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COMPARISON OF THE RABBIT AND COYPU DIGESTION ON THE BASE OF DIGESTIBILITY TRIALS

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Abstract

The objective was to determine if rabbit digestibility coefficients can be used in the coypu ration formulation. Indirect digestibility studies were carried out using 5 adult female New Zealand White rabbits and 5 adult, female coypus. Five typical feedstuffs (corn, wheat, wheat bran, extracted sunflower meal and alfalfa meal) have been tested, measured the nutrients digestibility and calculated the digestible energy content. In case of the feedstuffs, poor in fiber (corn and wheat) and that of containing the fiber in easily degradable form (wheat bran), the digestibility coefficients of the two species did not differ. The high-fiber feedstuff (alfalfa) has been digested less efficiently by the coypus. It is concluded that, despite great similarities in the digestive anatomy and functions, rabbit digestibility coefficients cannot be used in the coypu nutrition, especially in case of high-fiber feedstuffs. Cecotrophy in the coypu is apparently less important than in the rabbit.

Introduction

Owing to the relatively short breeding past (NRC, 1991), only few digestibility trials have been carried out with coypus or nutria (Myocastor coypus), a fur-bearing rodent native to South America. These experiments are rather difficult, because the coypu's nutritional behavior, such as the high selectivity in feed intake and the consequent great spoilage. For these reasons one has practically not even estimated values in the literature concerning the digestibility coefficients of the most important coypu's feedstuffs. As a further difficulty arises during comparison of the few existing data, gained by different methods (Olson, 1982).

The question has not only practical, but also theoretical importance, because the morphological features of the coypu and rabbit digestive tract are very similar. The well-justified question arises, whether can we use the rabbit digestibility coefficients during the coypu's ration formulation. At the same time the adaptation of the coypu to the originally aquatic way of life made its basal metabolism (the maintenance of the body temperature in the water) and its feeding behavior (the preference for the intake of the low-fiber aqueous plants in the nature) are in some respects different from those of the rabbit. The comparison of the fiber digestion of the two species seems to be especially interesting, because notwithstanding the mentioned similarity of the digestive tracts, there are different opinions concerning the coypu's cecotrophy (Scheelje, 1979; Hörnicke et al., 1985; Pereldik et al., 1987).

During the design of this experiment we have taken into consideration some practical points of view and tried to learn the the digestibility of nutrients of some important coypu feedstuffs, to make possible the proper ration formulation in the practice.

Materials and Methods

The experiment has been carried out in the animal facility of the Department of Poultry and Rabbit Nutrition of the Research Center for Animal Breeding and Nutrition, using the method of Fekete and Gippert (1986). Experimental animals: 5 adult, female New Zealand White rabbits and 5 adult, female coypus. The test feeds represented not only a different fiber level, but also a characteristic group of feedstuffs. According that the corn and wheat stood for the cereals (feed grains), the wheat bran represented the middlings, the sunflower did the extracted meals and alfalfa meal the hays. The results of the approproximate analyses of the tested feedstuffs are shown in Table 1.

For the associated (indirect) metabolic trial (Schneider and Flatt, 1975) we used two basal feeds. The first contained less protein and more fiber (17.3 % crude protein and 15.3 % crude fiber) and gave 40 % of the mixtures, made by this first this first basal diet, corn, wheat and wheat bran. The second basal feed had a higher protein and lower fiber level (21.5 % crude protein and 12.4 % crude fiber) and gave 60 % of the mixtures, made by this second basal diet, extracted sunflower meal and alfalfa meal. The composition of the two basal diet was the following: corn 0--27, barley 0--10, oats 53--10, alfalfa meal 0-26, soybean meal (solv. extracted) 0--10, sunflower meal (solv. extracted) 30--10, wheat straw 15--4, tallow 0--1, salt 0.5--0.5 and mineral-vitamin premix 1.5--1.5, first and second basal diet, respectively. The animals were fed with the basal diets and the experimental mixtures ad libitum in form of a pellet of 5*12 mm, both for the 5 rabbits and the 5 coypus.

The proximate analysis of the feeds and feces has been carried out by the methods described by the A.O.A.C. (1975).

