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Effect of selection on the body fat content of rabbits by means of the TOBEC method on the body composition and slaughter traits of their offspring

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ABSTRACT

The aim of this study was to clarify the usefulness of TOBEC method in the selection of body fat content of the rabbits. For this purpose rabbits of average ±1 S.D. live weight at 10 weeks and of average ±1 S.D. daily weight gain between 6 and 10 weeks of age were chosen from the experimental stock of the university, and their fat content was determined with an EM-SCAN SA-3152 type small animal body composition analyser (by means of TOBEC method). Based on the fat content determined, the best and worst 16% of the does and the best and worst 8% of the bucks were chosen and mated with each other (fatty doe with fatty buck and lean doe with lean buck). In the body fat content of the offspring significant differences were observed at 10 weeks of age (9.7 in the fatty and 7.1 in the non-fatty rabbits). Next to the fat content also the liver (3.0 and 2.1%) and other edible organs (2.3 and 1.8%) showed higher values in the offspring of fatty rabbits. In spite of these a higher ratio of the carcass was observed in the non-fatty animals (49.8 and 52.3%, respectively). Due to the higher ratio of the carcass, the protein content of the body was also higher in these rabbits (18.7 and 19.3%). Based on the results, the TOBEC method for the selection of rabbits based on their body fat content seems to be useful.
(Keywords: rabbit, fat, TOBEC, selection, body composition)

INTRODUCTION

The slaughter value and body composition of rabbits could be determined by different methods in practice (*Fekete*, 1992). In the case of growing rabbits, experimental slaughter and chemical analysis are most frequently used. These techniques are very reliable and accurate, but because of the slaughter of the animals they have become an obstacle to the genetic progress. Therefore the development of the non-invasive methods was required to estimate the body composition of the animals alive.

The high technology of the non-invasive methods is represented by computer tomography (CT) and magnetic resonance tomography (MR) nowadays. Both methods were effectively used by the researchers of our faculty to determine the slaughter value (*Szendrő et al*., 1992, 1994), the body composition (*Romvári*, 1996; *Kövér et al*., 1998; *Milisits*, 1998) and also the changes in the body composition of rabbits (*Romvári et al*., 1994; *Milisits*, 1998; *Milisits et al*., 1999b). These methods are also very reliable and accurate, but because of their high investment and action costs they are not widely prevalent.

The EM-SCAN small animal body composition analyzer (based on the TOBEC method) is much cheeper than the CT or the MR and also its action costs are more favourable. Above all it is a mobile machine, so measures can be taken at the place of the animals without any transferring, which is a possible stress factor of the animals.

The TOBEC (Total Body Electrical Conductivity) method (*Van Loan* and *Mayclin*, 1987), which was developed principally for pediatric research, can be used for the determination of fat-free mass of the body. Based on the former results it seems, that this technique is very accurate (r=0.88-0.99) in determining fat-free mass in living animals (*Cunningham et al*., 1986; *Fiorotto et al*., 1987; *Fekete* and *Brown*, 1993; *Staudinger et al*., 1995), but it can be used only with medium accuracy (r=0.59) to predict the ratio of fat in the body (*Fekete et al*., 1995).

Because this latter is more informative for the practice, several projects have been focused on this topic recently. But the results showed that the fat content of the whole body can be predict only with medium accuracy in the case of newborn (*Milisits et al*., 1999a) and growing rabbits (*Milisits et al*., 2000) and also in the case of rabbit does (*Szendrő et al.*, 1998).

In our experiment we wanted to try if a TOBEC method – in a range of medium accuracy – can be used in a selection program based on the fat content of rabbits or not. The aims of our study were as follows:

- Determination of the body fat content in 10 week old growing rabbits by TOBEC using a formerly developed prediction equation (*Milisits et al*., 2000).
- Execution of a two-way selection based on the estimated fat content.
- Comparison of the slaughter value and body composition of 10 week old rabbits in the next generation.

