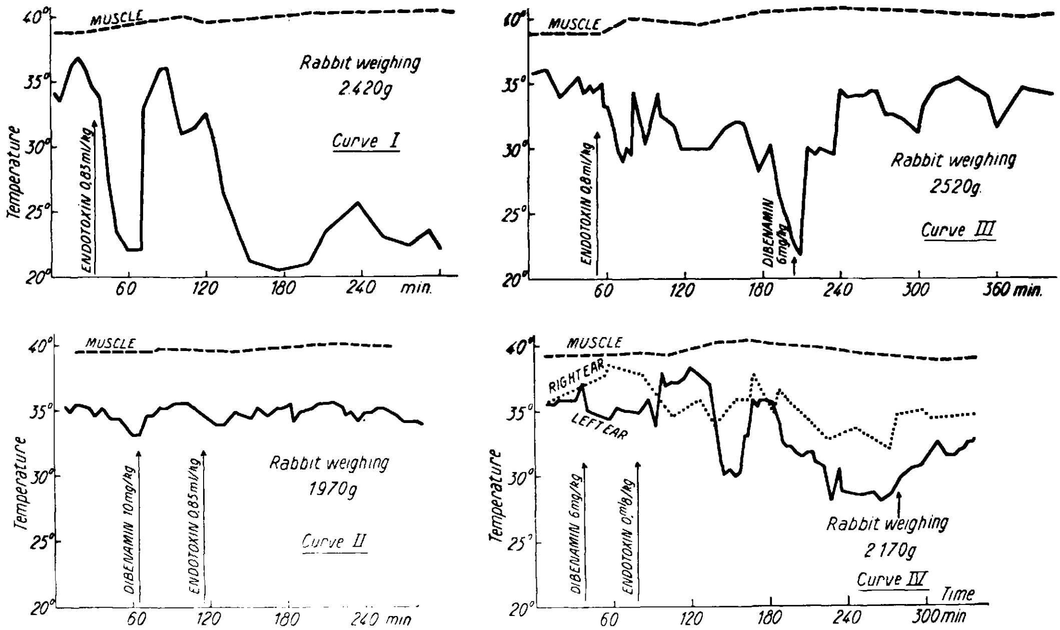

FIG. 1.

Effects of injections of dibenamin before and after the administration of typhoid endotoxin on the skin temperature of the rabbit's ear.

Curve 1—Skin temperature after an intravenous injection of typhoid endotoxin (1 m.l.d.).

Curve 2—Effect of an injection of dibenamin before the administration of the toxin.

Curve 3—Effect of an injection of dibenamin after the administration of the toxin.

Curve 4—Effect of 2 injections of dibenamin, one before and one after the administration of the toxin (the left ear has been dienervated four days before the experiment).

In the 4 curves, the internal temperature is indicated by a dotted line.

can be decreased by previous administration of Dibenamin. However, to maintain this effect, it is necessary to follow with another injection of Dibenamin (3 mg per kg) (Curve 4).

Summary and conclusions. The injection *S. typhosa* endotoxin appears to stimulate the liberation of adrenalin or adrenalin-like substances, bringing about peripheral vasoconstriction. Dibenamin, a sympatho-adrenal blocking substance, antagonizes this effect.

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Studies on the Effect of Different Carbohydrates on Chick Growth.* (18164)

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Nutritional differences among sucrose, dextrin, lactose, and cerelose have been reported by several workers. Elvehjem(1,2) has reviewed much of the work done on carbo-

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TABLE I. Effect of Supplements on Growth of Chicks Receiving Different Carbohydrates.

Treatment	4-week % wt gain (basal groups = 100%)* Dextrin	Sucrose	Lactose	Cerelose
Basal	279 g = 100% (36)	206 g = 100% (36)	149 g = 100% (32)	259 g = 100% (12)
Folic acid deficient	35% (12)	22% (17)	53% (11)	—
Basal +				
0.1 μg vit. B_{12}/day inj.	119(12)	113(12)	107(12)	—
1.0 μg ″	110(12)	118(11)	134(8)	—
0.6 μg vit. B_{12}/100 g ration	113(12)	—	127(12)	—
reticulogen (1 U.S.P. unit/day inj.)	114(12)	121(12)	142(9)	—
fish solubles (3%)	110(12)	107(12)	143(11)	—
sulfasuxidine (2%)	100(12)	81.5(12)	86.5(9)	—
sulfasuxidine (2%) + cellulose (10%)	88(12)	86(12)	74(11)	—
cellulose (10%)	91(12)	84(12)	—	—
2 × B vitamins	98(12)	100(12)	—	—
Basal (50%) + 50% dextrin	—	117(12)	174(12)	—

