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THE EFFECT OF AGE AND WEIGHT ON SLAUGHTER TRAITS AND MEAT COMPOSITION OF PANNON WHITE GROWING RABBITS

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ABSTRACT

Sixty Pannon White growing rabbits were slaughtered between the age of 70 and 98 days and in a live weight range of 1,900 to 3,500 g. The animals were selected for slaughter with a particular aim, i.e. to obtain rabbits of the same weight but of different age, and also animals of the same age but of different live weight. The effects of age and weight on the slaughter traits and meat composition were examined separately. It was concluded that the slaughter value of growing rabbits is influenced primarily by body weight, but in some instances age also has a notable effect. Higher dressing percentage was observed in the heavier rabbits among those of the same age, and in the older ones among those of the same weight. The reverse tendency was observed with respect to the ratio of the full gastrointestinal tract to body weight. It was also established that the effect of age on the perirenal fat is more substantial than its effect on the meat on the intermediate part. With regard to changes in the water and lipid content of the muscle tissues of the animals the effect of live weight seemed to be greater, but the effect of age also proved not to be merely negligible.

INTRODUCTION

The effect of slaughter age and body weight on the slaughter value and meat composition of rabbits has been investigated extensively. However, in most trials rabbits have been slaughtered at different ages (RUDOLPH *et al*., 1980; PETERSEN *et al*., 1988) or at different body weight (PARIGI-BINI *et al*., 1992; LAMBERTINI *et al*., 1996; MASOERO *et al*., 1996; SZENDRŐ *et al*., 1998); thus, as the older rabbits had greater live weight and the heavier ones were older the effects of weight and age could not be ascertained separately. Only very few papers deal with the separate evaluation of the effects of age and live weight (SZENDRŐ, 1989; ROIRON *et al*., 1992), and so this trial was aimed at achieving separate examination of the effects of age and live weight on the slaughter value and meat quality of rabbits.

MATERIAL AND METHOD

Animals and rearing conditions

The experiment was performed with 60 growing Pannon White rabbits, weaned at the age of 35 days and housed in a closed building, in groups of 5 or 6 per cage (800x500mm). The animals were kept under artificial lighting conditions (16 hours per day) and at a room temperature of 15-20 °C prior to the slaughter procedure. A commercially available pelleted diet (DE 10.30 MJ/kg, crude protein 17.5%, crude fat 3.6%, crude fibre 12.4%) was fed *ad libitum* to the young rabbits. Drinking water was freely available from self-drinkers.

Slaughter and analytical procedures

All the rabbits were slaughtered between the age of 70 and 98 days in a live weight range of 1,900 to 3,500 g. The animals were selected for slaughter with a particular aim, i.e. to obtain

rabbits of the same weight but of different age, and also animals of the same age but of different live weight (*Table 1*).

Table 1. Experimental groups and number of rabbits involved

Age (days)	Live weight (g)				
	1900	2300	2700	3100	3500
70	6	8	6		
84		6	8	6	
98			6	8	6

The rabbits were slaughtered and dissected according to the method of BLASCO *et al*. (1993) after 24 hours of fasting (with water available). The respective parts of the body were weighed while warm and the ratios of these weights to live weight and carcass weight were calculated. Meat samples were taken from half of the rabbits in each experimental group: these 40g samples were taken from the m. longissimus dorsi (24 mm slices at the 4th-5th dorsal vertebra) and from the muscle of the hind leg (16 mm slices at the neck of the right femur). The samples were homogenised and after drying their water content was measured by gravimetry. The total lipid content of 34 samples (17 for each muscle type) was analysed by extraction with petroleum ether. The total lipid content of the remaining samples was estimated by means of two specific muscle equations, obtained from the spectra NIRS of the dried muscles. Reflectance spectra of the muscle samples were recorded using a NIRSystem 4500 spectrophotometer, between the wavelengths of 1308 and 2388 nm. The calibration of total lipid content, after mathematical transformation by first derivative of raw spectra of absorbance (log 1/R), was performed by the Modified Partial Least Squares (MPLS) regression method, with internalcross-validation, by the application of the optimal number of components in each case (MASOERO *et al*., 1996). The performance results for the equations were: R^2 (calibration) = 0.92 and SEP = 0.52 % for the m. longissimus dorsi; R^2 (calibration) = 0.99 and SEP = 0.79 for the hind leg meat.

Statistical procedures

The differences between the groups with respect to the traits examined were tested with one-way ANOVA analysis. The LSD test was used to study inter-group differences. Bivariate linear and quadratic regression models were applied to determine the nature of the cumulative effect of body weight and age. The SPSS statistics software package (SPSS 8.0 FOR WINDOWS, 1997) was used in the evaluation of the data.

