EVALUATION OF SEVEN GENETIC GROUPS OF RABBITS FOR CARCASS TRAITS

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Abstract - Three hundred eighty-five growing rabbits representing seven genetic groups were evaluated for carcass traits. Both sexes of two parities were analyzed to determine the effects of straight and cross breeding as well as parity on carcass traits. Genetic groups were New Zealand White (NZW), Californian (CA), German Large White (GLW) as pure-breds; NZW x CA , CA x NZW, GLW x F1 {GLW x (NZW-CA) or GLW x (CA-NZW)} as terminal crossbred (TX) and F1 x F1 as crossbreds (buck:doe). At 12-13 weeks of age live body weight at slaughter (after 24 h fasting) averaged 2488, 2484, 2506, 2505, 2512, 2503 and 2500 g; dressing percentages were 61.2, 61.6, 61.5, 61.5, 61.4, 60.9 and 61.5% respectively. There were not significant differences among genetic groups for dressing percentages (total edible parts together). Sex was not important ($p \leq 0.01$) for all traits except offals which increased in females. Parity as source of variation was not important ($P \leq 0.01$) for all traits except skin, feet and loin percentages which increased in fryers of 1st parity while hind increased in fryers of 2nd ones. Interactions among main effects were not significant for all traits except some of which differed significantly in main effects.

Direct and maternal heterosis (H^E NZW x CA and H^M NZW x CA) were estimated for carcass traits and varied between negligible negative or positive values (except abdominal fat). Regarding crossbreeding effects on carcass yield, it revealed that generally low benefit of single or double crossbred rabbits.

INTRODUCTION

The common goal of producer and processor is to increase total meat percentage of the carcass of rabbits. There is evidence of variation among rabbit breeds and their crosses in carcass traits (RAO et al. 1978 ; LUKEFAHR et al., 1982 and 1983 ; JENSEN and TUXEN,1986 ; EL-QEN, 1988 ; RISTIC et al., 1988 ; SALEH et al., 1988 ; OZIMBA and LUKEFAHR, 1991 ; BRUN et al., 1992 ; PARIGI-BINI et al., 1993 and SZENDRÕ et al., 1995), but the nature and extent of this variation-mainly variation in carcass characters have not been investigated in many countries till now, although application of commercial crossbreeding has shown successful advantage in some countries in Europe. Investigations show that slaughter value varies upon breed, nutrition, management conditions, body weight and some less important factors (RUDOLPH, 1988). Carcass traits have also been analysed at different ages by many investigators, but according to investigations by SZENDRÕ (1989) dressing percentage is not affected by age if rabbits are slaughtered at the same body weight. This study was conducted to evaluate carcass traits of seven genetic groups of rabbits representing three breeds (NZW, CA and GLW) and four crossbred groups included reciprocal crosses of NZW and CA as first crossbred generation (F1), GLW x F1 as terminal crossbred (TX) and F1 x F1 as second crossbred generation (F2). In addition, effects of sex, parity and interactions among main factors in the statistical model on carcass characters also were examined. The estimation of direct and maternal heterosis percentages for carcass traits were taken into consideration as genetic parameters.

MATERIAL AND METHODS

Fifty-one to fifty-seven rabbits per genetic group were chosen randomly from the experimental animals ranged for slaughtering. Slaughter houses in Hungary do not accept rabbits lighter than 2.5 kg for slaughtering, therefore, rabbits were slaughtered at 2.5-2.8 kg live weight. Twenty to twenty seven and thirty to thirty one rabbits were slaughtered in three occasions at 12-13 weeks of age of 1st and 2nd parity resp., using recommended methods for slaughtering (BLASCO et al., 1993). Rabbits were weaned at 6 weeks of age and put in another cage after mixing with other litters (2 rabbits per cage) until slaughter. Growing period were in 1st and 2nd parity from 3rd March to 19th April and from 4th May to 20th June, 1995 respectively. The animals were fed commercial pellet *ad libitum* contained 17% crude protein and 14.87% crude fibre. Drinking water