* Figures in parentheses indicate the number of chicks surviving. Those with numbers greater than 12 indicate that two or three experiments were run.

hydrate differences in experimental animals. Only a small amount of work has been done on the effect of different carbohydrates in rations for the chick. Luckey *et al.*(3) found that the folic acid requirement of the chick varies with the type of carbohydrate. Couch *et al.*(4) showed that the biotin content of eggs from hens receiving sucrose as the carbohydrate is much lower than that of eggs from hens on dextrin rations. Sarma *et al.*(5) presented differences in vitamin B_6 synthesis with different carbohydrates.

It is the purpose of this paper to compare the nutritional value of sucrose, dextrin, lactose, and cerelose and to study the effect of folic acid, vit. B_{12}, and other growth factors on these carbohydrates as they affect chick growth.

Experimental. Straight run (New Hampshire ♂♂ X Single Comb White Leghorn ♀♀) cross bred chicks, which were the progeny of hens fed diet B-1 described previously(6) were used in all studies. The chicks were housed in electrically heated batteries with raised screen floors. Feed and water were supplied *ad libitum*. The chicks were wing-banded and weighed at 1 day of age. Weights were recorded at weekly intervals. Each group contained 12 birds. All chicks were divided into groups according to weight and immediately placed on test for four weeks. They all received a semi-purified ration containing carbohydrate 61 g, alcohol extracted casein 18 g, gelatin 10 g, salts V(7) 6 g, soybean oil 5 g, L-cystine 0.3 g, thiamine hydrochloride 0.3 mg, riboflavin 0.6 mg, nicotinic acid 5.0 mg, pyridoxine hydrochloride 0.4 mg, calcium pantothenate 2.0 mg, choline chloride 150 mg, biotin 0.03 mg, inositol 100 mg, 2-methyl-1,4-naphthoquinone 0.05 mg, α-tocopherol 0.3 mg, and folic acid 0.2 mg (except where indicated). Fortified haliver oil (60,000 U.S.P. units of vit. A, 6,000 U.S.P. units of vit. D_3 per g) was given by dropper (2 drops per bird per week). All supplements were added at the expense of the carbohydrate. Table I was compiled by cal-

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6. Robblee, A. R., Nichol, C. A., Cravens, W. W., Elvehjem, C. A., and Halpin, J. G., *Poultry Sci.*, 1948, v27, 443.

7. Briggs, G. M., Jr., Luckey, T. D., Elvehjem, C. A., and Hart, E. B., *J. Biol. Chem*, 1943, v148, 163.

culating the per cent gain or retardation of each group relative to that group's basal control. The basal groups are shown as 100%, and the weight in grams is the average of the three experiments run.

Results and discussion. Table I shows that the chicks receiving the basal ration containing dextrin grew 73 g more than those receiving sucrose. The chicks receiving cerelose grew 53 g more than the sucrose-fed birds, and the birds receiving lactose grew 57 g less than the sucrose-fed birds. The feathering and general appearance of the birds receiving dextrin, cerelose, or sucrose were excellent. By the end of the first week, the chicks on the lactose diets developed severe diarrhea which lasted throughout the test period. Their general appearance was very poor, which may have been due partly to the fact that it was impossible to keep their cages clean and dry. These birds showed no decrease in food consumption, and they consumed about twice the amount of water consumed by the other birds, indicating the extent of the diarrhea.

When folic acid was omitted from the basal rations, there was a very significant decrease in growth in all cases. Although the birds receiving lactose showed the smallest percentage decrease, the birds receiving dextrin showed the best growth. This confirms work done by Luckey *et al.*(3) who showed that the chick has a smaller requirement for folic acid on rations containing dextrin than on rations containing sucrose.

When chicks receiving the basal rations were injected with a low level of vit. B_{12}, slight responses were obtained with all carbohydrates tested. However, when a higher level of vit. B_{12} was injected or fed orally, the response obtained with lactose was greater than the responses obtained with the other carbohydrates. Reticulogen and fish solubles also gave a better response with chicks on a lactose diet than with chicks on diets containing sucrose or dextrin. This may indicate that chicks on a lactose diet have a higher requirement for unknown growth factors which have been reported to be present in these preparations.