MATERIALS AND METHODS

The experiment was carried out with Pannon White rabbits, weaned at the age of 6 weeks 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 TOBEC measurement. For the *ad libitum* feeding of the rabbits a commercial pelleted diet (DE 10.30 MJ/kg, crude protein 17.5%, crude fat 3.6%, crude fibre 12.4%) was used. Drinking water was available continuously from self-drinkers.

At 10 weeks of age the animals were weighed and those that represented the average (average±standard deviation) in the live weight and in the daily weight gain between 6 and 10 weeks of age were chosen for the experiment (n=915). Their fat content was determined by an EM-SCAN SA-3152 type small animal body composition analyzer, by the so-called TOBEC method. All of the animals were measured three times and the average of these measures was used for further calculations. The coefficient of variation was under 2% in every case. The fat content of the rabbits was calculated from the values measured using a prediction equation developed formerly (*Milisits et al*., 2000).

Based on the predicted fat contents the extreme 16-16% from the does and the extreme 8-8% from the bucks were chosen for the experiment. Fatty does were inseminated with sperm of fatty bucks and lean does with sperm of lean bucks. For every insemination fresh, attenuated sperm was used.

The fat content of the offspring was measured by TOBEC at birth and at 10 weeks of age. In both group rabbits with an average fat content predicted (average±standard

deviation) at 10 weeks of age were slaughtered immediately after the TOBEC measurements (n=17 and n=10, respectively). During the slaughter procedure rabbits were dissected according to *Blasco et al.* (1993). For the chemical analysis of the body composition the whole bodies were cut into pieces and homogenized by grinding them twice. A 100g sample was taken from each of the homogenates and stored at -20°C until use. The dry matter, crude fat, crude protein and crude ash content of the samples was measured according to the Hungarian Standards.

Data were evaluated by one-way ANOVA (LSD test) and discriminant analysis using the SPSS statistical software package (*SPSS for Windows*, 1999).

RESULTS

The basic data of the rabbits chosen for the experiment can be seen in *Table 1*.

Table 1

Basic data of the rabbits chosen for the experiment

Traits	Does				Bucks			
	Fatty (n=63)		Non-fatty (n=57)		Fatty (n=33)		Non fatty (n=36)	
	Average	S. D.	Average	S. D.	Average	S. D.	Average	S. D.
Weight at 10 weeks of age	2280	140	2305	174	2346	191	2277	166
Fat (%)	7.5	1.4	4.2	1.4	8.4	1.3	3.6	1.4

It is well visible that the predicted fat content of the rabbits clearly differs from each other between the two experimental groups. The differences observed between the fatty and non-fatty does and between the fatty and non-fatty bucks are also statistically proved ($P<0.05$).

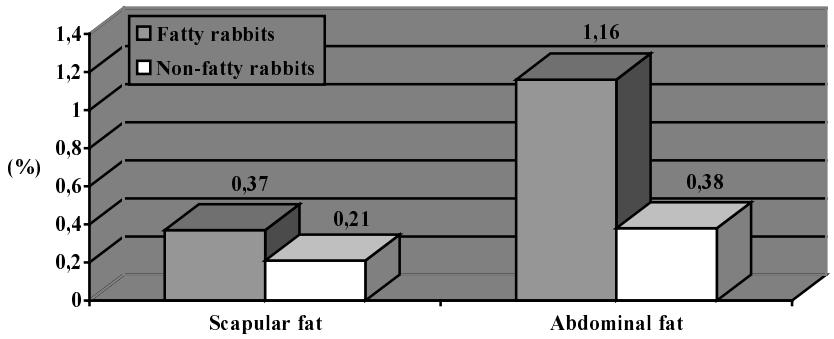
The offspring of the fatty and non-fatty parents showed the same fat content at 1 day of age. The average fat content in both group was 4.1% at that time. Based on this result it seems that the body fat content of the parents do not have a significant effect on the body fat content of the newborn rabbits.