was available continuously from self-drinkers. Rabbits were killed humanely after 24h of fasting from feed only. The following measurements were taken: body weight before and after fasting, weight loss, blood, commercial skin, feet (distal part of fore and hind legs), head, offals (full gastrointestinal tract), liver, giblets (kidneys, heart, lungs) abdominal fat, carcass (hot carcass minus head and edible parts), fore-quarters, loin region and hind-quarters of carcass (cutpoints between 7th and 8th ribs and dorsal vertebras and between 6th and 7th lumbar vertebras, in the line of the thighs). Ratios of single body parts to live weight after fasting were also calculated. Dressing percentage was calculated as follows :

Dressing % = [(carcass + head + liver + abdominal fat + giblets) / live weight after fasting] x 100.

Statistical analysis

Least squares analysis of data for unequal subclass numbers were performed using the GLM procedure of SAS (1990). A general model used to analyze carcass data was the following :

$$Y_{ijkl} = \mu + G_i + S_j + P_k + (GS)_{ij} + (GP)_{ik} + (SP)_{jk} + (GSP)_{ijk} + e_{ijkl}$$

where, Y_{ijkl} the observation on the ijkl th rabbits, μ = over all mean, G_i = fixed effect of i th genetic group (i = 1,... 7), S_j = fixed effect of j th sex (j = 1 and 2), P_k = fixed effect of k th parity (k = 1 and 2), $(GS)_{ij}$ = interaction between genetic group and sex, $(GP)_{ik}$ = interaction between genetic group and parity, $(SP)_{jk}$ = interaction between sex and parity, $(GSP)_{ijk}$ = interaction among genetic group, sex and parity and e_{ijkl} = random error.

Heterosis Estimation

Heterosis percentages were estimated for H^E NZW x CA (direct heterosis) and H^M NZW x CA (maternal heterosis) according to simple DICKERSON model (1969) by using genetic-group least-squares means as follows :

Direct heterosis effect (%) :

$$H^E_{NZW \times CA} = \{[(NZW \times CA) + (CA \times NZW) - (NZW \times NZW) - (CA \times CA)] / [(NZW \times NZW) + (CA \times CA)]\} * 100$$

Maternal heterosis effect (%) :

$$H^M_{NZW \times CA} = \{[2 * (NZW - CA) \times (CA - NZW) - (NZW \times NZW) + (CA \times CA)] / [(NZW \times NZW) + (CA \times CA)]\} * 100 - 0.5\, H^E_{NZW \times CA}$$

where, H^E and H^M represent direct heterosis and maternal heterosis effects, respectively, of NZW and CA breeds in this experiment.

RESULTS AND DISCUSSION

Least-squares means of body weight at 12-13 weeks of age of NZW, CA, GLW, NZW x CA, CA x NZW, GLW x F1 and F2 were 2644, 2654, 2642, 2642, 2647, 2651 and 2694 g respectively, and did not differ significantly. The differences among seven genetic groups were not significant for preslaughter weight of rabbits before and after fasting. Live weight (after 24 h fast) of seven genetic groups averaged 2488, 2484, 2506, 2505, 2512, 2503 and 2500 g respectively (Table 1). Ratios of single body parts are shown in Table 1. Dressing percentage based on hot carcass + head + liver + giblets (kidneys, heart, lungs) and abdominal fat weight divided by live weight after fasting were 61.2, 61.6, 61.5, 61.5, 61.4, 60.9 and 61.5 % respectively. Crossbreeding did not improve the dressing percentage. These results show that the differences among genetic groups in inedible parts (feet, offals and skin) and in some of edible parts (liver, abdominal fat, fore-quarters and hind-quarters) were statistically highly significant ($P \leq 0.01$; Table 1). LUKEFAHR *et al.* (1982 and 1983) and MASOERO (1986) presented parallel observations.

