The Voluntary Food Intake of Pigs
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A MODEL OF FOOD INTAKE REGULATION IN THE GROWING PIG

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INTRODUCTION

As selection for increased meat percentage and food utilization have reduced gain and food intake in the young pig, the main limiting factor for food intake in the growing pig is gut capacity. This selection tends to decrease gut capacity for food intake, probably by favouring pigs with an efficient feedback inhibition of gastric emptying. Selection for increased daily gain increases the pig's capacity for nutrient turn-over. The result of both kinds of selection (or an index including daily gain, food utilization and meat percentage) is, that the capacity for nutrient turn-over is favoured compared with gut capacity. Gut capacity becomes more limiting for production in the future. The selection increases the demand for high-energy diets especially for the piglet.

THE MODEL

On the basis of a literature review a model on food intake regulation in the growing pig is proposed. The main hypothesis is, that food intake is limited by two factors:

the capacity for nutrient turn-over (metabolic regulation)
the gut capacity (physical regulation)

the components of which are summarized in Figure 1.

In the short term, the metabolic regulation is determined by the concentration of nutrients in the blood, while the regulation in the long term is determined by the capacity for nutrient turn-over. This capacity could partly be regulated by the size of the adipose cells using insulin in the cerebrospinal fluid as a 'messenger', as indicated in Figure 2.

For piglets the capacity for nutrient turn-over is normally higher than the gut capacity, and gut capacity is limiting. The capacity for nutrient turn-over becomes more limiting as pigs grow. Therefore, increased energy concentration in the food means an increased energy intake by the piglet, while the finishing pig hardly responds to energy concentration within the normal range. These relationships are shown in Figure 3.

In the short term, the gut capacity is limited by the capacity of the stomach, while the capacity in the long term is determined by the feedback inhibition of gastric emptying. This inhibition is mainly determined by the amount of undigested material in the distal parts of the gastrointestinal tract. As a consequence the amount of undigested material per kg food could have large influence on the gut capacity. When maximum energy intake by the pig is wanted, it seems better to increase the digestibility of carbohydrate and protein than to add fat to a high-fibre diet. Approaches to this problem are indicated in Figure 4.

The introduction of a 'gut-fill unit' related to foodstuffs and/or mixtures could be of great value in predicting and optimizing food intake for the young pig.

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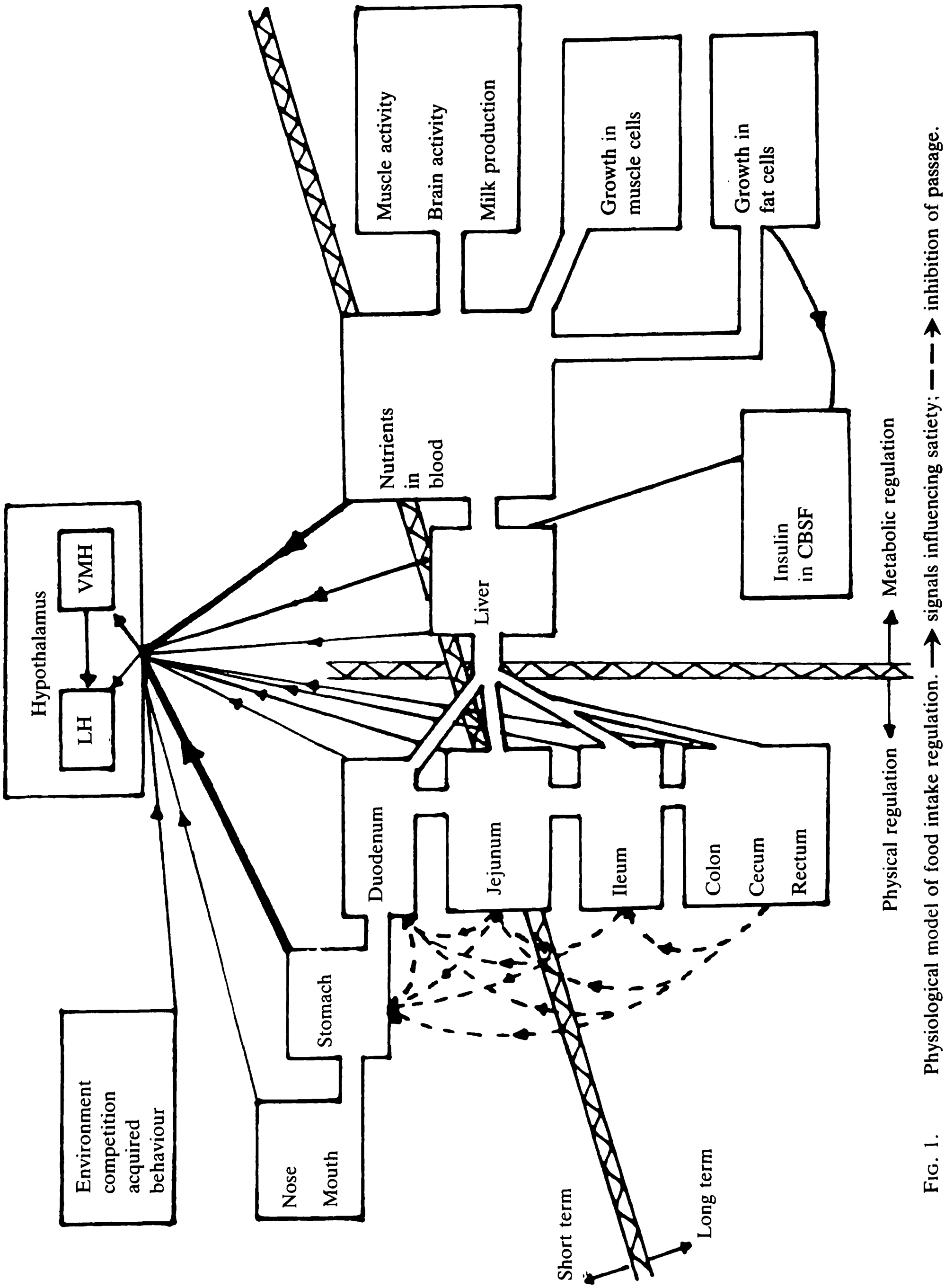

