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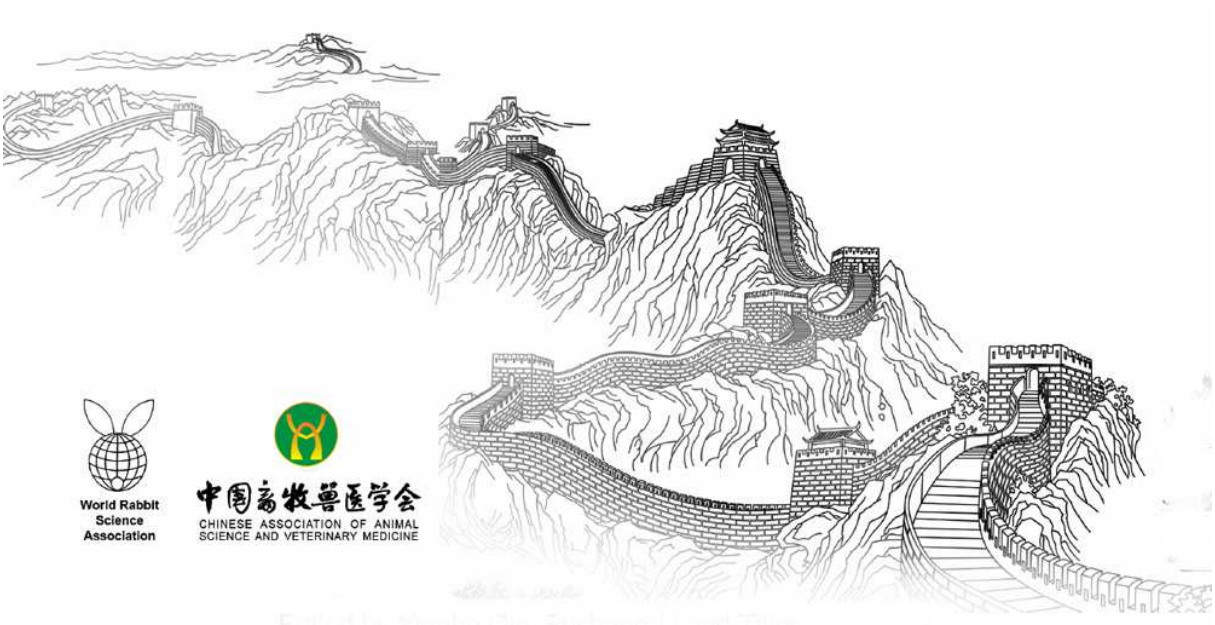

DIVERGENT SELECTION FOR TOTAL BODY FAT CONTENT OF GROWING RABBITS
3. EFFECT ON CARCASS TRAITS AND FAT CONTENT OF MEAT

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ABSTRACT

The aim of the experiment was to investigate the effect of a divergent selection for total body fat content on carcass traits and fat content of different meat cuts. The fat content of rabbit body was measured by computer tomography (CT) at age of 10 weeks. From generation 0 (non-selected animals) 15.6 % of male and 23.8 % of female rabbits with the lowest fat content (Lean group) and 15.1 % of male and 23.8 % of female rabbits with the highest fat content (Fat group) were selected. From generation 1 (Gen 1) the percentage of selected rabbits were 23.7 % of male, 41.6 % of female in Lean group and 20.7 % of male and 36.4 % of female rabbits in Fat group (Gen2). Offspring of the selected rabbits were slaughtered at age of 11 weeks, and carcass traits and ether extract content of meat samples were determined. The ratio of perirenal fat to reference carcass was significantly higher in Fat rabbits than in Lean ones in the Gen1 and Gen2. The changes in dressing out percentage and ratio of fore, mid and hind parts to reference carcass were not clear. In Gen1, a trend in the ether extract content of different body parts was observed and in Gen2 the ether extract content of fore leg and abdominal wall were significantly higher in Fat rabbits than in Lean ones. It can be concluded that the divergent selection for total body fat content was effective in decreasing or increasing the ratio of perirenal fat content to reference carcass and the ether extract content in meat cuts. The effect of divergent selection on dressing out percentage and ratios of fore, mid and hind parts to reference carcass has not been demonstrated.

