

Influence of the Level of Fat on the Digestibility of a Diet in Rabbits

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In order to discover the influence of fat on the digestibility of a diet and on the nutritive yield, the authors have carried out three digestibility tests with rabbits, of Giant Spanish breed, in which the following conclusions have been reached:

The calorimetric method provides a rapid and accurate determination of the digestibility of the dry substance and metabolizable energy of a diet with rabbits, as there are very significant correlations between the tests, one based on chemical analysis and the other on the determination of the combustion heat of foods and faeces from balance tests.

When the fat level of the ration is increased by the percentages tested (3.1, 6.4 and 9.7), the digestibility of the dry substance and organic substance increases, these results being significant at 0.1 and 5 % respectively and a very significant increase is also observed of the coefficient of digestibility of the fat of the diet (0.1 %).

With regard to the digestibility of the protein and fibre, there are no significant differences, while the digestibility of the nitrogen free extracts (N.F.E.) increases as the fat level of the diet increases, a decrease being observed in the digestibility of this nutrient when the fat reaches a level of 9.7 % in the diet.

The increase of the percentage of fat of the ration causes an increase in the nutritive yield of the diet as shown by the values of total digestible nutrients (T.D.N.), metabolizable energy and net energy.

In order to discover the nutritive yield of a diet it is necessary to refer to its digestibility and from this to calculate what is called metabolizable energy; but we can also find out this energy by determining the combustion heat of the food eaten by the animal and that of its faeces, both determined in the calorimetric pump.

Calorimetric methods have figured among the pioneers in studies on Nutrition; afterwards they were less used due to the laboriousness and high cost of the old calorimetric systems. At present these techniques are highly accurate, which justifies their present-day interest in the different fields of nutrition.

In view of the foregoing, for some time in our laboratory we have been making a comparative study of these techniques with the conventional ones based on the determination of digestibility by chemical ana-

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lysis, centering our interest up to now on different experiments carried out with sheep and pigs.

POND *et al.* (8) determined the digestibility of a diet, in pigs, by two different techniques: that of the calorimetric pump and that of the indicator using chrome oxide, and observed that the digestible energy determined by both methods was similar. Also in this same species FONOLLÁ *et al.* (5) carried out a comparative study between the conventional techniques by chemical analysis and calorimetry, finding a very high correlation between the values obtained for the digestibility of dry substance and metabolizable energy.

After these tests BRUGGER and VARELA (3) compared the data obtained by means of these two techniques already mentioned, in their experiments with five different breeds of pigs, observing a very high correlation with a level of significance of 0.01.

Lastly, BOZA *et al.* (2), with sheep, also observed the existence of a correlation also significant in the digestibility of dry substance obtained by the direct method and that calculated from the combustion heat in a calorimetric pump.

So far as we know there is no work of this type in the bibliography on rabbits, an animal of extraordinary interest for our region.

On the other hand, it appeared interesting to study the effects of high energy diets (due to the addition of fat to them at different levels) on the digestibility and nutritive value of the rations in this animal species; because as is known the fat level of the ration, due to the digestive peculiarity of this species, cannot go beyond a fixed maximum on account of the digestive capacity for this nutrient.

As regards the influence of the fat level on digestibility and nutritive yield of a ration, FISCHER and KIMBEL (4), MOREIRAS *et al.* (7), and VARELA *et al.* (9), with rats, observed an increase of the coefficient of

digestibility of the fat when this was increased in the diet.

With pigs, GREELEY *et al.* (6) studied the influence of this nutrient on the diet, proving that on its level increasing its digestibility also increased significantly, while that of the protein was not affected.

Materials and Methods

Three digestibility experiments have been carried out following the direct method with Giant breed Spanish rabbits (males with an initial weight of 2.5 kg) testing a diet with 3.1 % fat, to which olive oil was added up to the levels of 6.4 and 9.7 %.

At the same time as the coefficients of digestibility were obtained by the direct method, the digestibility of the dry substance was studied in each experiment following the calorimetric technique, with the object of observing in this species a possible correlation between the two techniques and as a control test between our results.

From the data obtained in these tests we have determined the energy values of the diets, expressing them in metabolizable energy and net energy.

The experiments have been carried out in a battery of eight metabolism cages, especially for these animals, in an air-conditioned laboratory, kept at a constant temperature of 20° C, relative humidity (65 %) and the period and degree of light also being constant.

The methodology and analytical techniques and calorimetry followed in these tests have been the standard ones and have been amply described by one of the authors in a previous paper (1).

Results

The results obtained have been treated statistically, by means of variance analysis and the digestibility values of the dry ma-

Table I. *Coefficients of digestibility and energy values obtained by direct method.*

	Diet A (3.1 % fat)	Diet B (6.4 % fat)	Diet C (9.7 % fat)
Dry substance	56.24 ± 0.49	59.38 ± 0.20	56.78 ± 0.90
Organic substance	58.63 ± 0.59	61.43 ± 0.21	59.30 ± 0.77
Protein	74.67 ± 1.09	75.56 ± 0.16	70.90 ± 0.58
Fat	79.11 ± 0.72	89.51 ± 0.60	91.05 ± 0.63
Fibre	30.97 ± 1.58	33.77 ± 0.99	29.35 ± 1.35
NFE ¹	60.49 ± 0.54	62.22 ± 0.30	58.36 ± 0.88
TDN ²	51.8	62.4	64.4
Metabolizable energy ³	188	227	235
Net energy ³	97	136	144

¹ NFE, Nitrogen free extracts; ² TDN, Total digestible nutrients; ³ Cal/100 g diet.

Table II. *Coefficients of digestibility (C.D.) of dry substance and metabolizable energy (M.E.) obtained by the calorimetric method.*

Diet	Fat added %	C.D. %	M.E. (Cal.)
A	3.1	59.4	228
B	6.4	60.4	243
C	9.7	60.0	251

terial and metabolizable energy obtained by the two methods employed have been correlated (Table I and II).

Discussion

POND *et al.* (8), FONOLLÁ *et al.* (5), BRUGGER and VARELA (3) and BOZA *et al.* (2) have compared these two methods in digestibility experiments carried out with rats, pigs and sheep, finding a high significant correlation between them.

The comparative study of our results with rabbits, on the methods of digestibility, one based on chemical analysis and the other on the determination of the combustion heat, has given us some correlations with values of *r* equal to 0.931, 0.701 and 0.995, with probabilities between $P < 0.5$ and $P < 0.001$ on comparing the coefficients of digestibility of the dry substance obtained by both methods.

The influence of the fat level of the diet on the digestibility and nutritive yield of a ration has been amply studied by FISCHER and KIMBEL (4), MOREIRAS *et al.* (7), VARELA *et al.* (9) and GREELEY *et al.* (6), observing an increase of the coefficient of digestibility of this nutrient when the percentages of fat used agree with the digestive capacity of the animal. These tests quoted have been carried out with rats and pigs, a fact which completely agrees with the results obtained in our experiments with rabbits.

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