IN VIVO MEASUREMENTS OF BODY COMPOSITION OF DWARF AND NORMAL RABBIT

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Abstract - The authors have measured the body composition of the normal (New-Zealand White) and the dwarf rabbits before weaning using the TOBEC method (TOtal Body Electrical Conductivity). The measurements have been performed between 0-55 days in the case of the dwarf rabbit and the normal rabbits could be measured till the 22nd day. The obtained TOBEC results have been compared between the 0-22 days.
In their experiments, the following results were obtained: the total body electric conductivity measured in the case of dwarf rabbit and normal rabbit were the same. By analysing the results, they have found other similarities between the parameters of the two type of rabbits. The body weight gain has been changing similarly in both cases. The obtained TOBEC number (E value) has been compared to the lean mass, to the fat percent, to the body mass and in every case, there was significant ($p<0.05$) relationship until the 22nd day of the experiment. The results obtained in the TOBEC equipment, have been used in regression equations established by the direct chemical analysis of rats and the fat percent ($y_1=0.25$), the lean mass percent ($y_2=0.28$), and lean mass in grams ($y_3=0.87$) have been calculated. The results show that there is a significant relation ($p<0.05$) between the E value and the body mass. The relationship is also significant between the lean mass and the E value ($p<0.05$). The correlation between the E value and the body mass was 0.9707 in the case of the dwarf rabbit and it was 0.9406 in the case of the normal rabbit.

INTRODUCTION

To measure the body composition of rabbits, many methods are used. In recent years, those methods come to the highlight that are quick and harmless for the animal. Because the rabbit has a small body size, it might serve as a model for measuring the chemical body components. The success of feeding experiments using living animals are many times depend on the knowledge of the body composition (DE BLAS *et al.*, 1977; FRAGA *et al.*, 1978). FEKETE and BROWN (1991) have compared adult and growing (5-10 weeks old) New-Zealand White rabbits that were kept on different diets. They have found significant difference between the two groups. In case of animals kept on different diets, it is very important to measure continuously the main chemical components (FREDERICKS *et al.*, 1976). The traditional method of chemical analysis can only be performed at the end of the experiment, it consumes much work and its costs are high. In spite of this, the method is widely spread (KLISH *et al.*, 1984; FIOROTTO *et al.*, 1987). Because of these facts, it is necessary to use indirect measuring methods (VAN LOAN and MAYCLIN, 1987; FIOROTTO *et al.*, 1987; FEKETE and BROWN, 1992). The knowledge of the body composition has importance not only in the veterinary science, but also in human medicine, for example, pharmacological testing. At the same time it is also important to mention that there are strict animal protection laws that require high standards while performing experiments on animals. The direct chemical analysis can be used to evaluate and to calibrate the different methods.
In our experiment, we have measured the body total electric conductivity (CUNNINGHAM *et al.*, 1986) (TOtal Body Electrical Conductivity), by using the TOBEC method. The evaluation of the method was based on the chemical analysis. We have performed these measurements to obtain data concerning the change of the body composition of the normal and the dwarf rabbit. In our experimental job, we would like to answer the question of whether the results obtained with the TOBEC method could be used or not without the chemical analysis to monitor the change of the body composition. The importance of this is that if it can be proved that TOBEC method is exact than examination of the body composition during feeding experiments can be much easier. The simplicity of the method is that the animals do not need any pre-treatment before the measurements. The data can be easily analysed and handled by the connected computer.
In our present experiments, we have not paid attention to the factors that are influencing the body composition and we have performed only comparative measurements.

MATERIALS AND METHODS

The animals

During the experiment, we have been accidentally chosen weaning normal and dwarf rabbits from 5-5 families. The experimental animals were fed *ad libitum* with normal rabbit food, and the water was supplied also *ad libitum*. We have used 5 dwarf and 5 normal rabbits from every families for the measurements. Every rabbit was measured 10 times in the TOBEC equipment. The rabbits were together with their mothers during the whole experiments.

