The effect of the gut flora on the growth response of the chick to fish solubles. By G. F. HARRISON and M. E. COATES, *National Institute for Research in Dairying, Shinfield, Reading*

The earlier suggestion that the growth-promoting activity of fish solubles may be by modification of the intestinal microflora (Harrison & Coates, 1964) has now been tested. Germ-free chicks, reared in Gustafsson type isolators, and control groups in conventional quarters, were given a diet based on maize and soya-bean meal with or without 5% fish (herring) solubles. The mean body-weights at 4 weeks were: germ-free without fish solubles 337 g, with fish solubles 350 g; conventional without fish solubles 303 g, with fish solubles 340 g. The growth increase with the solubles was significant ($P<0{\cdot}001$) in conventional quarters but not in the germ-free isolators.

To study the effect of the gut flora of conventional chicks on the growth of germ-free chicks, fresh droppings from conventional birds, or the droppings sterilized by autoclaving, were introduced into germ-free isolators. The droppings were spread on the diet, with and without fish solubles, at the rate of about 1 g per chick. Mean body-weights at 4 weeks were: no droppings, no fish solubles 353 g, with fish solubles 373 g; sterilized droppings, no fish solubles 338 g, with fish solubles 369 g; fresh droppings, no fish solubles 283 g, with fish solubles 313 g. The growth increase with fish solubles was significant ($P<0{\cdot}05$) only when fresh or sterilized droppings were given. The highly significant depression in growth ($P<0{\cdot}001$) caused by fresh droppings was not fully counteracted by fish solubles.

In further experiments, an aqueous extract of fresh droppings from conventional birds was sterilized by filtration and a single dose of 0·2 ml was given to germ-free chicks on diets with and without fish solubles. No significant differences in body-weight were observed at 4 weeks.

These findings indicate that dietary fish solubles had a small, non-significant effect on growth of germ-free chicks, but significantly improved growth when birds were given fresh or autoclaved droppings. It appears that the growth-promoting activity of fish solubles requires the presence of the non-filterable fraction of chick droppings that depresses growth. Although the effect seems to be largely dependent on the presence of a microflora it is evidently not entirely so, since a small dose of autoclaved droppings also depressed growth; dietary fish solubles completely counteracted this depression but only partially reversed the more severe depression in birds given fresh droppings.

REFERENCE

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A rapid method for the estimation of thermic energy in rats. By D. S. MILLER and M. J. STOCK, *Department of Nutrition, Queen Elizabeth College, London, W8*

The technique to be described has been developed to reveal relative changes in thermic energy due to variations in dietary treatments and to the administration of

pharmacologically active substances. The method is based on the estimation of heat production by the comparative carcass principle.

Weanling, hooded rats are maintained on a stock diet (Amvilac No. 2, Glaxo Laboratories Ltd, Greenford) until 30 days of age and are then divided into groups of four rats of equal weight. One group is killed and retained for the estimation of initial carcass energy content and the remainder are fed the stock diet for a further 10 days when they too are killed and carcass energy is determined by bomb calorimetry.

The agreement between replicates was considerably improved when all groups were fed identical amounts of food and so a controlled feeding programme was adopted whereby the calorie intakes of all rats are maintained at $220W^{0.75}$kcal/day, where W is the body-weight (kg) of the rat at the beginning of the assay. This amount of food is fed throughout the experiment and allows for good growth rates and complete emptying of food pots with little spillage.

From the determined caloric density and nitrogen content of the diet, the intake of metabolizable energy may be calculated according to the method of Miller & Payne (1959): alternatively urine and faecal energy losses can be determined directly. Total heat production is obtained by subtracting the carcass energy gain from the energy intake. From this an estimate of thermic energy can be obtained by subtracting a maintenance allowance of $107W^{0.75}$kcal/day (Miller & Payne, 1963) where W is the weight on day 5 of the assay. The results from four separate assays are shown in the table.

Table 1. *Thermic energy results*

	Thermic energy expressed as a percentage of intake			
Diet	Assay 1	Assay 2	Assay 3	Assay 4
Stock	23·0	21·2	20·4	23·4
	24·3	22·1	19·2	22·6
Stock + drug A		42·7		
		46·1		
Stock + drug B			19·0	
			19·8	
Stock + drug C				30·0
				28·7

Drug A was administered by daily intraperitoneal injection and drugs B and C by mixing with the powdered diet.

It can be seen that, as well as obtaining good duplicates within an assay, inter-assay replication is also reliable. The results for three drugs, A, B and C, indicate that the method is sensitive to changes in heat production induced by pharmacological agents. The following paper demonstrates how the method can be used to measure changes in calorie utilization due to differing dietary treatments.

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