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Nutrition of the cat

2. Protein requirements for growth of weanling kittens and young cats maintained on a mixed diet

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After designing a practical stock diet that would support growth and reproduction of cats maintained under laboratory conditions, the next step was to ascertain the minimal level of protein necessary for normal growth on a mixed diet, since protein sources formed the most expensive of the ingredients used (Dickinson & Scott, 1956). The experiments briefly reported earlier (Dickinson & Scott, 1955) indicated that, with the type of mixed diet used, growth was satisfactory only when the protein fraction exceeded 30% of the dry weight of the diet.

EXPERIMENTAL

General. The origin, selection and management of the kittens were similar to those described in a previous paper (Dickinson & Scott, 1954); most were born and reared in the laboratory and the rest were obtained at weaning from domestic sources. Each kitten was weighed three times a week and its general condition noted.

Exp. 1. Twelve kittens weighing between 1 and 1·8 kg were caged in pairs, so that the total weights of the pairs were as close as possible. For a preliminary period, pairs A, B, C, D and E received either a stock diet containing 67% protein (Dickinson & Scott, 1956) or a basal diet containing 50% protein (Dickinson & Scott, 1954) for 3 weeks. They were then placed on the test diets shown in Table 1.

Table 1. *Exp.* 1. *Composition (parts by weight) of the diets of kittens*

	Diet given to pair				
Ingredient	E (8% protein*)	D (14% protein*)	C (17% protein*)	B (21% protein*)	A (24% protein*)
Minced potato	70	70	70	70	70
Wood flour	14	14	14	14	14
Potato starch	7	7	7	7	7
Bone meal	4	7	7	7	7
Salt	0·5	0·5	0·5	0·5	0·5
Water	55	55	55	55	55
Fat	6	6	5	5	4
Minced herring	2	21	35	50	70
Minced liver	0·5	7	10	14	21

* N × 6·25.

The proportions of minced herring and liver were adjusted to provide levels of 24, 21, 17, 14 and 8% protein, calculated on the basis of the dry weight from nitrogen estimations (Kjeldahl) × 6·25. The diets were mixed in bulk in sufficient quantity to last for the experimental period and preserved by canning. Pair F was given the basal diet containing 50% protein used in previous experiments (Dickinson & Scott, 1954). After 11 days pair E, which had suffered severe weight loss on 8% protein, was given a diet calculated to contain 30% protein.

Exp. 2. Sixteen kittens from six litters were caged in four balanced groups, G, H, J and K. Each group contained three kittens (2 ♀, 1 ♂) of similar weight and mean age 11 weeks and a larger male weighing over 2 kg and aged 18 weeks. In the preliminary period the groups received the stock diet. The experimental diets (Table 2), containing 43, 37, 30, 23% protein (N × 6·25), were improved in comparison with those of

Table 2. *Exp.* 2. *Composition (parts by weight) of the diets of kittens*

	Diet with protein* content of			
Ingredient	23%	30%	37%	43%
Minced potato	70	50	30	20
Potato starch	5	5	5	5
Cut wheat	10	10	12	15
Bone meal	3	3	2	2
Salt	0·5	0·5	0·5	0·5
Fat	5	4	3	3
White fish	20	30	45	45
Minced herring	20	30	45	45
Minced liver	10	14	16	16

* N × 6·25.

Exp. 1 by the addition of white fish and kibbled whole wheat grains and the omission of wood flour. For the first 12 days group G received 43 %, group H 37 %, group J 30 % and group K 23 % protein. These levels were then changed so that group G now received 30 %, group H 23 %, group J 43 % and group K 37 % for 16 days.

RESULTS

Exp. 1. Individual mean daily weight changes for the kittens are shown in Table 3, and the curves for the mean body-weights of the pairs receiving 50, 21 and 8 % protein are plotted in Fig. 1. All the kittens gained weight steadily on the stock diet, averaging 16 g/day, but on the test diets only the pair receiving 50 % protein continued to gain, whereas the remainder lost weight. Those receiving 14 and 8 % lost more than 20 % of their original body-weight in the first 11 days, after which the pair that had been receiving 8 % was given 30 % protein, on which it regained its original weight in 14 days (Fig. 1).