We have shown previously(8) that sulfasuxidine affects the growth of chicks as well as the liver storage and caecal content of folic acid. When sulfasuxidine was fed to chicks on different carbohydrates, the growth of the birds receiving sucrose and lactose was retarded in contrast to no effect in the case of the dextrin-fed birds. This indicates that the intestinal flora established on a ration containing dextrin as the carbohydrate constituent is affected in a different way or to a different extent by sulfasuxidine than the flora of chicks fed sucrose or lactose.

Since growth responses had been reported by Lepp *et al.*(9) with cellulose when 18% casein was fed, 10% cellulose was tried but gave a growth depression in all cases. A combination of sulfasuxidine and cellulose did not produce any response. Groups of chickens were fed twice the level of folic acid and other B vitamins. This was done to determine whether the difference in folic acid requirements on dextrin and sucrose diets, or intestinal synthesis of other known factors, was the cause of better growth with dextrin. No further growth responses were observed. In no case was it possible to obtain as good growth with chicks fed the sucrose ration as with chicks fed the dextrin ration.

It was interesting to find when diets with a carbohydrate consisting of 50% dextrin and either 50% sucrose or lactose were fed; the chicks exhibited significantly better growth. The response was especially striking in the lactose group in which a weight gain of 115 g and complete disappearance of the diarrhea were observed.

Johansson *et al.*(10) showed that the flora of hens on a dextrin diet contain 10 times the number of coliforms as the flora of hens on a sucrose plus biotin diet. It may be that 50% dextrin is enough to change the intestinal flora to the apparently more favorable condition and in the case of the lactose

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9. Lepp, A., Harper, A. E., and Elvehjem, C. A., *Poultry Sci.*, 1949, v28, 372.

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TABLE II. Excretion Time of Chicks as Affected by Different Carbohydrates.*

Carbohydrate	2 wk minutes	4 wk Group 1 minutes	4 wk Group 2 minutes
Lactose	77 ± 7	86 ± 14	78 ± 6
Sucrose	115 ± 22	133 ± 6	149 ± 17
Dextrin	140 ± 8	177 ± 5	181 ± 11

* Includes stand. error. $\sqrt{\frac{d^2}{n(n-1)}}$.

group to also eliminate entirely the dehydration caused by lactose.

It was thought that a clearer understanding of the intestinal effects would be had by determining the time it takes for food to pass through the digestive tract of the chicken. At 2 and 4 weeks, 5 chicks per group were put in individual cages and given feed and water *ad libitum*. Each bird was given a number zero capsule filled with carmine 40, which is not absorbed by the intestine. The length of time taken for red to first appear in the feces was taken as the excretion time. The results are shown in Table II. The excretion time of the dextrin birds was 20% longer than the sucrose birds. These data lend support to the theory that carbohydrate differences may be explained on the basis of intestinal synthesis or efficiency of carbohydrate breakdown in the gut. It would seem that dextrin allows more time for synthesis to take place, since chicks fed this ration retain the food longer. This extra time may allow additional synthesis of some unknown chick growth factor or factors.

Summary. When the rate of growth of chicks is used to measure the nutritional efficiency of carbohydrates they fall in the following order: dextrin, cerelose, sucrose, and lactose. Cellulose, sulfasuxidine, reticulogen, fish solubles, or vit. B_{12} do not change the significant differences observed when these carbohydrates are fed. However, the lactose-fed birds do give the greatest response to reticulogen, fish solubles and the higher levels of vit. B_{12}. The excretion times of chickens fed these different carbohydrates are in the following decreasing order: dextrin, sucrose, and lactose. The possibility of these nutritional differences being explained by the synthesis of known and/or unknown factors is discussed.

We are indebted to Merck and Co., Inc., Rahway, N. J., for crystalline vit. B_{12}, and crystalline vitamins; to the Lederle Laboratories Division, American Cyanamid Co., Pearl River, N. Y., for synthetic folic acid; to Abbott Laboratories, North Chicago, Ill., for haliver oil; to Wilson and Co., Inc., Chicago, Ill., for gelatin; and to E. I. duPont de Nemours and Co., Inc., New Brunswick, N. J., for crystalline vit. D_3.

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Experimental Production of the L. E. Phenomenon in the Skin of Man.* (18165)

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The L.E. cell, first described by Hargraves, Richmond and Morton(1), was originally observed in incubated marrow aspirates of patients suffering with acute disseminated lupus erythematosus. Sundberg and Lick(2) found occasional L.E. cells in the peripheral blood in acute disseminated lupus erythematosus although again leukocytic concentration in the test tube was employed. Haserick and Bortz

* Presented before the Joint Meeting of the North Central Region College of American Pathologists and the Michigan Pathological Society, Detroit, Mich., May 13, 1950.

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