The statistical analyses were performed as described by Pearce (1965). The digestible energy content was calculated on the basis of the equation of Schiemann et al. (1972).

Results

The nutrients' digestibility coefficients of the tested feedstuffs for rabbits and coypus are summarized in Table 2. and Figures 1, 2, 3, 4 and 5.

The dry matter digestibility of the low-fiber grains (corn and wheat) does not differ between the two species. The dry matter of the medium-fiber wheat bran and extracted sunflower meal is better digested by the coypus; that of the high-fiber alfalfa meal, by the rabbits. There is a same tendency concerning the digestion of the organic matter.

The protein digestibility coefficients of corn, wheat and wheat bran are higher at the rabbits, that of the extracted sunflower meal at the coypus; in case of the alfalfa meal practically there are not any difference.

As the crude fiber digestibility concerns, practically there are no differences between the two species in case of the corn, wheat and extracted sunflower meal; the crude fiber of the wheat bran has significantly ($p<.001$) been better digested by the coypus; that of the alfalfa meal by the rabbits.

The rabbits digested better the fat (ether extract) of each tested feedstuff.

The digestibility of the corn, wheat and extracted sunflower meal N-free-extract practically did not differ in the two species. The coypus digest better the N-free extract of the wheat bran and the rabbits did in case of the alfalfa meal.

Compared the calculated digestible energy content of the different feedstuffs (Table 3), one can state that it's only the alfalfa meal, where there is a significant difference ($p<0.05$) between the two species, namely the rabbit energy value is higher by 9 %.

Discussion

While the rabbit nutrient requirements are rather known (NRC, 1977; Blum, 1984), that of the coypus' remained uncleared. Considering the large cecum, one could hypothesize a great fiber need, like the rabbits'. Nevertheless, Holdas (1982) pointed out, that the coypu fiberr requirement has been overestimated. Pereldik et al. (1987) suggest only a fiber need of approximately 50 % of the rabbits.

In the present experiment the digestibility of dry matter, organic matter, crude fiber and N-free extract, in case of the corn and wheat (poor in fiber) are practically the same at the two species. The high-fiber alfalfa meal has been less digested by the coypus, compared to the rabbits. It's only the wheat bran and the extracted sunflower meal, where the digestibility of the dry matter, organic matter, crude protein and fiber (sunflower meal only) are higher at the coypus and not at the rabbits. One can suppose that the coypu fiber requirement is at that level, i.e. between 10 and 13 % of the air-dry feed. This is less by 15-19 % than the rabbit recommendations (Fekete and Gippert, 1985).

The protein digestibility of the corn, wheat and wheat bran are higher at the rabbits. The explanation of that may lead to the field of cecotrophy. It is well-known that by means of the intake of the soft feces pellets the rabbits "save" an important amount of protein (Fekete and Bokori, 1985). Hörnicke et al. (1985) report about the cecotrophy of the coypu, too. During this and by this way the average daily feces consumption of an adult individual was 30 feces pieces. This activity lasted 7 hours in a day. They state that the quality of feed influences the measure and the duration of the cecotrophy.

On the contrary, Pereldik et al. (1987) say that there is not a cecotrophy at the coypus. Babtist and Mensah (1988) described that at the cane rat (Thryonomys swinderiamus), a species, very close to the coypu both taxonomically and behavior, practises the cecotrophy, but the form of the two feces types does not differ.

During the present experiment we sporadically could detect some intake of soft feces pellets, very like normal feces in form. Based on the described observation and the protein digestibility data we suppose that the significance of the cecotrophy in the coypu is smaller than in the rabbit.

The coypu fat requirement is low (2 %) and above 3-4 % even the fur quality worsens (Pereldik et al. 1987). On the contrary, the rabbit fat digestion is excellent (Fekete et al., 1989), so it was not surprising that the coypus fat (ether extract) digestibility coefficients were lower than that of the rabbits. The physiological explanation of this phenomenon (differences in the bile, lipase production ?) remained unclear.

The coypu meets its energy requirement mostly from easily degradable carbohydrates, such as sugar and starch. In agreement with that - except the alfalfa and sunflower meal - the coypu digestibility coefficients of the N-free extract were slightly higher than those of the rabbit.