RESULTS AND DISCUSSION

The most important slaughter data are summarised in *Table 2*. Based on these data it can be established that dressing percentage, calculated with or without the head and edible organs, shows an increasing tendency within advancing age and rising live weight. These tendencies are in agreement with the results of ROIRON *et al*. (1992), but could not be proven statistically (except in certain cases) due to the low number of animals involved. It is already known from data in the literature (SZENDRŐ, 1989; ROIRON *et al*., 1992) that live weight has a more significant effect on the slaughter traits than age, but based on the results of this experiment it can be concluded that the effect of age is not merely negligible either.

This conclusion is much truer in the case of the fore, intermediate and hind parts, for which the ratios in relation to the live weight show a more favourable tendency with advancing age

than with increasing live weight. Although the tendencies observed could not be proven statistically, it seems that the effect of age could also be important.

Table 2. Effect of age and live weight on the carcass traits of Pannon White growing rabbits

Age (days)	Live weight (g)														
	1900			2300			2700			3100			3500		
	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.
Live weight (g)															
70	6	**1933**	20.1	8	**2308**	7.5	6	**2698**	12.8						
84				6	**2370**	5.8	8	**2713**	8.5	6	**3117**	3.3			
98							6	**2730**	11.5	8	**3085**	38.6	6	**3530**	26.5
Dressing percentage with head and edible organs (%)															
70	6	**56.0**	1.18	8	**56.2^{A}**	0.72	6	**56.6**	1.28						
84				6	**58.9^{B}**	0.76	8	**58.3**	0.61	6	**58.9**	0.55			
98							6	**58.9**	0.79	8	**59.7**	0.38	6	**60.2**	0.56
Dressing percentage without head and edible organs (%)															
70	6	**48.3**	1.18	8	**48.8^{A}**	0.77	6	**49.8**	1.18						
84				6	**51.2^{B}**	0.73	8	**51.2**	0.46	6	**52.3**	0.54			
98							6	**51.7^{a}**	0.70	8	**52.9^{ab}**	0.28	6	**53.7^{b}**	0.64
Ratio of fore part to live weight (%)															
70	6	**14.8**	0.39	8	**15.5**	0.38	6	**15.1**	0.43						
84				6	**15.6**	0.26	8	**15.9**	0.21	6	**15.8**	0.23			
98							6	**16.0**	0.40	8	**16.4**	0.25	6	**16.9**	0.42
Ratio of intermediate part to live weight (%)															
70	6	**14.9**	0.50	8	**14.8^{A}**	0.29	6	**15.8**	0.36						
84				6	**16.1^{abB}**	0.45	8	**15.8^{a}**	0.20	6	**17.1^{b}**	0.47			
98							6	**15.8^{a}**	0.29	8	**16.7^{b}**	0.28	6	**17.5^{b}**	0.29
Ratio of hind part to live weight (%)															
70	6	**18.7**	0.38	8	**18.5**	0.23	6	**18.9**	0.49						
84				6	**19.5**	0.46	8	**19.5**	0.24	6	**19.4**	0.34			
98							6	**19.8**	0.39	8	**19.7**	0.17	6	**19.3**	0.33
Ratio of fore part to carcass weight (%)															
70	6	**30.5^{a}**	0.30	8	**31.7^{b}**	0.44	6	**30.4^{a}**	0.23						
84				6	**30.5**	0.67	8	**31.1**	0.30	6	**30.2**	0.42			
98							6	**31.0**	0.44	8	**31.1**	0.45	6	**31.5**	0.55
Ratio of intermediate part to carcass weight (%)															
70	6	**30.8^{ab}**	0.37	8	**30.3^{a}**	0.26	6	**31.7^{b}**	0.40						
84				6	**31.4^{ab}**	0.63	8	**30.9^{a}**	0.21	6	**32.6^{b}**	0.75			
98							6	**30.7^{a}**	0.61	8	**31.6^{ab}**	0.41	6	**32.5^{b}**	0.21
Ratio of hind part to carcass weight (%)															
70	6	**38.7**	0.39	8	**37.9**	0.30	6	**38.0**	0.35						
84				6	**38.1**	0.48	8	**38.0**	0.36	6	**37.1**	0.58			
98							6	**38.4^{a}**	0.51	8	**37.3^{ab}**	0.39	6	**36.0^{b}**	0.70
Ratio of perirenal fat to live weight (%)															
70	6	**0.41^{a}**	0.06	8	**0.57^{ab}**	0.08	6	**0.85^{b}**	0.22						
84				6	**0.65^{a}**	0.12	8	**0.57^{a}**	0.07	6	**1.06^{bA}**	0.12			
98							6	**0.65^{a}**	0.13	8	**0.76^{aB}**	0.07	6	**1.06^{b}**	0.06
Ratio of skin to live weight (%)															
70	6	**14.3**	0.53	8	**15.2**	0.39	6	**14.8^{AB}**	0.27						
84				6	**14.2^{a}**	0.22	8	**14.4^{aA}**	0.29	6	**15.4^{b}**	0.30			
98							6	**15.6^{B}**	0.40	8	**16.0**	0.47	6	**16.0**	0.42
Ratio of full gastrointestinal tract to live weight (%)															
70	6	**16.6**	0.99	8	**15.8**	0.49	6	**15.2**	0.81						
84				6	**15.2**	0.99	8	**15.7**	0.66	6	**13.6**	0.47			
98							6	**13.9**	0.78	8	**13.3**	0.33	6	**12.8**	0.22
Meat on intermediate part (g)															
70	6	**171^{a}**	6.6	8	**209^{bA}**	7.3	6	**277^{c}**	10.5						
84				6	**238^{aB}**	10.4	8	**274^{b}**	3.8	6	**345^{c}**	9.8			
98							6	**286^{a}**	7.5	8	**344^{b}**	7.5	6	**411^{c}**	9.4
Perirenal fat weight (g)															
70	6	**7^{a}**	1.1	8	**13^{ab}**	1.9	6	**22^{b}**	5.6						
84				6	**14^{a}**	2.7	8	**14^{a}**	1.8	6	**31^{b}**	3.7			
98							6	**18^{a}**	3.4	8	**23^{a}**	1.9	6	**36^{b}**	2.0

