MEAT QUALITY FEATURES OF LIGHT AND HEAVY TYPES OF NEW ZEALAND WHITE RABBITS

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Abstract - As the growth capacity of rabbits has been increased considerably by breeding strategies it cannot be excluded that meat quality aberrations may occur as in porc production. There-fore, a project was started to investigate if there exist any differences in meat quality between rabbits of different growth capacities. Ten male and ten female rabbits of light and of heavy types of New-Zealand white rabbits were used, respectively. In the present experiment only small differences were observed between the two weight groups for both sexes concerning pH-value, conductivity, colour (Lab), R-value, water holding capacity, grilling losses, and texture measured in the longissimus muscle. In general, differences between sexes were more distinct than between weight classes indicating a tendency to a less favourite meat quality in males.

INTRODUCTION

As the growth capacity in rabbits was increased in the past considerably by breeding strategies the question arised whether a PSE-like condition may occur, as well. For measuring meat quality aberrations it is necessary to have available appropriate methods for measuring differences in quality and to know the features of normal meat quality.

In general, meat quality is described by specified criteria as there are ingredients of tissues (amino acids, fatty acids, vitamins and minerals), hygienic and toxicological aspects, sensoric quality, physical and technological aspects (objective indicators for the sensoric quality), and nutritional/physiological value (digestability and wholesameness of food). For the consumer the most important criterium is the sensoric quality expressed as juiciness, tenderness, and flavour. Objective indicators for the sensoric aspects are pH-value, conductivity, R-value (onset of rigor), colour, water holding capacity, cooking and grilling losses, drip losses, texture, and TBA-method for degree of rancidity.

For the rabbit only few information is available concerning meat quality aspects, besides for meatiness. OSMAN (1991) reported about differences in meat quality traits of male white New-Zealand rabbits in response to reduced feeding time and age (14 and 18 weeks). In the older rabbits higher pH_{24}-values and higher colour values (GÖFO) were observed in the loin meat and in the hind-quarter meat. There was a tendency for improved water holding capacity but higher cooking losses, as well. Whereas, JENSEN (1995) observed a less favourite meat quality in rabbits older than 90 days indicated by higher shear values. Comparing the performance of Helle Großsilber, White New-Zealands, and their reciprocal crosses KROGMEIER and DZAPO (1991) found no differences for pH-values and conductivity. Richter (1992) could not find any differences for pH-values, meat colour, water holding capacity, and dripp losses between different breeds of rabbits. But, BIENIEK et al. (1995) reported about a better meat quality in crossbreds of White New Zealand and Black Tan rabbits. They found significant differences between sexes, as well. Using rapeseed oil and soybean oil KESSLER and PALLAUF (1994, 1995) observed higher proportions of linoleic and linolenic acid in adipose tissues.

The intention for the present project is to compare meat quality characteristics of male and female New-Zealand rabbits differing significantly in their growth capacity.

MATERIAL AND METHODS

Fourty male and fourty female rabbits each of the breed ZIKA white New-Zealand were fattened under usual commercial conditions up to 112 days of age. Pelleted feed (16.5 % crude protein, 10.5 MJ metabolizable energy, 15 % crude fibre) and water were given ad libitum. The ten heaviest and the ten lightest rabbits of each sex were selected for quality control. The experimental design was 2-factorial: sex and body weight.

The rabbits were caught and brought to the slaughter house one hour prior to slaughtering. They were stunned by captivebolt, bleeded by cutting the carotid artery, and eviscerated by hand. The individuals of the different treatments were killed in a rotating systemin in 3 minute intervals. About 15 minutes post mortem internal temperature (digital thermometer), conductivity (WTW Conductometer LF 191) and pH (WTW pH 192) were measured in the M. longissimus dorsi between the 4th and 5th lumber vertebrae. For measuring colour (Minolta Chromameter II) according to the Lab system the longissimus muscle was cut between these two vertebrae. About 5 grams of muscle tissue were collected at the same position and frozen in liquid nitrogen for the determination of the R-value (HONIKEL and FISCHER, 1977). After the measurements the carcasses were weighed and frozen for further analyses.
After thawing of the carcasses the internal temperatures, pH-values, conductivity, and colour were recorded, again. The dissection of carcasses was done according to the recommendations of the DLG. Following dissection water holding capacity was measured by the method of GRAU and HAMM (1953). Meat samples were taken for analysing the protein and fat content of muscle. Grilling losses and texture (Warner-Brazler shear tool; INSTRON Modell 4301) values of longissimus muscle were determined after thermal treatment (internal temperature 85 C) of the samples on a plate grill.
For statistical analysis the subroutine GLM of the SAS package was used. As the internal temperatures of the carcasses differed significantly after thawing the temperature was used as a covariate in the statistical model. A two-way analysis of variance was performed.

RESULTS AND DISCUSSION

The differences between the means of the heavy and light body weight groups were 455 and 511 g in males and females, respectively. This corresponds to relative differences of 16 and 18 % in the heavier groups (table 1). Females were heavier than males. No differences between groups were found for carcass yields and the proportions of front halfs and thighs. The percentage of the longissimus muscle was significantly higher in females than in males. There was a non-significant tendency of higher proportions of longissimus muscle in the heavy as compared to the light groups.