FIG. 1. Physiological model of food intake regulation. →

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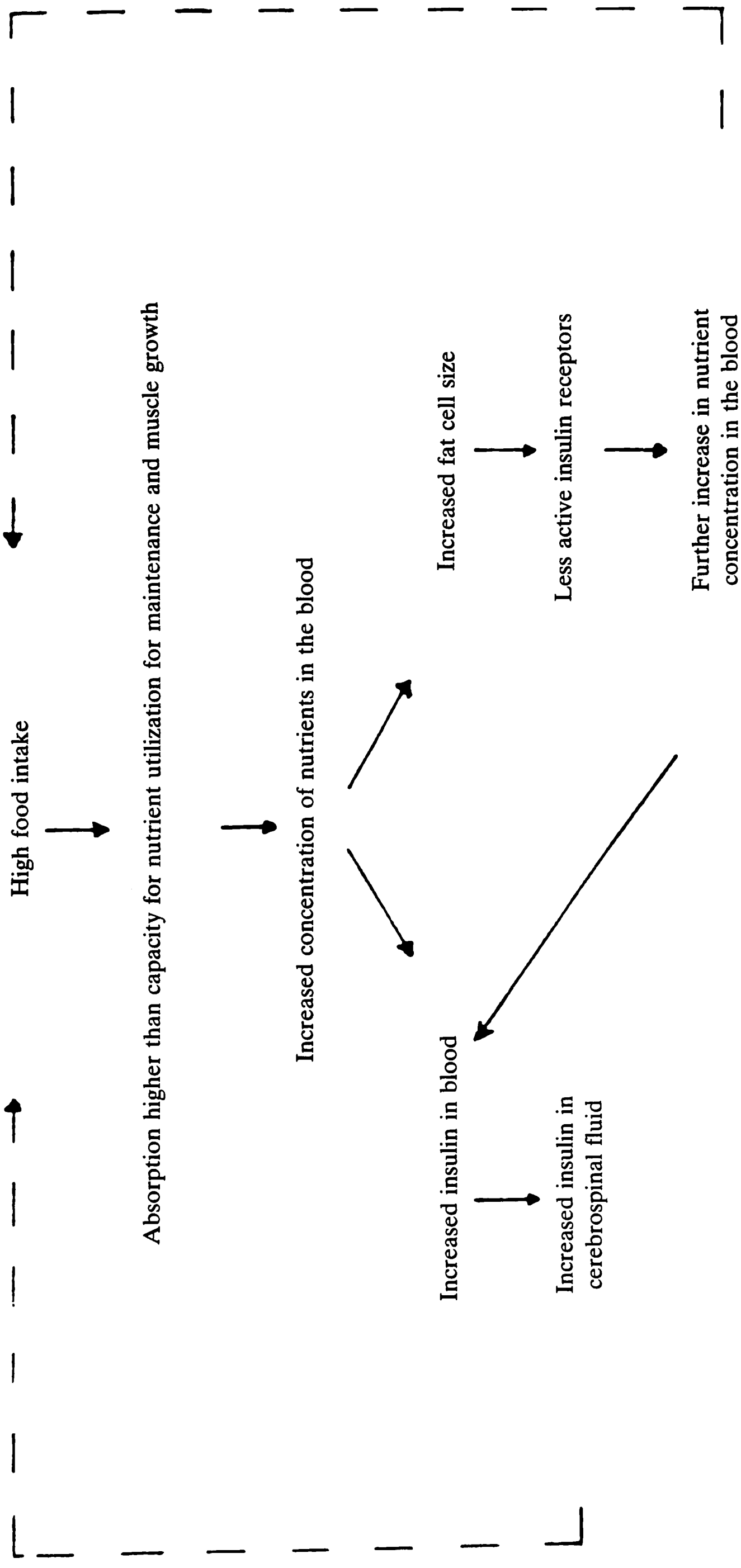