The digestibility of the alfalfa nutrients - except the crude protein, which was the same - were lower for the coypus. This is added up in the digestible energy value: 2421 kcal for rabbit and

2212 kcal for coypu. This fact demonstrates that the coypu can compensate/tolerate the high fiber content of the feed only to a certain limit and presumably do not require a lot. This later can be proved by the practical observations, that the coypus do not eat even the older, high-fiber green alfalfa.

Conclusions

1. In spite of the great similarities of the anatomy and function of the digestive system, the rabbit digestibility coefficients - especially at the high-fiber feedstuffs - cannot be used during the coypu ration formulation.

2. Presumably owing to the aquatic way of life (continous possibility for the intake of low-fiber parts of aqueous plants), the significance of cecotrophy decreased at the coypu.

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Table 1 chemical composition of the tested feedstuffs, %

Feedstuff	DM	CP	EE	CF	NFE
Corn	92.2	9.4	3.8	2.1	74.5
Wheat	88.8	13.1	1.8	2.6	71.5
Wheat bran	88.8	14.5	3.9	10.4	53.6
Sunflower meal	89.6	36.9	1.5	12.7	31.5
Alfalfa meal	91.6	19.2	2.47	23.9	37.0

Legend: DM = dry matter;

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Comparison of rabbit and coypu digestibility coefficients (%), n = 5 — Table 2

Nutrient	Species	Corn	Wheat	Wheat bran	Sunflower meal, extr. solvent	Alfalfa meal medium
Dry matter (DM)	rabbit	76.63 ± 0.89	77.85 ± 0.97	70.51 ± 1.64[a]	69.22 ± 1.11[c]	68.83 ± 1.75
	coypu	76.53 ± 1.78	77.86 ± 1.20	73.53 ± 1.65[a]	74.48 ± 1.64[c]	66.97 ± 1.47
Organic matter (OM)	rabbit	76.85 ± 0.92	78.12 ± 1.11	72.32 ± 1.72	71.37 ± 0.89[b]	70.43 ± 1.67[a]
	coypu	77.49 ± 1.72	79.12 ± 1.20	74.77 ± 1.60	75.09 ± 1.57[b]	67.55 ± 1.43[a]
Crude protein (CP)	rabbit	72.57 ± 1.25[b]	73.79 ± 1.03	71.05 ± 0.73	77.67 ± 1.23[c]	65.63 ± 1.71
	coypu	68.54 ± 2.14[b]	72.98 ± 1.65	70.97 ± 2.28	80.92 ± 1.37[c]	65.69 ± 1.54
Crude fiber (CF)	rabbit	42.36 ± 2.61	38.47 ± 2.72	33.17 ± 2.24[c]	16.82 ± 1.81	27.17 ± 2.14[c]
	coypu	44.86 ± 3.02	40.63 ± 2.50	41.20 ± 2.59[c]	17.73 ± 1.74	18.85 ± 1.86[c]
Ether extract (EE)	rabbit	93.18 ± 1.17[c]	91.62 ± 1.18[c]	89.72 ± 1.39[c]	92.10 ± 1.08[c]	88.12 ± 1.29[c]
	coypu	84.86 ± 0.93[c]	83.54 ± 1.23[c]	83.90 ± 1.65[c]	83.45 ± 1.17[c]	71.88 ± 1.19[c]
N-free extract (N-f.e.)	rabbit	82.33 ± 1.03	84.39 ± 0.72	76.78 ± 1.25[a]	77.34 ± 1.54	80.39 ± 1.44[c]
	coypu	83.63 ± 1.47	84.85 ± 0.59	79.10 ± 1.31[a]	77.34 ± 1.53	74.94 ± 1.66[c]

The digestibility coefficients differ between the two species at a level of
a: $p<0.05$; b: $p<0.01$; c: $p<0.001$

Table 3

The calculated digestible energy values ,DE, kcal/kg
(mean ± standard deviation)