Table 1. Least-squares means and standard errors (± SE) of carcass

Traits	Genetic groups					
	NZW	CA	GLW	NZW x CA	CA x NZW	GLW x F
No. of rabbits	56	51	57	55	56	55
Live weight, g. (before fasting)	2644 ± 16	2654 ± 17	2642 ± 15	2642 ± 16	2647 ± 16	2651 ± 1
Live wt. after 24h fasting, g.	2488 ± 15	2484 ± 16	2506 ± 15	2505 ± 16	2512 ± 15	2503 ± 1
Weight loss during 24 h fasting, %	5.88 ± .5	6.44 ± .5	5.12 ± .5	5.15 ± .5	5.12 ± .5	5.57 ± .5
Blood %	3.11 ± .4	1.88 ± .5	2.91 ± .4	2.98 ± .4	2.93 ± .4	2.78 ± .4
Feet %	$3.54 \pm .4^{A}$	$3.14 \pm .5^{C}$	$3.38 \pm .4^{B}$	$3.31 \pm .4^{B}$	$3.33 \pm .4^{B}$	$3.44 \pm .4^{A}$
Offals %	$16.1 \pm .2^{C}$	$16.4 \pm .3^{BC}$	$17.0 \pm .2^{AB}$	$16.0 \pm .2^{C}$	$17.1 \pm .2^{A}$	$16.8 \pm .2^{A}$
Head %	5.52 ± .2	5.25 ± .2	5.96 ± .2	5.35 ± .2	5.41 ± .2	5.37 ± .2
Liver %	$2.4 \pm .04^{BC}$	$2.3 \pm .04^{CD}$	$2.5 \pm .04^{AB}$	$2.2 \pm .04^{D}$	$2.6 \pm .04^{A}$	$2.5 \pm .04^{A}$
Kidneys + Lungs + Heart %	1.60 ± .03	1.60 ± .03	1.62 ± .03	1.63 ± .03	1.64 ± .03	1.59 ± .0
Abdominal fat %	$.60 \pm .1^{B}$	$.95 \pm .1^{A}$	$.51 \pm .05^{B}$	$.65 \pm .06^{B}$	$.59 \pm .05^{B}$	$.56 \pm .06^{B}$
Skin %	$14..4 \pm .2^{B}$	$14.9 \pm .2^{A}$	$13.4 \pm .2^{C}$	$14.2 \pm .2^{B}$	$13.4 \pm .2^{C}$	$13.9 \pm .2^{B}$
Carcass %	51.1 ± .9	51.4 ±1.0	50.9 ± .9	51.6 ± .9	51.2 ± .9	51.0 ± .9
Fore part %	$16.2 \pm .3^{A}$	$15.3 \pm .3^{B}$	$14.9 \pm .3^{B}$	$15.0 \pm .3^{B}$	$15.0 \pm .3^{B}$	$15.0 \pm .3^{B}$
Loin part %	15.4 ± .2	16.1 ± .2	15.8 ± .2	15.9 ± .2	15.9 ± .2	15.7 ± .2
Hind part %	$19.5 \pm .2^{b}$	$20.1 \pm .2^{ab}$	$19.8 \pm .2^{ab}$	$20.5 \pm .2^{a}$	$19.8 \pm .2^{ab}$	$20.0 \pm .2^{a}$
Carcass + head %	56.6 ± 1	56.7 ± 1	56.9 ± 1	56.9 ± 1	56.6 ± 1	56.4 ± 1
Dressing %*	61.2 ± 1	61.6 ± 1	61.5 ± 1	61.5 ± 1	61.4 ± 1	60.9 ± 1
Hind + lion %	$34.8 \pm .3^{b}$	$36.2 \pm .3^{a}$	$35.5 \pm .3^{ab}$	$36.4 \pm .3^{a}$	$35.7 \pm .3^{ab}$	$35.7 \pm .3^{a}$

*: Dressing % = [(carcass + head + liver + kidneys + lungs + heart + abdominal fat) / live weight after fasting] x 100.
Least-squares means ± S.E. having the same capital or small letter within each row are not significantly different (P ≤ 0.01