Key words: Rabbit, divergent selection, carcass traits, fat content

INTRODUCTION

During the final stage of pregnancy and near the peak of lactation the does, especially nulliparous ones, have to face a negative energy balance, as they are not able to consume enough feed (energy) to satisfy their requirements (Xiccato, 1996). Sánchez *et al*. (2012) demonstrated a close connection between health status of does and their body condition that can be improved through the methods summarized by Pascual *et al*. (2013). In addition, a new method was proposed by Kasza *et al*. (2016b), based on the selection for total body fat content.

Rabbit meat is generally described as having low fat content (Dalle Zotte and Szendrő, 2011). However, there are significant differences between the different carcass parts and meat cuts (Pla *et al*., 2004). Selection for total body fat content could modify the fat content of meat and some carcass traits. The objective of the experiment was to investigate the effects of divergent selection for total body fat content on carcass traits and fat content in different carcass parts and meat cuts.

MATERIALS AND METHODS

Animals and experimental design

The experiment was carried out at Kaposvár University. Maternal line (Pannon Ka) of the Pannon Breeding Program was divergently selected for total body fat content by computer tomography (CT) measurement. The method of CT measurement was described by Donkó *et al.* (2015), and that of the selection by Kasza *et al*. (2016a). From generation 0 (non-selected animals), 15.6 % of male and 23.8 % of female rabbits with the lowest fat content (Lean group) and 15.1 % of male and 23.8 % of female rabbits with the highest fat content (Fat group) were selected. From generation 1 the percentage of selected rabbits were 23.7 % of male, 41.6 % of female in Lean group and 20.7 % of male and 36.4 % of female rabbits in Fat group. The Fat and Lean rabbits in the first and second generation (Gen1 and Gen2) were investigated.

Rabbits housing and feeding were described by Kasza *et al.* (2016a). At the age of 11 weeks rabbits from the Gen1 (n = 110) and Gen2 (n = 111) were randomly selected and slaughtered according to the recommendation of WRSA (Blasco and Ouhayoun, 1996). Chilled meat samples (n = 60 *Longissimus dorsi* /LD/ meat; n=60 hind leg /HL/; n=60 fore leg /FL/ meat; and n=60 abdominal wall /AW/ meat) were transported to the Department of Animal Medicine, Production and Health of Padova University, then vacuum-packaged and stored at -40 °C for subsequent chemical analysis.

Chemical Analysis After overnight thawing at +4 °C, each LD, HL, FL and AW cut was prepared for grinding with a Retsch Grindomix GM 200 (10 seconds at 4000 rpm). Then, each sample was freeze-dried and stored in closed plastic tubes at +4 °C up to analysis. Lipid extraction was performed with the Accelerated Solvent Extraction (M-ASE), in which chloroform/methanol (1:2) was the binary solvent mixture used for extraction. Ether extract content was determined gravimetrically after the removal of the solvent by vacuum evaporation under nitrogen stream at room temperature (AZ-2 PLUS machine, Genevac UK).

Statistical Analysis Data of carcass traits and the ether extract concentration of meat samples were analysed by one-way ANOVA using the SPSS 10.0 software package.

RESULTS AND DISCUSSION

The results of dressing out percentage and ratio of carcass parts to reference carcass are shown in Table 1. The dressing out percentage of Lean and Fat groups in Gen1 or Gen2 did not differ. In the Gen1 there were not significant differences in ratios of fore, mid and hind parts, however significant difference was observed in ratio of perirenal fat. In Gen2 the fore part was larger and the perirenal fat was lower in the Lean animals than in Fat group ($P<0.05$). Also significant differences were found between fore parts of Lean-Gen1 and Fat-Gen 2 ($P<0.05$), between mid parts of Fat-Gen 1 and Lean-Gen2 ($P<0.05$), between hind parts of Lean-Gen1 and Lean-Gen2 ($P<0.05$) and Fat-Gen1 and Fat-Gen2 ($P<0.05$). On one hand, selecting for decreasing or increasing the total fat content, the ratio of

Table 1: Effect of divergent selection on dressing out percentage and ratio of carcass parts to reference carcass

