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EFFECT OF GENETIC VARIATION ON GROWTH RATE AND MEAT QUALITY IN RABBITS

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ABSTRACT

The studies were conducted on Termond White, New Zealand White, California, Alaska, Grand Chinchilla, New Zealand White meat line and Genia hybrid line rabbits from 35 days of age to reaching a body weight of 2600 g.

The most rapid growth rate was obtained by rabbits of New Zealand White meat line and Genia hybrid line, with feed conversion per 1 kg weight gain below 3.5 kg. Rabbit carcasses were characterized by good carcass meat content ranging from 76.3 to 78.9%. The highest meat content of unsaturated fatty acids (UFA) was characteristic of California (64.94%) and Genia (61.90%) rabbits.

INTRODUCTION

Utilization of rabbits for meat has been given increasing prominence over a dozen years or so (Niedzwiadek and Zajac, 1998). Medium-sized, early-maturing breeds characterized by a rapid rate of growth and low feed intake are most important for rabbit meat production. In the past decade, intensive farming of rabbits has been conducted using specialized meat lines. These are mostly hybrids produced as a result of complex crosses, such as “Hyla plus” and “Genia” lines created in France, the “white rabbit” in Belgium, and “Zika” in Germany (Lebas et al., 1991; Zajac et al., 1994). Contrary to expectations, the interbreeding studies carried out at the National Research Institute of Animal Production did not result in significant effects.

Large potential for exports and new market conditions in Poland made it necessary to undertake studies on rabbit breeds that would be most useful for production of carcasses and meat of high quality.

MATERIAL AND METHODS

The experiment was carried out at the Experimental Stations in Balice and Chorzelów belonging to the National Research Institute of Animal Production. The experimental material consisted of Termond White, New Zealand White, California, Alaska, Grand Chinchilla, New Zealand White meat line and Genia hybrid line rabbits.

The studies involved 60 male and 60 female rabbits of each breed, from 35 days old to reaching 2600 g of body weight. Rabbits were kept in closed, heated houses equipped with a microclimate control system.

The animals were fed complete pelleted feeds containing 16.5% crude protein, 13.3% crude fibre, and 2.94% crude fat, with 2450 kcal ME.

4-5 rabbits of the same sex were kept in each cage, providing 1020 to 1100 cm^2 area/animal and free access to water.

The following parameters were observed: body weight, feed conversion per 1 kg weight gain, slaughter value and meat value.

At the end of fattening, 24 rabbits were slaughtered from each group, with equal proportions of sex. Detailed carcass analysis was performed using methods described by Niedzwiadek (1983 and 1996). After 24 h cooling at about 4°C, the carcasses were divided into 3 basic cuts - front, loin and back. Dissection was performed to determine the content of meat, bones and fat in different cuts.

Chemical analyses were made to determine dry matter, crude protein, crude fat and fatty acids in samples of meat from the *longissimus dorsi* muscle of loin. Water binding capacity was determined using the Grau-hamm method (Hamm, 1973).

Higher fatty acids were analysed using chromatograph GC Varian 3400.

The results are tabulated as means and coefficients of variation for individual parameters. Significant differences between the groups were calculated using Statgraphics (1987) software.

RESULTS AND DISCUSSION

Analysis of variance performed for fattening and slaughter traits of rabbits showed that the differences between means for males and females were statistically non-significant. For this reason, the results of the experiment are tabulated without regard to sex.

At the beginning of the experiment, rabbits of all breeds and lines had similar body weights which ranged from 702 g for Alaska rabbits to 743 g for Grand Chinchilla (Tab. 1). NZW meat line and Genia hybrid line rabbits were the quickest to achieve a weight of 2600 g (at 80 and 82 days, respectively). California and Alaska rabbits were the slowest to achieve final body weights (at 109 and 103 days, respectively). Differences between the breeds were confirmed statistically. Daily weight gains were the highest for NZW meat line and Genia hybrid line rabbits (42 and 40 g, respectively). Feed conversion per 1 kg weight gain was the lowest for NZW meat line and Genia hybrid line rabbits (3.24 and 3.32 kg, respectively).