Feedstuff	DE, rabbit	DE, coypu
Corn	3383 ± 50	3357 ± 95
Wheat	3290 ± 69	3312 ± 79
Wheat corn	2781 ± 100	2848 ± 86
Sunflower meal	2952 ± 121	3007 ± 148
Alfalfa meal	2421 ± 133	2212 ± 145 *

*: $p < .05$ after the Student t-test

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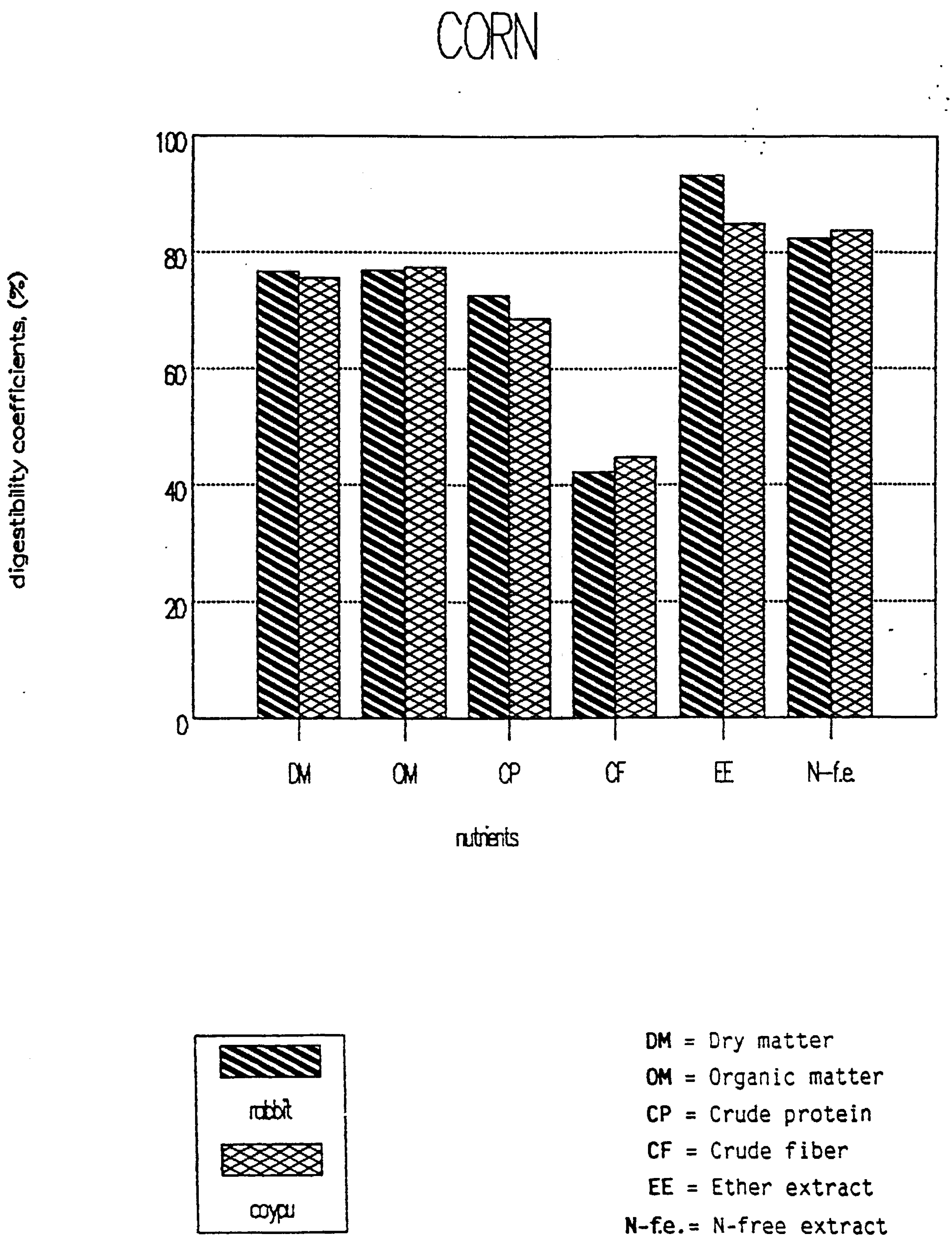
Figure 1.