These results agreed with ZELNIK and GRANAT (1974) ; JENSEN and TUXEN (1986) and PARIGI-BINI et al. (1993) who slaughtered growing rabbits of similar weights, breeds and/or their crosses. In this experiment the differences among pure breeds were not significant for percent of carcass traits except fore-quarters, abdominal fat, liver, skin, offals and feet ; NZW pure-breds had significantly higher percentages for fore-quarters and feet ; CA pure-breds for abdominal fat and skin percentages ; GLW for offals and liver percentages (Table 1). These percent of organs were higher in pure-breds than in crossbreds. Within crossbred groups there were not significant differences ($P \leq 0.01$) for carcass traits except inedible parts (feet, offals and skin) and liver; terminal crossbred (TX) had significantly higher percentage of inedible parts ; CA x NZW crossbred fryers were excellent for liver and NZW x CA for skin percentages. Terminal crossbred did not differ significantly from reciprocal crosses of NZW and CA for liver and skin percentages (Table 1). The results reported here are in agreement with work of LUKEFAHR et al. (1983) who did not find big difference between proportions of fore-quarters and loin cuts in straightbreds and crossbreds. Proportion of the less valuable fore-quarters to body weight proved to be 15.19%, while that of the hind-quarters was 19.98%. Proportion of the most valuable parts (loin region and hind-quarters, together) amounted to 35.74% within the carcass. Nearly the same result (61.9 %) dressing percentage was reported by SZENDRO et al. (1995) for the Pannon White breed with a live weight before fasting that ranged between 2.6-2.8 kg. It is difficult to compare these results objectively to other those available in literature, because of different slaughter and evaluation methods.

Sex difference in carcass traits was not significant except in offals which were increased in females. This result was in line with LUKEFAHR et al. (1983) and Kim et al. (1985) who found not significant effect of sex on dressing percentage.

Parity as source of variation was not significant in slaughtering traits ($P \leq 0.01$) except skin, feet, loin and hind-quarters. Skin, feet and loin percentages were increased in fryers of 1st parity while hind-quarters percentage was increased in fryers of 2nd parity. Significant parity effect on these traits was observed which is difficult to give a reason for. Similar effects were found by SALEH et al. (1988) who studied effect of month of birth on carcass traits of seven genetic groups of rabbits {two pure breeds (BOUSCAT and FLANDER), two reciprocal crosses, two backcrosses and F2}.

Looking at the importance of interactions between the main effects in the model one can conclude that the interaction between genetic group and sex as well as genetic group by parity except skin percent was not significant. The interaction between parity and sex was highly significant ($P \leq 0.01$) in offals and giblets. The second order of interaction between genetic groups, sex and parity was also highly significant in feet and giblets ($P \leq 0.01$).

Direct and maternal heterosis (H^E NZW x CA and H^M NZW x CA) were estimated for carcass traits to compare single and double crossbred (NZW with CA) vs. pure-bred (NZW and CA) fryers. Most estimates of heterosis indicated that crossbreeding is associated with a negative or has very little importance in bettering carcass traits (Table 1). The same results were shown by LUKEFAHR et al. (1983), EL-QEN (1988) and BRUN and OUHAYOUN (1988), they found that individual heterosis was associated with little improvement in carcass performance of the crossbred rabbits. Crossbreeding decreased abdominal fat and weight loss percentages of carcass which can be considered as an advantage for consumer (Table 1). Similar to these results were concluded by BRUN et al. (1992) who confirmed that direct and maternal effects on carcass yield and carcass fatness were significantly influenced by selection more than crossbreeding.

CONCLUSION

No significant differences were observed among genetic groups in dressing percentage. NZW, CA and CA x NZW groups had the highest measurements in the proportions of fore-quarters and feet, abdominal fat and skin and liver and offals respectively. The other genetic groups in these traits were not different significantly from the highest ones. The females had a higher percentage of offals in comparison with males. Crossbreeding decreased abdominal fat percent of carcass which can be considered as an advantage for consumer. Estimates of direct and maternal heterosis indicated that crossbreeding is associated with a negative effect or has very little importance in improving carcass performance except abdominal fat and weight loss.

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