Table 1 : Live weights (g) and carcass traits in percent (means±s.d.; w=weight, s=sex)

	light		heavy		signific.	
	♂	♀	♂	♀	w	s
live weight	2,755 ± 180	2,895 ± 209	3,251 ± 305	3406 ± 151	***	*
carcass yield	53.59 ± 1.11	53.60 ± 0.64	53.50 ± 1.34	52.30 ± 1.24	n.s.	n.s.
front half	23.22 ± 0.96	22.66 ± 1.31	22.56 ± 1.42	23.54 ± 1.17	n.s.	n.s.
thighs	34.30 ± 1.65	34.74 ± 0.75	34.58 ± 1.30	33.59 ± 1.86	n.s.	n.s.
long. muscle	11.06 ± 0.67	12.09 ± 0.84	11.45 ± 0.76	12.21 ± 0.52	n.s.	***

No significant differences between groups were recorded for meat quality traits measured 15 minutes post mortem, except for colour of the longissimus muscle (table 2). In the heavy groups there was a tendency for higher pH-values and lower conductivity values of males versus females. The pH- and the conductivity values in this experiment were higher and/or lower than the values found by OSMAN (1991) or KROGMEIER and DZAPO (1991). OSMAN (1991) measured pH at the same time (15 minutes p.m.) in the loin whereas KROGMEIER and DZAPO (1991) measured pH and conductivity 90 minutes post mortem in the M. semimembranosus. The higher pH-values in the present experiment may be due to the very carefull handling of the animals. Maybe, the braking down of carbohydrates has not started at the time of measurement. Concerning the differences in colour measurements it was observed that the female rabbits exhibited higher values for brightness (L) and yellowness (b) indicating a lighter meat. The lower L-values and the higher values for red (a) in males corresponded with the darker appearance of the meat. There are no data on Lab-values in rabbits available from literature. R-values were higher in heavy rabbits as compared to the light groups. Apparently, the onset of rigor mortis was enhanced in the heavy groups, but differences did not reach statistical significance.

Table 2 : Meat quality traits measured 15 minutes post mortem (means±s.d.; w=weight, s=sex)

	light		heavy		signific.	
	♂	♀	♂	♀	w	s
conductivity (mS)	1.55 ± 0.08	1.61 ± 0.17	1.71 ± 0.25	1.50 ± 0.12	n.s.	n.s.
pH	7.33 ± 0.15	7.34 ± 0.14	7.15 ± 1.02	7.45 ± 0.16	n.s.	n.s.
L	40.69 ± 3.21	45.76 ± 3.88	41.16 ± 4.32	43.67 ± 4.60	n.s.	**
a	2.61 ± 0.78	1.87 ± 0.50	2.10 ± 0.78	1.66 ± 0.56	n.s.	**
b	-0.70 ± 0.43	0.45 ± 1.86	-0.81 ± 0.52	-0.38 ± 0.51	n.s.	*
R-value	0.89 ± 0.03	0.88 ± 0.03	0.94 ± 0.10	0.94 ± 0.10	n.s.	n.s.

Table 3 : Meat quality traits measured after thawing (means±s.d.; w=weight, s=sex)

	light		heavy		signific.	
	♂	♀	♂	♀	w	s
conductivity (mS)	7.44 ± 1.42	7.34 ± 1.34	7.36 ± 1.33	7.38 ± 1.66	n.s.	n.s.
pH	5.62 ± 0.12	5.58 ± 0.11	5.68 ± 0.11	5.64 ± 0.10	n.s.	n.s.
L	55.59 ± 1.55	57.02 ± 2.53	56.08 ± 2.28	57.47 ± 3.48	n.s.	n.s.
a	1.79 ± 0.51	1.49 ± 0.48	1.97 ± 0.80	1.32 ± 0.68	n.s.	*
b	0.00 ± 0.56	0.38 ± 0.95	-0.32 ± 0.75	-0.09 ± 1.31	n.s.	n.s.
WHC	0.54 ± 0.10	0.50 ± 0.12	0.52 ± 0.09	0.50 ± 0.09	n.s.	n.s.
grill losses (%)	30.87 ± 3.15	30.34 ± 4.08	30.50 ± 2.34	30.58 ± 2.61	n.s.	n.s.
texture (N)	27.62 ± 11.6	21.51 ± 7.91	26.01 ± 8.83	25.52 ± 8.43	n.s.	n.s.
dry matter (%)	25.65 ± 0.84	25.51 ± 0.65	25.21 ± 0.71	26.03 ± 0.83	n.s.	n.s.
fat (%)	9.27 ± 2.28	8.76 ± 1.88	8.84 ± 2.05	9.95 ± 2.04	n.s.	n.s.

Meat quality traits measured after thawing are summarized in table 3. Again, there were no differences concerning pH-values and conductivity values for weight and for sex. The pH-values seem to be in a normal range corresponding to the values found by OSMAN (1991) and RICHTER (1992). The differences for colour measurements were in the same range as 15 minutes post mortem. The only significant effects were observed for sex in the a-value which means that males had darker meat than females. No effects were recorded for water holding capacity and grilling losses for weight groups. This is in agreement with OSMAN (1991). For texture measurements higher shear forces (N) were received for males than for females independent of weight. Concerning all the traits measured as indicators for meat quality it is obvious that the effects of sex were more pronounced than for weight classes showing a tendency of a less favourite meat quality in male rabbits.

It can be concluded that there is little - if any - difference in meat quality between heavy and light rabbits of the tested breed. Some effects of sex on various traits indicate a better meat quality in female than in male rabbits. The experiment will be continued with an increased number of animals.

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