DM = Dry matter
OM = Organic matter
CP = Crude protein
CF = Crude fiber
EE = Ether extract
N-f.e.= N-free extract

Figure 2.

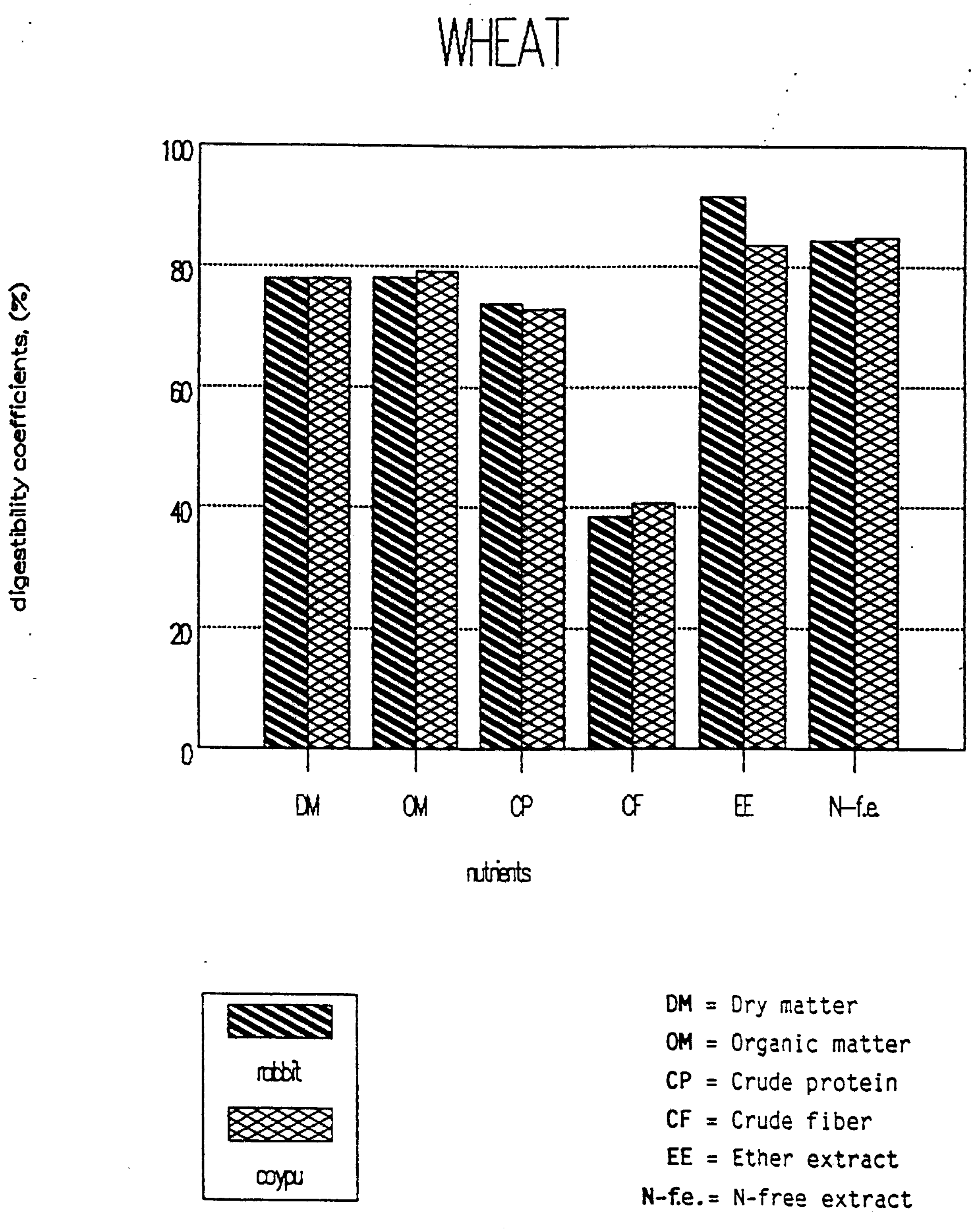