FIG. 2. Fat cell size and insulin as regulators of food intake: a possible mechanism. — — — inhibition; ——— stimulation.

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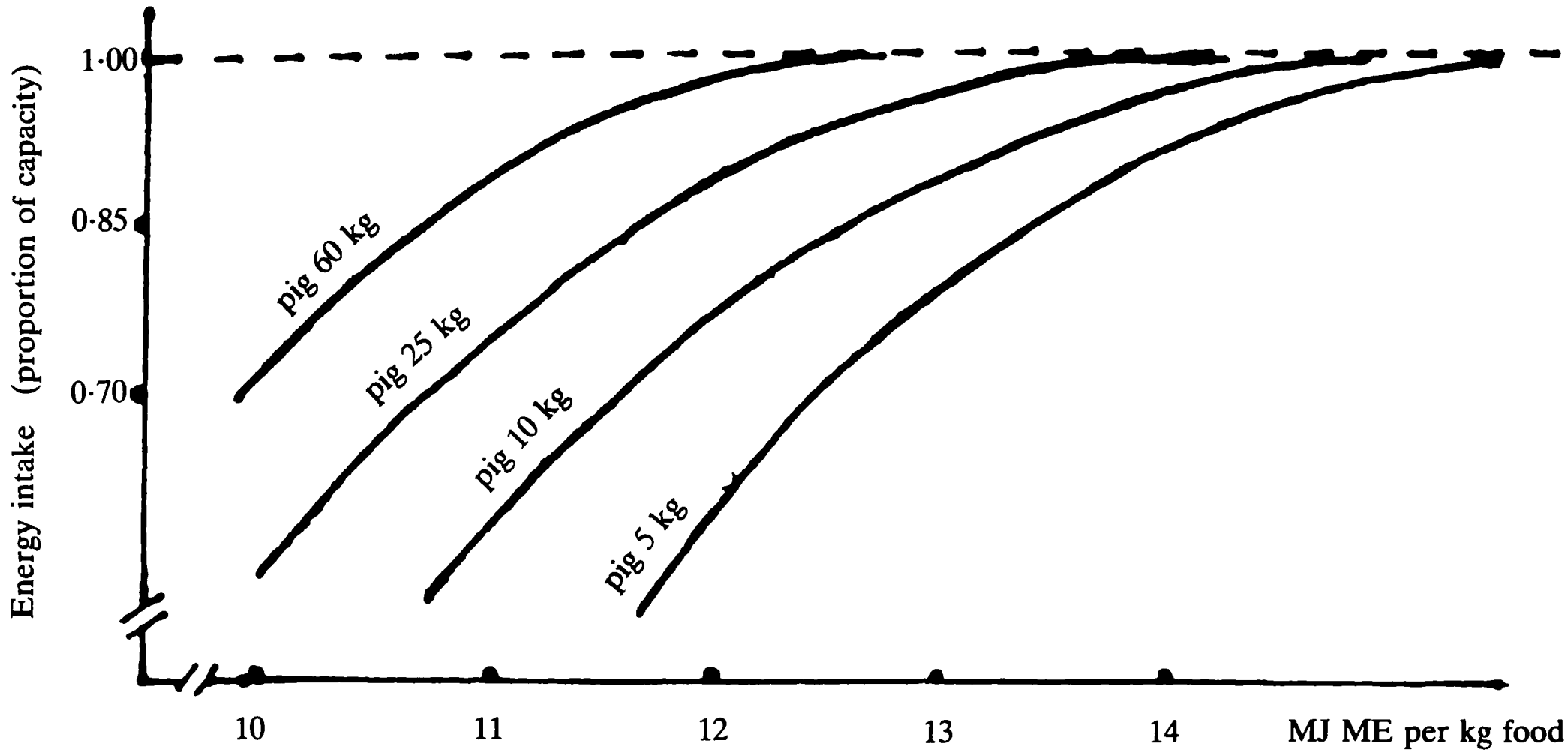

