during growth. During post-diapause development the embryo engulfs yolk and serosa cells so that it eventually contains most of the enzyme rich egg components. Apparently a gradual transfer of enzyme from yolk to embryo then occurs. The amount of tyrosinase in the egg membranes is low and remains practically static during the whole of development.

Attempts to obtain the enzyme from nymphs (after the 3rd instar) and from adults have been unsuccessful.

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Effect of Skim-milk, Lactose, Vinegar and Iodine on the Quantitative Character of a Coccidian Infection.*

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Skim-milk and lactose supplements in the diet were recommended by Beach and Davis[1] as affording a considerable degree of protection against coccidiosis in poultry. The explanation of the claimed benefits was the production of an abnormal degree of acidity in the caeca of the birds, which in turn injured or destroyed the sporozoite or merozoite stages of the parasites. Since the rat is a favorable host for the study of a coccidian infection, an experiment was planned in which one series of hosts received the regular growing ration made up to 40% with skim-milk beginning 4 days before the date of the first infection and continuing throughout the experiment, and another series received its regular ration without skim-milk. Infection was accomplished by forced feeding of from 1,500 to 3,000 oocysts of *Eimeria miyairii* daily for 4 or 5 successive days. The counts of the oocysts eliminated in the fecal pellets were taken as the index of the infection intensity. Seventeen rats on the skim-milk diet eliminated from 94 to 376 million oocysts each; mean, 203.24 millions. Sixteen controls on the regular diet eliminated from 72 to 464 million oocysts each; mean, 237.25 millions. The difference in the means divided by the standard deviation of the difference ($34.01 \div \sqrt{737.25 + 381.334}$) was 1.02, a nonsignificant value. Through the kindness of Dr. Donald Starr of the Chemistry Department it was possible to determine the

* Project No. 40, Industrial Science Research Fund, Iowa State College.

1 Beach, J. R., and Davis, D. E., *Hilgardia*, 1925, **1**, 167.

pH of the entire content of the small intestine of some of the rats at the end of the experiment. The values for 3 rats on the milk diet were 6.92, 6.74, and 7.28; for 3 controls, 6.60, 6.75, and 6.48. It is evident that the skim-milk diet did not produce an abnormally acid condition in the small intestine of the rat, and that the parasite population was not reduced by the diet. Another similar experiment in which the percentage of skim-milk was reduced to 22% and the doses of parasites were lighter gave mean yields of 123 million oocysts for 8 rats on the special diet and 122 million oocysts for 7 on the regular diet.

An experiment was carried out exactly as the former except that the diet was made up to 20% with lactose instead of adding skim-milk supplement. Four rats receiving the lactose eliminated a mean of 211 million oocysts, while the 4 controls eliminated a mean of 207 million oocysts.

Kerr and Botham[2] announced that they had found iodine of value in the control and treatment of avian coccidiosis. The infected birds were given to drink only a 1:8 mixture of (a) a stock solution composed of 1 gm. of resublimated iodine, 2 gm. of potassium iodide, and 50 cc. of water added to 450 cc. of milk and (b) water.

Allen[3] found that ordinary vinegar added to the drinking water of fowls in the proportion of 1 to 79 reduced the numbers and vitality of the oocysts eliminated. To test out these measures in a preliminary way, 3 rats out of a litter of 10 were given to drink only the Kerr and Botham mixture, 3 the diluted vinegar, and 4 tap water. The day after they were put on these drinks each rat received 3,000 infective sporulated oocysts, and the same dose each of the succeeding 4 days. The counts (in millions) for the recipients of iodine were as follows: 525, 436, 432. The same for the recipients of vinegar: 409, 645, 449. The controls: 517, 346, 370, 413. This test experiment seems to indicate that iodine and vinegar have no general value as coccidicidal agents.

In conclusion, it has been shown that skim-milk or lactose supplement in the diet, iodine in the drinking water, or vinegar in the drinking water do not exert any restraining influence upon the numerical increase of the coccidian population in the alimentary tract of the mammal.

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[2] Kerr, W. R., and Botham, G. H., *Vet. J.*, 1931, **87**, 10.

[3] Allen, E. A., *Poultry Science*, 1933, **12**, 324.