The equipment

The total body electrical conductivity was measured by the "EM-SCAN SA2 SMALL ANIMAL BODY COMPOSITION ANALYSER" machine. This equipment serves as a small animal body composition analyser. According to the English expression and abbreviation, the equipment is called TOBEC (**TO**tal **B**ody **E**lectrical **C**onductivity) and the method is called the TOBEC method.

Theory of the method

During the examination, the living body is put into an electromagnetic field and special sensors are measuring the changes caused by chemical composition of the living body in the electromagnetic field. The changes occur because the fatless body tissues have higher electrolyte content and higher conductivity (ability of causing changes in the electromagnetic field) than the body fat.

The TOBEC method

The basic concept of the method is that the electrolyte content distriction in the living body can be measured by the TOBEC equipment. On the basis this measurement and the body mass (g), the body length (cm), girth (cm), a connected computer software calculates the total body electrical conductivity, the lean mass and fat percentage compared to the body mass according to the following equation:

$$12{,}60+0.576*E-0.000571*E^2=fat\%$$

Our own results were analysed by a simplified regression equation. After we have measured the body mass, the length and the girth, the rabbits were put into the machine on a gauze surface. Every rabbit were measured 10 times in the machine. The obtained results were analysed by a connected computer software. At the end of the measurement, the computer calculated the following data: the TOBEC number (E value), the lean mass (g) and the fat percentage. The results were used at the analyse of our experiments.

RESULTS AND DISCUSSION

At first, we compared the body mass between the 0-22 days. The correlation between the body mass and TOBEC number (E value) was significant ($p<0.05$). The correlation between the E value and the lean mass, in both case, was also significant ($p<0.05$). These results are shown in the following figures (Figure 1).

Since the equipment that we have used had measuring capacity of 40-400g, the dwarf rabbits could be measured until the 55th day, and consequently the normal rabbits were measured until the 22nd day. Between the 0-22 days, the body mass gain was significant ($p<0.05$).

The TOBEC number obtained by the machine is related to the rate of the chemical components of the body and not to their absolute amount. This way, if we compared the body mass changes to the TOBEC number, we can pull conclusions about the body composition changes in the two different types of rabbits. These results are shown in Figure 2.