The fat content values, predicted at 10 weeks of age, showed a higher body fat content in the fatty rabbits than in the non-fatty ones. The average predicted fat content was 6.5% in the fatty and 5.3% in the non-fatty rabbits. The difference observed between the groups was also statistically proved ($P<0.001$). The fat content of the fatty rabbits was 22.6% higher than the fat content of the non-fatty rabbits. According to the fat content at 1 day of age fatty rabbits showed 1.6 times, non-fatty rabbits 1.3 times higher fat content at 10 weeks of age.

The scapular and abdominal fat content at slaughter also showed a significant ($P<0.001$) difference between the two experimental groups (*Figure 1*).

Figure 1

Ratio of the scapular and abdominal fat to the liveweight in the offspring of fatty and non-fatty rabbits



The ratio of scapular fat to the live weight was 1.8 times, the ratio of abdominal fat to the live weight 3.1 times higher in the fatty than in the non-fatty rabbits.

The chemical analysis of the whole bodies also showed a higher fat content in the fatty rabbits (9.7±1.9 in the fatty and 7.1±1.6 in the non-fatty rabbits). The difference between the two groups was statistically significant at the level of $P<0.05$.

The success of the selection can also be proved by the result of the discriminant analysis. Based on the chemically analyzed fat content the offspring of the fatty and non-fatty rabbits can be correctly identified by 82% (*Table 2*).

Table 2

Result of the discriminant analysis based on the chemically analyzed fat content

Real groups	Estimated groups	
	Fatty rabbits	**Non-fatty rabbits**
Fatty rabbits (n=17)	**76.5%** (13)	23.5% (4)
Non-fatty rabbits (n=10)	10% (1)	**90%** (9)

The identification based on the estimated fat content was also successful, but the accuracy of this grouping was a little bit lower (*Table 3*).

Table 3

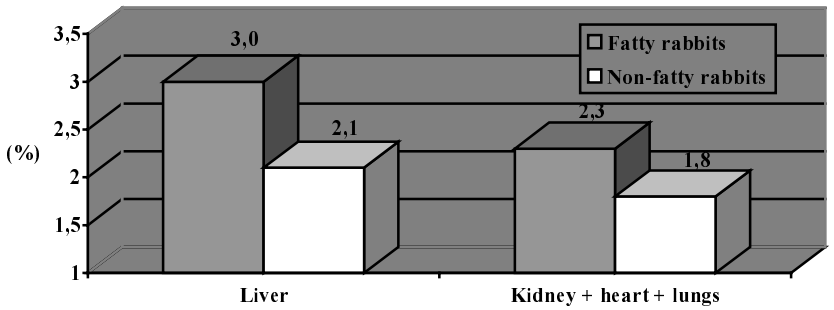
Result of the discriminant analysis based on the estimated fat content

Real groups	Estimated groups	
	Fatty rabbits	**Non-fatty rabbits**
Fatty rabbits (n=17)	**70.6%** (12)	29.4% (5)
Non-fatty rabbits (n=10)	20% (2)	**80%** (8)

It was interesting to see that the ratio of the liver to the liveweight also showed a significantly higher value in the offspring of fatty rabbits. Its ratio was about 1.5 times higher in the fatty than in the non-fatty rabbits (*Figure 2*).

Figure 2

Ratio of the liver and other edible organs to the liveweight in the offspring of fatty and non-fatty rabbits at 10 weeks of age



Other edible organs also showed a higher ratio in the fatty rabbits, but the difference between the groups was not statistically significant in this case.

In contrast to the ratio of fat and edible organs the ratio of the carcass to the liveweight was lower in the offspring of fatty rabbits (49.8 and 52.3%, respectively). The difference between the groups was significant at $P<0.05$ level.

Due to the higher ratio of the carcass in the non-fatty rabbits the crude protein content of these animals also showed a higher value (18.7±0.4 in the fatty and 19.3±0.9 in the non-fatty animals). This difference could be proved statistically at $P<0.1$ level.

CONCLUSIONS

Based on these results it seems that the EM-SCAN machine (TOBEC method) is a useful device in the selection of rabbits based on their body fat content. However, it is necessary to mention that these results have been originated from an early stage of a long experiment, so for proving the usefulness of this method and clarifying the correlation between fat content and reproductive traits the continuation of the experiment is necessary.

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