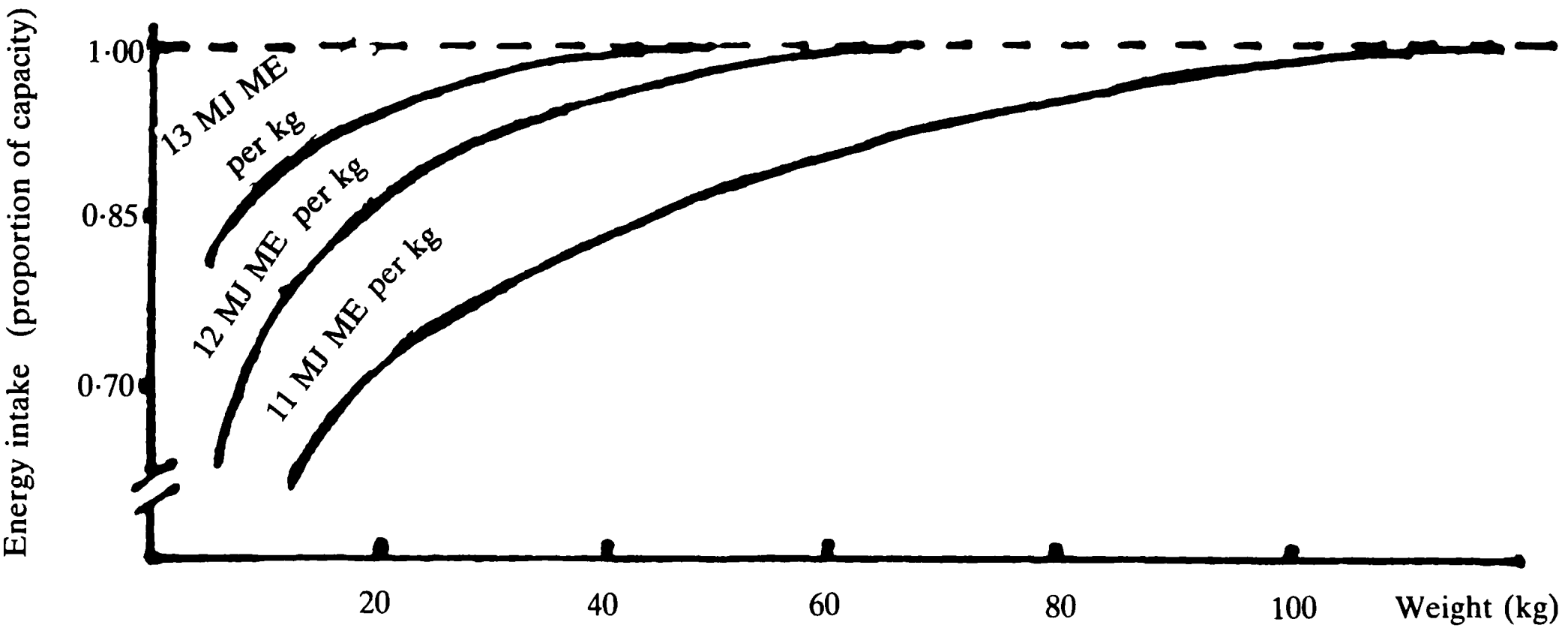

FIG. 3. Relationship between energy concentration in food, energy intake and weight of the pig.