Figure 1

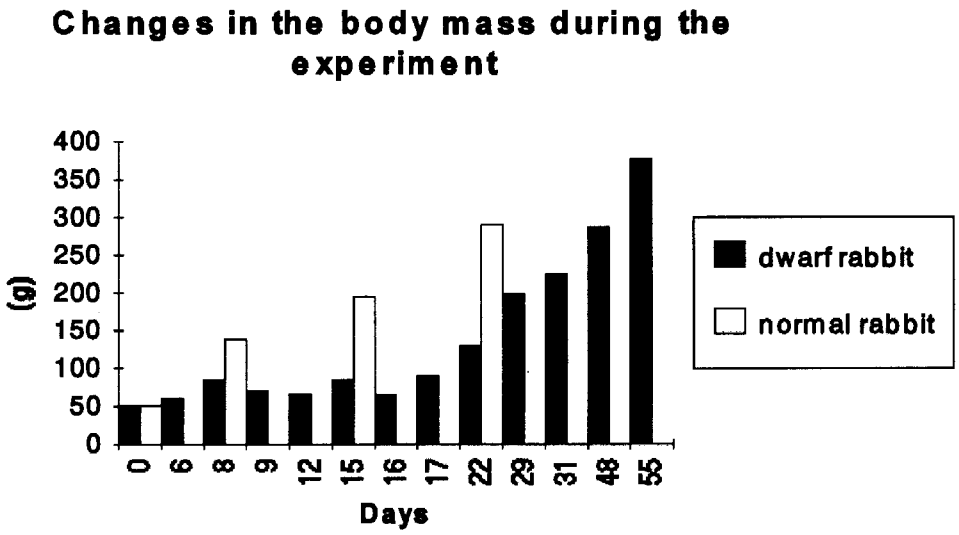
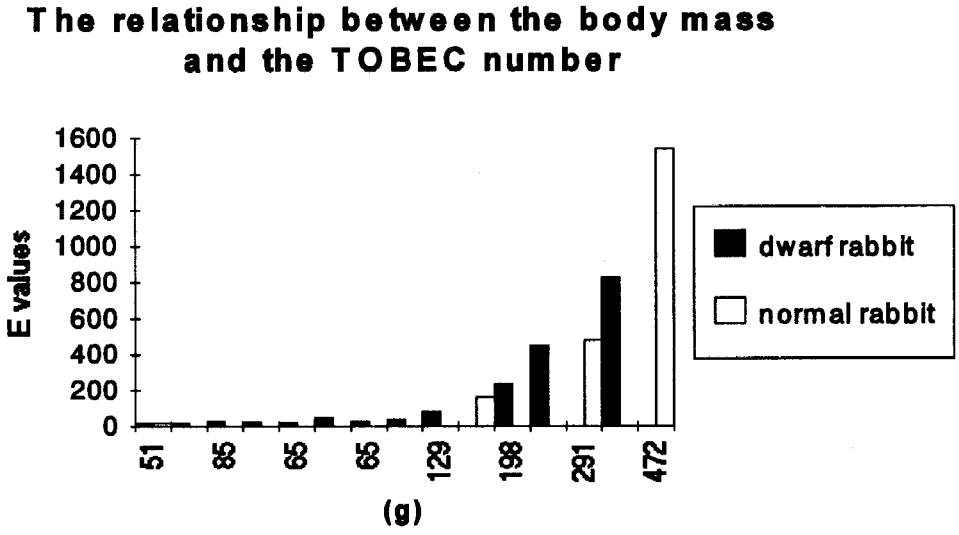


Figure 2



This figure shows that correlation between the body mass and TOBEC number between 0-22 days of the experiment is significant. This also means the rate of the chemical components of the body has a significant changes between 0-22 days of the experiment ($p<0.05$). We have also considered the relationship between the lean mass and the TOBEC number. This is shown on Figure 3.

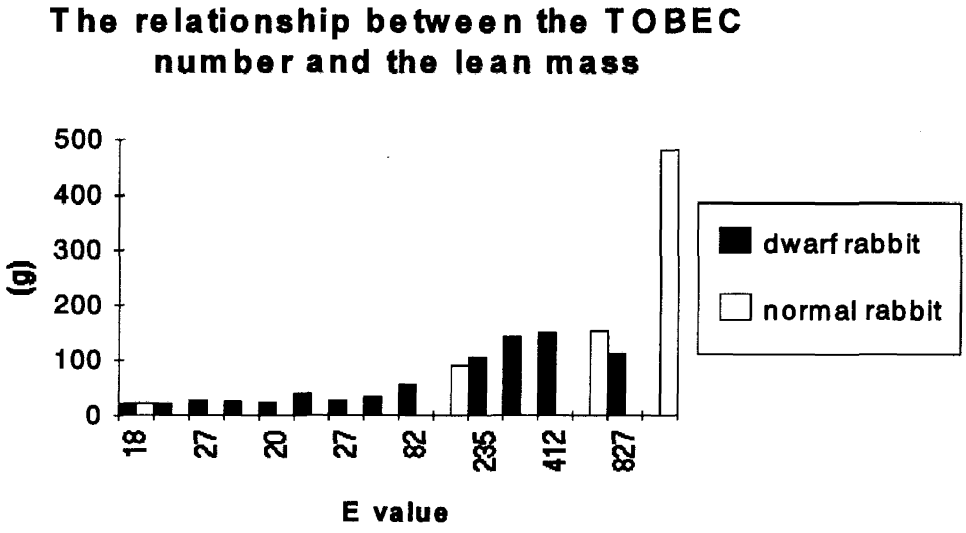
On days 0-22 of the experiment, the body mass and the lean mass show significant change ($p<0.05$) in the case of both type of rabbits. To support the rehability of the measured results obtained by the TOBEC equipment, we have produced three simplified regression equation based on the direct chemical analysis of rats:

1. y_1=fat%= - 0.001465*E+3.40 r=0.25
2. y_2=lean mass%= - 0.009285*E+29.27 r=0.28
3. y_3=lean mass(g)= 0.15959*E+15.13 r=0.87

In the equations, we have used the data obtained by the TOBEC method, and calculated the fat percentage , the lean mass percentage and the lean mass in grams. The results showed the correlation between the lean mass and the E value in both cases. This is also supported by the rates of the absolute measurements. In case of the fat percentage, we have found no correlation.
It is very important to perform the direct chemical analysis of the rabbits and these experiments are on the way in the Department of Animal Nutrition. The results of the chemical analysis would answer the question of how

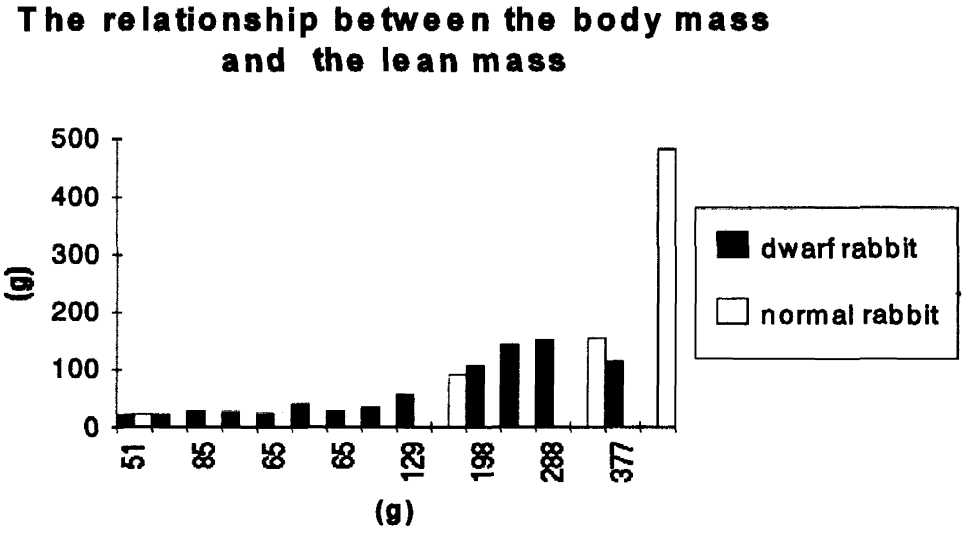
much these results could be compared to the results of the chemical analysis of rats. These chemical analysis will decide whether the TOBEC method is enough alone to measure the body composition or not.

Figure 3



If we summarise Figure 2. and 3., the following result is obtained Figure 4.

Figure 4



According to our results, we have claimed that the TOBEC method is useful to follow *in vivo* the changes in the body composition of the dwarf and the normal rabbits.
By analysing our results, we have seen that the changes in the body composition of the two different types of rabbits are similar between days 0-22 of the experiment.
The measuring capacity of the TOBEC equipment is between 40-400g, this way we could measure the normal rabbit until 22nd day and the dwarf rabbit until the 55th day of age.
It is supposed that in nutritional experiments, the dwarf rabbit is able to serve as a model for measuring the changes in the body composition of the normal rabbit.
This theories should be supported by the chemical analysis. This would make it possible to work out calibration equation for the TOBEC machine in the case of rabbits.
Our results offer new perspectives for the nutritional experiment, since it is capable to follow the changes in the body composition in *in vivo* circumstances.

The TOBEC method is humanitarian, harmless to the animals, cheap, clean and fast and can be very important in case of breeding animals.

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