By far the highest rate of growth was obtained by NZW meat line and Genia hybrid line rabbits. In the studies of Lebas et al. (1991), Rochambeau (1989) and Zajac et al. (1998), the use of heterosis effect made it possible to obtain body weights (at 90 days of age) of 2250 to 2500 g, with daily weight gains not exceeding 35 g.

Also feed conversion in these two groups was very low (less than 3.5 kg). In leading rabbit producing countries of Western Europe, feed conversion is at similar levels (Lebas et al., 1991; Schlolaut et al., 1995; Zajac et al., 1994).

Dressin out percentage was high and ranged from 58.6% to 61.3% (Tab. 2). The highest dressing out percentage was characteristic of California rabbits (61.3%), followed by New Zealand White meat line (60.5%), Grand Chinchilla (60.4%) and Alaska (60.1%). A high slaughter yield of California, Alaska and Grand Chinchilla rabbits which were exposed to a long period of fattening (after 100 days) confirmed the observations of Petersen et al. (1988) that slaughter yield increases with age.

Carcasses of rabbits (Tab. 2) were characterized by a high meat content of 76.3 to 78.9%. The proportion of bones in carcasses ranged from 14.5% for New Zealand White to 16.3% for Alaska and Grand Chinchilla. Carcasses varied as to their fat content. The lowest fat content was found in California (3.9%) and NZW meat line and Genia hybrid line rabbits (5.1%), the highest in Termond White (7.2%) and Grand Chinchilla (7.0%) rabbits. Differences between the breeds were confirmed statistically.

Under the management conditions, NZW meat line rabbits proved to be of the best quality. Also the low fat content of carcasses confirms their great advantages.

The content of protein, one of the more important nutrients, in meat, ranged from 21.14% for NZW rabbits to 22.61% for TW rabbits.

The crude fat content ranged from 4.02% for Genia rabbits to 5.17% for NZW meat line. The low fat content (2-3%) is in agreement with Ouhayoun et al. (1987), while the higher values correspond to the results obtained by Niedzwiadek et al. (1992).

Total cholesterol content showed great variation, from 120 (California, Grand Chinchilla) to 145 (New Zealand White) and 157 mg/100 g meat (Genia).

pH-24 h value was similar in breed groups and ranged from 5.51 to 5.77. These results are in agreement with those reported by Niedzwiadek (1983) and Labecka (1990).

The nutritive evaluation of rabbit meat includes the composition of higher fatty acids. From a physiological point of view, the higher the content of unsaturated fatty acids (including linoleic C-18:2 and linolenic C-18:3 acids), the better the nutritive value.

In the present experiment, the highest UFA content was found in the meat of California (64.94%) and Genia (61.90%) rabbits. The differences were not significant.

In other feeding trials, Chericato et al. (1996) reported PUFA contents of 18-19% for New Zealand White rabbits and Cavani et al. (1996) those of 37-38%.

The highest content of hypocholesterolemic fatty acids (unsaturated + c18) (DFA) occurred in the breeds California (72.03%), Alaska (70.96%), Genia (70.17%) and Grand Chinchilla (70.14%), and the lowest in NZW meat line rabbits (67.17%).

In summing up the results, California rabbits of all breeds were characterized by best meat quality and best percentage proportion of fatty acids in *longissimus dorsi* muscle.