Table 3. *Exp.* 1. *Mean daily weight changes of individual kittens*

		11 days on test diet	
Pair	21 days on stock diet (50 % protein). Change in weight (g)	Protein in diet (%)	Change in weight (g)
A	+16, +16	8	−40, −33
B	+ 7, +18	14	−19, −33
C	+19, +10	17	−28, −20
D	+19, +19	21	−27, −16
E	+18, +14	24	−26, −21
F	+25, +15	50	+11, + 6

Table 4. *Exp.* 2. *Mean daily weight changes* of groups of kittens*

	Group G		Group H		Group J		Group K	
Period	Protein in diet (%)	Weight gain (g)	Protein in diet (%)	Weight gain (g)	Protein in diet (%)	Weight gain (g)	Protein in diet (%)	Weight gain (g)
First test period (12 days)	43	16	37	7	30	3	23	5
Final test period (16 days)	30	8	23	4	43	16	37	15

Mean daily weight gain on stock diet = 13 g.

* Three kittens and one young male cat in each group.

Exp. 2. On the stock diet, the mean daily weight gain of the kittens was 13 g. When placed on the test diets the groups receiving 37, 30 and 23 % protein made considerably smaller gains than on the stock diet, but those in group G receiving 43 % gained well (Table 4). However, during the final period the rate of gain of groups G and H, transferred from 43 to 30 % and from 37 to 23 % protein, respectively, fell to approximately half, while groups J and K, transferred to the higher levels, made good

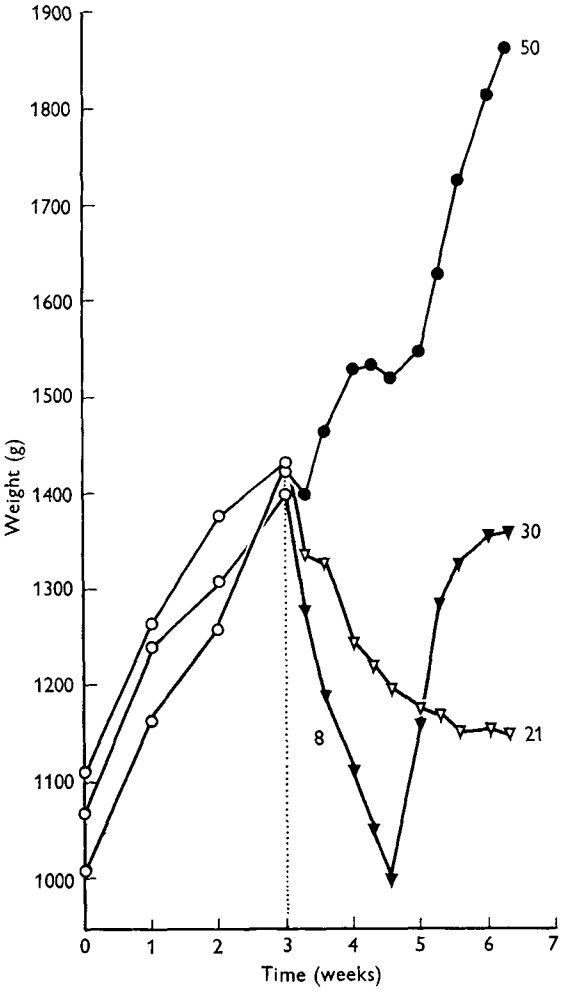

Fig. 1. Exp. 1. Mean weights of kittens in groups A, D and F. o—o, on basal or stock diet. Numbers on curves give percentage of protein in the diet; dotted line shows change in diet.

gains (Table 4). The effects of changing the level of protein on the mean body-weight of the weanling kittens is shown in Fig. 2*a*. Fig. 2*b* shows the effects of the same changes in diet on the weight of individual young male cats.

DISCUSSION

These results indicate that, with the type of mixed diet used, the growth of weanling kittens and young male cats was satisfactory only when the protein fraction exceeded 30% of the dry weight of the diet.

This requirement is higher than that of growing puppies, which Heiman (1947) found to be 20%, and of growing pigs, which Reber, Whitehair & MacVicar (1953) found to be 41% for very young pigs, falling to 20% as piglets approached 8 weeks of age. McCoy (1949) concluded that optimum growth of the rat occurs on diets

containing between 25 and 30% protein, although satisfactory growth in this animal was obtained by Hamilton (1939) with diets containing only 16%.