$^{a, b}$ Different letters in the same row indicate significant difference ($P<0.05$)

$^{A, B}$ Different letters in the same column indicate significant difference ($P<0.05$)

When the weight of the fore, intermediate and hind parts was studied in relation to the weight of the carcass an interesting tendency was observed in the case of the hind part. The ratio of this part to carcass weight increased with advancing age at the same weight, but decreased with increasing live weight at the same age. In the case of the fore and intermediate parts no unambiguous changes were observed.

The ratio of perirenal fat was found always to be higher in heavier rabbits at every age examined. These results are in total agreement with the findings of ROIRON *et al*. (1992).

In the case of the skin to body weight ratio no unambiguous tendencies were observed with advancing age, but a higher skin ratio was obtained when live weight increased at the same age.

Neither weight nor age had a significant effect on the ratio of the weight of the full gastrointestinal tract to live weight. In spite of this, it could be observed that in heavier or elder rabbits this ratio was distinctly lower. This change seems to be logical, as a favourable change in dressing percentage can be achieved only if the ratio of wastage (e.g. alimentary tract) changes conversely.

By the use of the group average data in linear and non-linear regressions it was established that the weight of meat on the intermediate part increased linearly and that of the perirenal fat exponentially in the weight range examined.

As the next step in the analysis procedure age was used as a second variable. In the case of meat on the intermediate part, based on the above relation, a linear approximation was applied (*Fig. 1*). The function can be given as follows:

$$\mathbf{Y = 0.140 \times X_1 + 2.072 \times X_2 - 125.3,}$$

where Y = weight of meat on intermediate part [g], X_1 = live weight [g], X_2 = age [weeks].

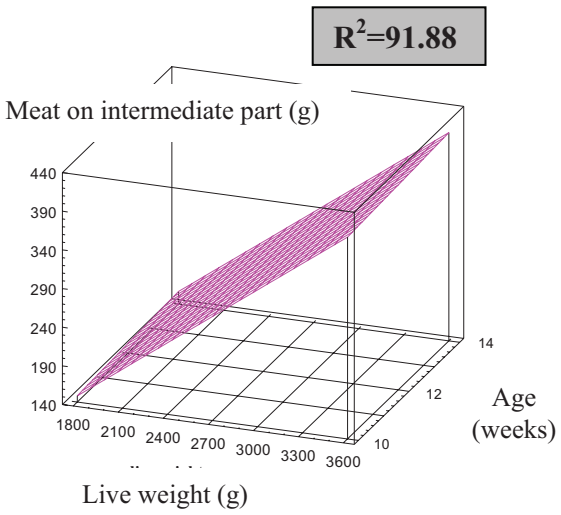

Fig. 1. Bivariate linear relation showing the cumulative effect of age and body weight on the meat on the intermediate part