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Table 1. Parameters of fattening performance of rabbits

Breed	Initial fattening body weight (g)		Age at reaching 2600g body weight (days)		Daily weight gains (g)	Feed conversion ratio (kg feed/kg liveweight)	
	X	v%	x	v%	x	x	v%
Termond White	716	15.71	93 Bb	9.87	32.48 AB	3.46 A	7.16
Alaskan	702	18.32	103 B	11.22	19.98 B	4.06 B	9.24
Grand Chinchilla	743	9.83	101 B	7.65	28.14 B	3.89 AB	10.02
Kalifornian	713	20.63	109 Ba	12.67	25.50 B	3.82 AB	7.16
New Zealand White	710	12.38	94 Bb	9.61	32.03 AB	3.41 A	6.19
NZW meat line	708	11.08	80 A	7.37	42.04 A	3.24 A	8.16
Genia line	714	13.16	82 A	8.00	40.13 A	3.32 A	8.26

Numbers with different letters in columns differ significantly: small letters $P \leq 0.05$, capital letters $P \leq 0.01$.

Table 2. Carcass content of tissue components in rabbits of different breeds

Breed	Carcass weight (g)		Carcass content						Dissection Losses	Dressing out percentage
			Meat (%)		Bones (%)		Fat (%)			
	x	v%	X	v%	x	v%	x	v%	%	%
Termond White	1155	5.51	76.3 b	2.28	15.9 ab	6.14	7.2 a	56.82	0.6	59.7
Alaska	1201	5.78	76.7 b	3.00	16.3 b	7.12	5.3 c	62.36	1.7	60.1
Grand Chinchilla	1245	6.78	76.5 b	2.15	16.3 b	7.55	7.0 a	53.44	0.2	60.4
California	1216	4.91	78.9 a	1.95	16.0 b	11.17	3.9 b	49.15	1.2	61.3
New Zealand White	1265	5.28	78.0 a	1.65	14.5 a	7.73	6.3 ac	36.17	1.2	58.9
NZW meat line	1236	4.62	78.0 a	1.54	16.1 b	6.24	5.1 c	52.63	0..8	60.5
Genia line	1252	4.55	78.6 a	1.68	16.1 b	6.84	5.1 c	58.47	0.2	58.6

a, b For explanation of significant differences see Table 1.

Table 3. Some physicochemical indicators of longissimus dorsi and fatty acid composition (in % of total fats) of rabbits.

Item	Termond White	Alaskan	Grand Chinchilla	Californian	New Zealand White	NZW meat line	Genia line
Dry matter (%)	29.05	29.23	29.05	29.06	29.74	29.71	30.92
Crude protein (%)	22.61	21.27	22.31	21.70	21.14	21.11	22.34
Crude fat (%)	4.93	4.96	4.24	4.60	4.49	5.17	4.02
Total cholesterol (mg/100 g meat)	135.93ab	128.20ab	120.98a	120.00a	145.50ab	141.80ab	157.80b
Water holding capacity (%)	10.66	9.25	7.73	10.00	9.76	13.20	9.77
pH –24h	5.77	5.71	5.76	5.60	5.73	5.68	5.51
Saturated acids (SFA)	39.14	39.07	39.92	32.06	39.71	41.17	38.10
Unsaturated acids(UFA)	60.86ab	60.93ab	60.08ab	64.94a	60.30ab	58.84b	61.90ab
Monounsaturated acids(MUFA)	37.96	35.09	35.79	35.62	35.72	36.28	35.65
Polyunsaturated (PUFA)	22.91	25.85	24.29	27.03	24.58	22.55	26.26
Polyunsaturated acids n-3 (PUFA-3)	3.12	3.10	3.08	3.46	3.11	3.72	3.69
Dietary fatty acids having desirable neutral or hypo-cholesterolemic effect in humans (DFA)*	69.92ab	70.96ab	70.14ab	72.03a	69.85ab	67.17b	70.17ab
Dietary fatty acids having undesirable (hypercholesterole-mic) effect in humans (OFA)*	30.08ab	29.04ab	29.86ab	27.97a	30.15ab	32.84b	29.83ab

* DFA - total unsaturated fatty acids (UFA) + C18

* OFA - total acids C14+C16

For explanation of significant differences see Table 1.