The protein content of cat's milk, about 50% of the dry weight, is higher than that of many other mammals (Abderhalden, 1898; Lusk, 1928; Davies, 1939). Albanese (1950) quotes an observation that young kittens did not thrive on and rejected fresh cow's milk, but accepted and grew well on an evaporated milk that contained proteins at twice the concentration found in fresh milk. This finding may be due to the higher protein requirements of the cat.

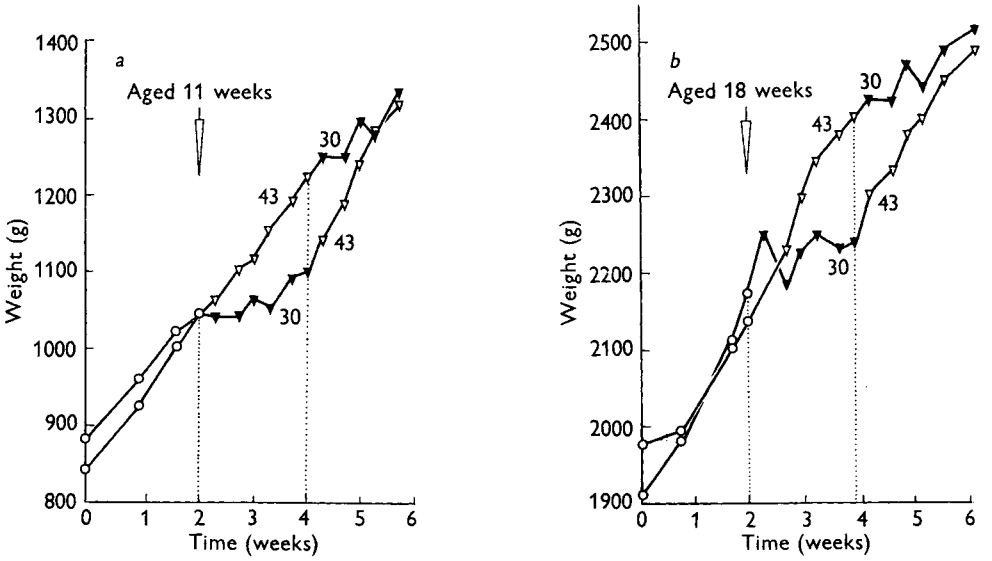

Fig. 2. (*a*) Mean weights of weanling kittens, and (*b*) weights of individual male cats in groups G and J. o—o, on stock diet. Numbers on curves give percentage of protein in the diet; dotted lines show change in diet.

The presence of a new sulphur-containing amino-acid in cat's urine (Westall, 1953), and the observation of Carvalho da Silva, Fried & de Angelis (1952) that the metabolism of tryptophan and nicotinic acid does not follow the same paths as in the rat, suggest differences in the nitrogen metabolism of the cat.

Thus the higher level of dietary protein necessary for growth in the cat may be due to a high requirement for particular amino-acids or other protein constituents, rather than to a higher total nitrogen requirement.

SUMMARY

1. Because sources of animal protein are expensive it was desirable to determine the most economical level, compatible with satisfactory growth, at which they should be fed to kittens receiving a mixed diet.

2. Diets were prepared and canned in which the content of fish and liver was adjusted to provide different levels of protein (N × 6·25 on a dry-weight basis).

3. In the first experiment, weight changes of pairs of kittens were recorded first on a stock diet, then on the experimental diets containing 24, 21, 17, 14, 8 and 50% protein. Only the pair receiving 50% gained weight. Those on 8% lost severely but recovered their original weight on a diet containing 30% protein.

4. In the second experiment, groups of four kittens were given diets containing 43, 37, 30 and 23% protein. Weight gains were satisfactory only when the kittens received the diets containing 43 and 37% protein.

5. It is concluded that with the type of mixed diet used growth of kittens is satisfactory only when the protein fraction exceeds 30% of the dry weight. This requirement is higher than those of other young animals which have been investigated, with the exception of very young pigs.

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