	Generation				SE	P
	1		2			
	Divergent selection					
	Lean	Fat	Lean	Fat		
Rabbits, no.	57	53	52	59		
Dressing out percentage[1], %	55.9	55.9	56.9	56.6		
Fore part[2], %	30.8^{b}	30.6^{ab}	31.3^{b}	29.9^{a}	0.12	*<0.001*
Mid part[2], %	30.1^{ab}	30.9^{b}	30.2^{a}	29.8^{ab}	0.11	*0.006*
Hind part[2], %	36.7^{a}	36.5^{a}	37.5^{b}	37.9^{b}	0.08	*<0.001*
Perirenal fat[2], %	1.11^{b}	1.43^{c}	0.84^{a}	1.32^{bc}	0.04	*<0.001*

[1]Calculated as ratio of chilled carcass to body weight at slaughter; [2] Calculated as ratio to reference carcass weight
^{a,b,c}: Means with different letters in the same row differ significantly at $P<0.05$ level

fore part to reference carcass increased and decreased, respectively. On the other hand, in mid and hind parts such change was not clear. A rank order could be observed in perirenal fat: Fat-Gen2 > Fat-Gen1 > Lean-Gen1 > Len-Gen2, which showed that the divergent selection was mainly effective in increasing or decreasing the ratio of perirenal fat to reference carcass.

In chickens, similar results were published when they were divergently selected for high or low abdominal fat content (Leclercq *et al*., 1989; Baéza and Le Bihan-Duval, 2013), and also high heritability of abdominal fat was estimated (Zerehdaran *et al*., 2004; Baéza and Le Bihan-Duval, 2013). Zomeño *et al*. (2013) published results about the successful divergent selection for intramuscular fat content of rabbits.

In the present study, the dressing out percentage slightly improved and only in fore part changed significantly. However, when rabbits were divergently selected for thigh muscle volume, a significant decrease in perirenal fat percentage was observed in plus selected animals (Szendrő *et al.*, 2012). In chickens, the fat line had lower muscle (*Pectoralis major* and *Sartorius*) yield than those of lean chickens (Baéza *et al*., 2015). In addition, negative correlations were found between the percentage of abdominal fat and the muscle weights.

The results of the divergent selection on ether extract content of different meat cuts are shown in Table 2. In Gen1 only a trend without significant differences was observed for each meat cut, whereas in Gen2 the ether extract contents of FL and AW exhibited significantly higher values in Fat rabbits than in Lean ones. Regarding HL and LD meat cuts, similar tendencies could be observed.

Table 2: Effect of divergent selection on ether extract percentage (%) of rabbit meat cuts

	Generation				SE	P
	1		2			
	Divergent selection					
	Lean	Fat	Lean	Fat		
Meat samples, no.	15	15	15	15		
Longissimus dorsi	3.68	3.79	3.61	3.78	0.05	0.548
Hind leg	5.01^{a}	5.45^{ab}	5.20^{ab}	5.85^{b}	0.11	*0.027*
Fore leg	9.58^{a}	9.96^{ab}	8.95^{a}	11.7^{b}	0.29	*0.003*
Abdominal wall	9.46^{ab}	11.2^{ab}	8.75^{a}	11.8^{b}	0.39	*0.012*

^{a,b}: Means with different letters in the same row differ significantly at P<0.05 level

It seems that the divergent selection had the greatest effect on the ether extract content in meat cuts with a high fat content, whereas the same effectiveness in case of meat parts with low fat content was not observed. The effect of selection on the fat content of meat was confirmed by some authors. Zomeño *et al.* (2013) found positive correlations between lipids content in *Longissimus dorsi* muscle and perirenal fat content in lines A and V (maternal lines); however, no relationship was detected in line R (terminal line). The rabbits in the present experiment also belonged to a maternal line. Zomeño *et al.* (2013) reported also significant differences in the perirenal fat content of rabbits selected for high or low intramuscular fat presence. In fat chickens, carcass fatness was higher than lean chickens, but no difference in the lipid content of *Pectoralis major* and *Sartorius* muscles was observed (Baéza *et al*., 2015).

CONCLUSIONS

The divergent selection for total body fat content was effective in decreasing or increasing the ratio of perirenal fat content to reference carcass in the second generation. In addition, this selection could modify the ether extract content of meat cuts with high fat content. Differently, the effect of selection on dressing out percentage and ratios of fore, mid and hind parts to reference carcass was not demonstrated.

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