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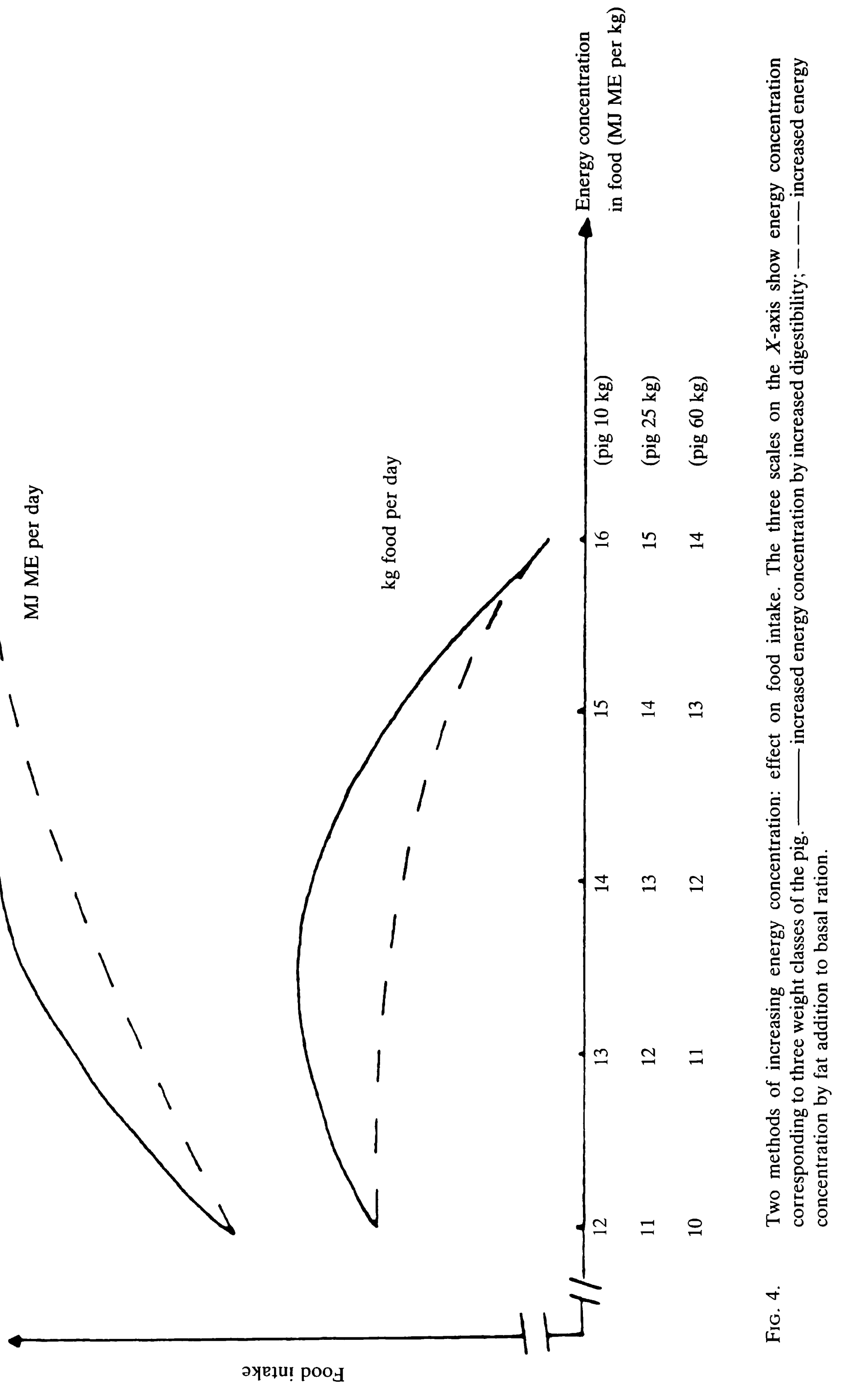

FIG. 4. Two methods of increasing energy concentration: effect on food intake. The three scales on the *X*-axis show energy concentration corresponding to three weight classes of the pig. ——— increased energy concentration by increased digestibility; – – – – increased energy concentration by fat addition to basal ration.

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