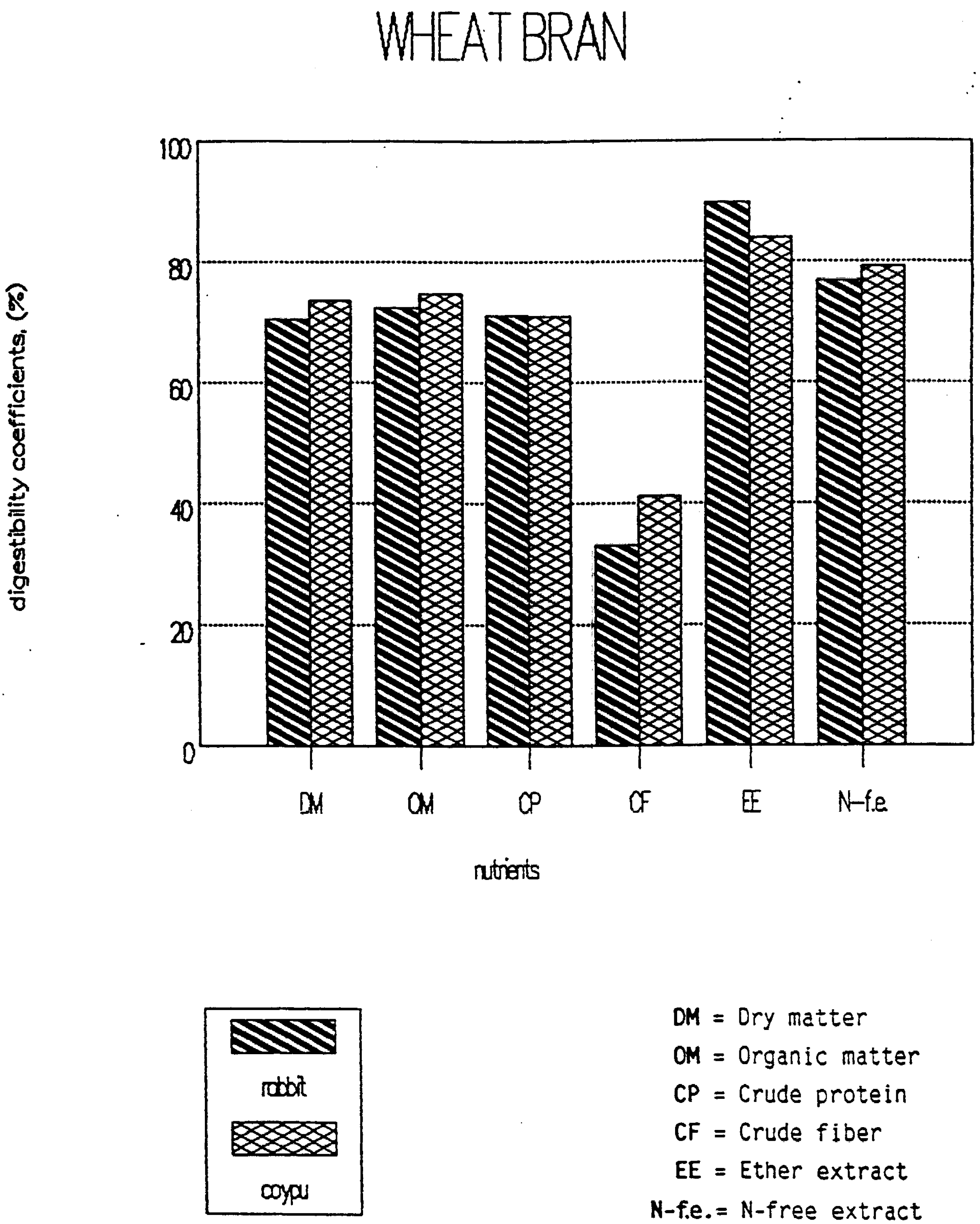
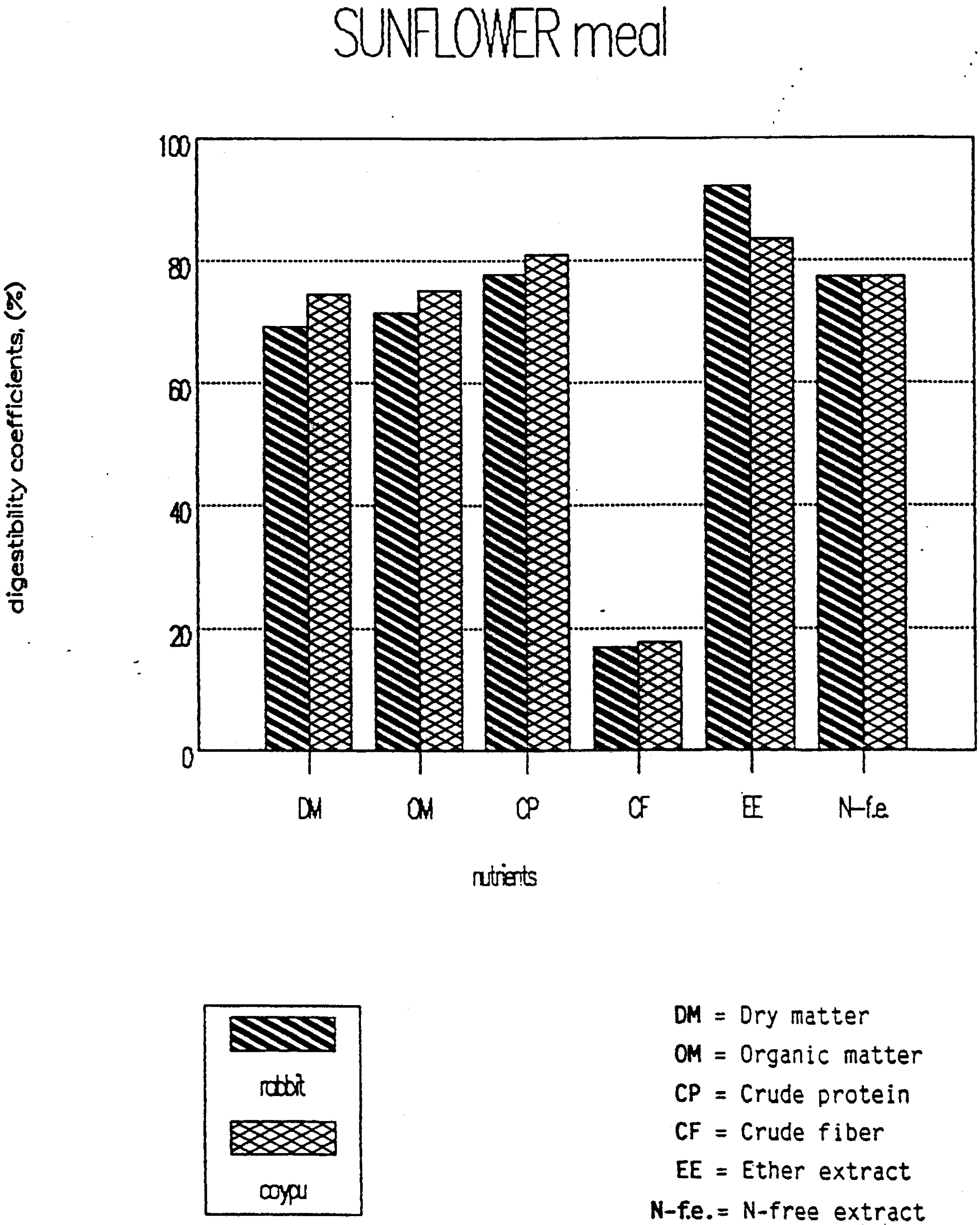

