	$16.0_{AB}\pm0.32$	<0.01
	Hybrid	$11.2^{b}_{B}\pm0.26$	$14.7_{A}\pm0.65$	$14.2_{A}\pm0.45$	$15.3^{b}_{A}\pm0.40$	$15.9_{A}\pm0.54$	<0.01
	Prob.	0.01	0.98	0.81	0.03	0.91	

^{ab} Means with different superscript letters in the same column (within traits) differ significantly (P<0.05, Bonferroni test)
$_{A\text{-}D}$ Means with different subscript letters within the same row differ significantly (P<0.05, Bonferroni test)
SE – Standard error

The proportions of skin and lung-heart were higher for the Californian at 9 and 15, and 17 weeks respectively while the hybrid had greater proportions of liver at 13 weeks, head at 9 weeks and feet at 17 weeks (Table 1). The differences in the proportions of head and feet may be an indication of the differing conformations of the two breeds, with the intense selection for meat production in the Californian resulting in more favourable conformation (Serem *et al.*, 2013).

The only significant difference between the breeds in the contributions of each portion was the higher percentage of the fore leg portion of the Californian at 13 weeks (Table 1). However, the proportions of meat and bone in each portion differed, with the Californian having higher proportions of meat in the hind leg at 9 and 11 weeks, in the fore leg at 13 weeks and in the fore part at 11 weeks. The hybrid had higher proportions of bone in the hind and fore legs at 15 weeks. The total meat yield was also significantly higher in the Californian at 11 and 17 weeks and tended to be higher throughout the growth period. The Californian rabbit is well known for producing carcasses with a high meat to bone ratio (Serem *et al.*, 2013), whereas the relatively unimproved nature of the Dutch red may have reduced the meat yield of the hybrid. The hybrid did have significantly more meat in the fore part portion at 9 weeks, which was not expected; however this difference was reversed by 11 weeks and may have been due to sampling bias.

CONCLUSIONS

An increase in slaughter age was characterised by a decrease in the proportion of organs and an improvement in muscular development, thus resulting in higher dressing percentages and meat yields. This was particularly notable at 13 weeks and supports the current local industry practice of slaughtering at this age. The effect of breed was seen in differences in the proportions of skin, lung-heart, liver, head and feet, along with portion and total meat yields. These differences appear to indicate that the Californian is preferable for meat production due to higher meat yields and less waste. Further research into the efficiency of production and reproduction of these breeds is required to conclusively determine which is more suitable for development in South Africa.

ACKNOWLEDGEMENTS

This work is based on research supported by the South African Research Chairs Initiative of the Department of Science and Technology and the National Research Foundation of South Africa. Any opinion, finding and conclusion or recommendation expressed in this material is that of the author(s) and the National Research Foundation does not accept any liability in this regard.

REFERENCES

Baruwa I.O. 2014. Profitability and constraints to rabbit production under tropical conditions in Nigeria. *J. of Livestock Sci., 5, 83–88.*

Blaga B., Burny P. 2014. Rabbit production and rabbit market in Romania: the most frequent breeds, half-breeds and their characterization. *Rabbit Gen., 4(1), 1–6.*

Blasco A., Ouhayoun J., Masoero G. 1993. Harmonization of criteria and terminology in rabbit meat research. *World Rabbit Sci., 1(1), 3–10*.

Bura M., Pătruică S., Ţigănele D., Şandor T. 2015. Research on the productive performance of young rabbit hybrid bred in a household system (II). *SPASB, 48(2), 128–133*.

Chodová D., Tůmová E. Martinec M., Bízková Z., Skřivanová V., Volek Z., Zita L. 2014. Effect of housing system and genotype on rabbit meat quality. *Czech J. Anim. Sci., 59, 190–199*.

Dalle Zotte, A. 2002. Perception of rabbit meat quality and major factors influencing the rabbit carcass and meat quality. *Livest. Prod. Sci., 75(1), 11–32*.

Dalle Zotte A. Szendrö K. Gerencsér Z. Szendrö Z. Cullere M. Odermatt M. Radni I., Matics, Z. 2015. Effect of genotype, housing system and hay supplementation on carcass traits and meat quality of growing rabbits. *Meat Sci., 110, 126–134.*

Gómez E., Baselga M., Rafel O., Ramon J. 1998. Comparison of carcass characteristics in five strains of meat rabbit selected on different traits. *Livest. Prod. Sci., 55(1), 53–64*.

Lukefahr, S.D, Cheeke, P.R. 1991. Rabbit project development strategies in subsistence farming systems. *World Anim. Rev., 68*(3).

Pascual M., Pla M., Blasco A. 2008. Relative growth of organs, tissues and retail cuts in rabbits selected for growth rate. *In: Proc. 9th World Rabbit Congress, 2008 June, Verona, Italy, 211–216.*

SAS Institute Inc. 2011. SAS® 9.3 System Options: Reference, Second Edition. Cary, NC: SAS Institute Inc.

Serem J.K., Wanyoike M.M., Gachuiri C.K., Mailu S.K., Gathumbi P.K., Mwanza R.N., Kiarie N., Borter, D.K. 2013. Characterization of rabbit production systems in Kenya. *J. Agric. Sci. Appl., 2(3), 155–159.*

Szendrö Z., Radnai I., Biró-Németh E., Romvári R., Milisits G., Kenessey Á. 1998. The effect of live weight on the carcass traits and the chemical composition of meat of pannon white rabbits between 2.2 and 3.5 kgs. *World Rabbit Sci., 6(2), 243–249.*

Tůmová E., Bízková Z., Skřivanová V., Chodová D., Martinec M., Volek, Z. 2014. Comparisons of carcass and meat quality among rabbit breeds of different sizes, and hybrid rabbits. *Livest. Sci., 165, 8–14.*

=============