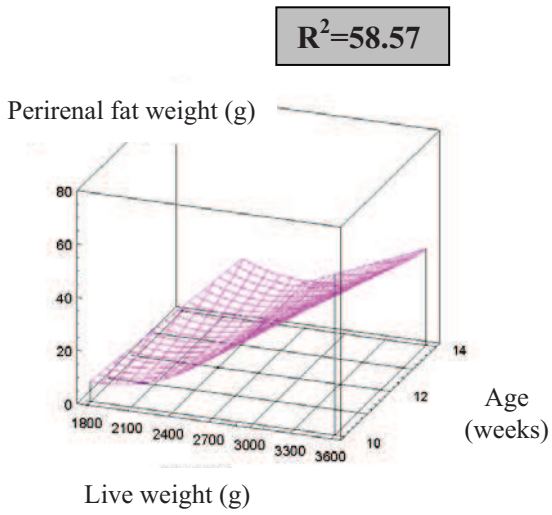

Fig. 2. Bivariate quadratic relation showing the cumulative effect of age and body weight on the amount of perirenal fat

In the case of the perirenal fat a quadratic non-linear regression model was used, based on the above correlation. The surface area shown in *Fig. 2* can be described by the following equation:

$$\mathbf{Y = 0.0076 \times X_1 + 3.6887 \times X_2 + 0.0002 \times X_1^2 + 0.8644 \times X_2^2 - 0.0095 \times X_1 \times X_2 - 33.09,}$$

where Y = perirenal fat weight [g], X_1 = live weight [g], X_2 = age [weeks].

It can be seen in *Fig. 1* that in the live weight range investigated weight exerted a quite conclusive effect on the amount of meat on the intermediate part. With rabbits of the same live weight but of different ages the muscle obtained from the intermediate part proved to be of almost the same amount.

In the case of the perirenal fat the effect of age was more considerable (*Fig. 2*). In the low weight range the young rabbits had less renal fat than older ones of the same weight. The opposite proved to be the case at higher live weight, where the amount of renal fat in the 10-week-old rabbits was higher than in those of 14 weeks. It must be added that the changes shown above have to be evaluated carefully, especially by the border-lines of the ranges investigated and with respect to the low number of samples.

The tendencies observed in changes in the water and lipid content of the different types of muscle tissues (*Table 3*) were very similar to those in relation to the respective slaughter traits. It seems that the effect of live weight was more significant than that of age in this case. It can be observed that the water content of the muscles decreased with increasing live weight at the same age, but no tendentious changes were found with advancing age at the same weight. In the case of lipid content the effect of weight was seen only at the age of 98 days. In the live weight and age ranges examined no significant differences were observed between the water and fat content of the m. longissimus dorsi and of the hind leg muscles, presumably due to the small number of samples involved.

Table 3. Water and lipid content of m. longissimus dorsi and hind leg muscles

Age (days)	Live weight (g)														
	1900			2300			2700			3100			3500		
	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.	n	Mean	S.E.
Water content of m. LD (%)															
70	3	73.5	0.97	4	74.0	0.64	3	73.5	0.52						
84				3	73.3	0.45	4	72.8	0.44	3	73.3	0.38			
98							3	75.2	0.95	4	73.6	0.45	3	73.0	0.88
Water content of hind leg muscles (%)															
70	3	73.2	1.38	4	73.2	0.88	3	71.4	0.69						
84				3	72.2	0.79	4	72.5	0.49	3	70.8	0.56			
98							3	73.3	0.76	4	73.3	0.55	3	71.1	0.63
Lipid content of m. LD (% of dry matter)															
70	3	4.11	0.89	1	4.61	1.35	3	4.03	1.42						
84				3	2.94	1.13	4	2.28	0.5	3	2.67	0.29			
98							3	2.50	0.1	4	3.02	0.45	2	4.89	0.52
Lipid content of hind leg muscles (% of dry matter)															
70	3	10.4	1.62	4	9.9	2.56	3	14.8	6.35						
84				3	13.3	1.86	4	10.2	0.98	3	12.3	1.57			
98							3	7.2	0.36	4	7.6	1.49	3	15.0	1.98

CONCLUSIONS

Based on these trial results it can be established that the slaughter value of the growing rabbits was influenced primarily by body weight, but in certain instances age also had a notable effect. Dressing percentage proved higher in the heavier rabbits of the same age and in the older ones of the same weight. A reverse tendency was observed in the case of the ratio of the full gastrointestinal tract to body weight.

The changes in the weight of meat on the intermediate part appeared linear and those in the perirenal fat exponential in the weight and age ranges examined. The effect of age was more substantial in the case of the perirenal fat than with respect to the meat on the intermediate part.

The changes in the water and lipid content of the most important muscle tissues of the rabbits proved very similar to those in relation to the respective slaughter traits. In both cases the effect of live weight was greater than that of age, but the effect of age was not merely negligible.

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