WHEAT
digestibility coefficients, (%)
100
80
60
40
20
0
DM
OM
CP
CF
EE
N-f.e.
nutrients
rabbit
coypu
DM = Dry matter
OM = Organic matter
CP = Crude protein
CF = Crude fiber
EE = Ether extract
N-f.e. = N-free extract

Figure 3.



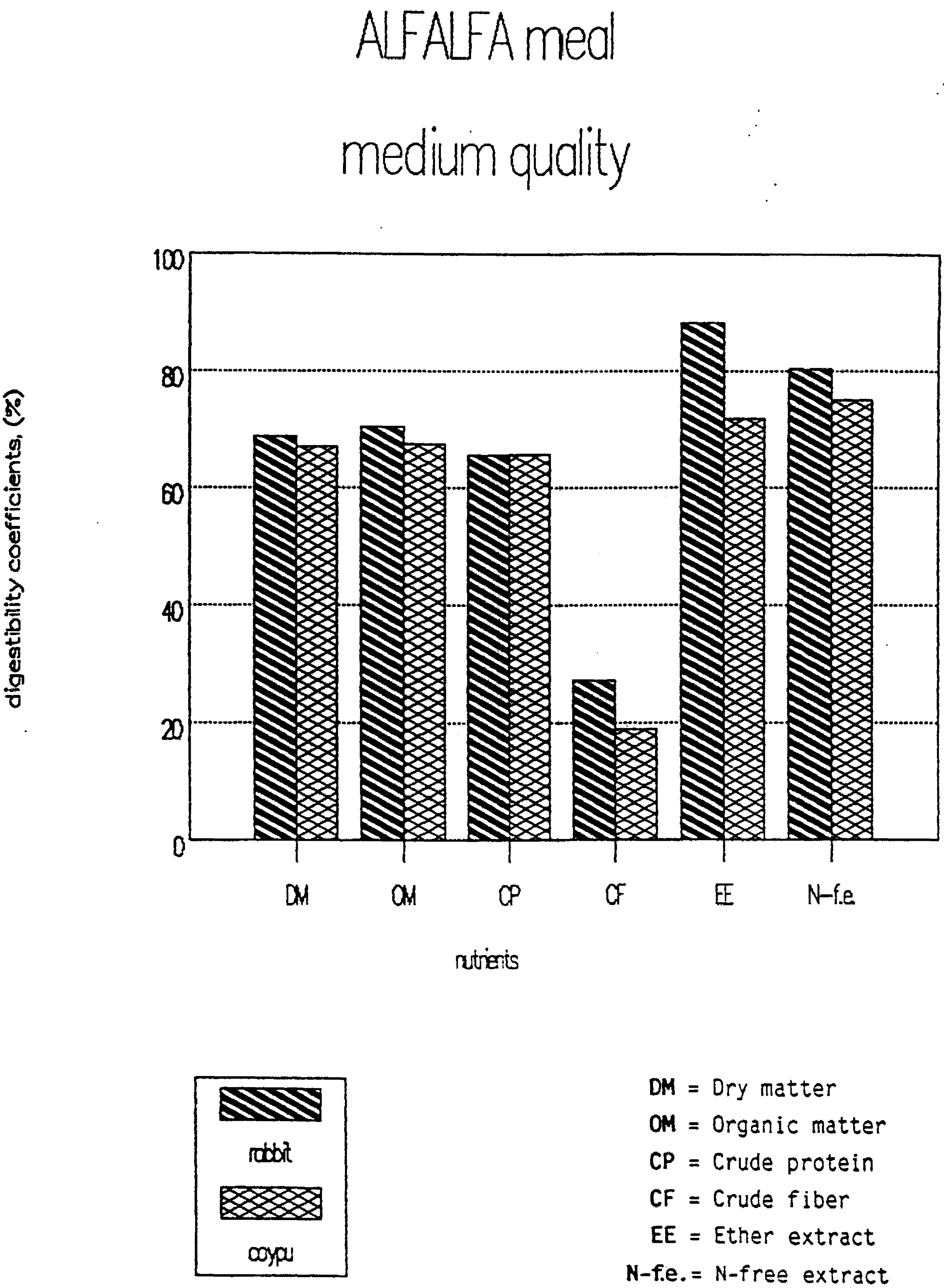
DM = Dry matter
OM = Organic matter
CP = Crude protein
CF = Crude fiber
EE = Ether extract
N-f.e. = N-free extract

Figure 4.



DM = Dry matter
OM = Organic matter
CP = Crude protein
CF = Crude fiber
EE = Ether extract
N-f.e. = N-free extract

Figure 5.



DM = Dry matter
OM = Organic matter
CP = Crude protein
CF = Crude fiber
EE = Ether extract
N-f.e. = N-free extract