TABLE I.
Average Inositol Content of Eggs at Various Stages of Embryonic Development. Numbers in parentheses indicate maximal deviation from the mean.

Incubation, days	No. of eggs	Avg inositol content, $\mu g/mg$	
		Total	Free
0	11	.22 (± .05)	
	18		.046 (± .01)
7	2	.24 (± .0)	
10	2	.21 (± .04)	
14	2	.26 (± .04)	
20	10	.24 (± .03)	
	8		.19 (± .05)

and for total inositol at 7 and 14 days of incubation. In the second, the eggs were taken after 0, 10, and 20 days of incubation. In the third, groups of 6 eggs were analyzed at 0 and 20 days of incubation.

The average content of inositol in an egg at various periods of incubation is shown in Table I. The values for free inositol at the beginning and end of the incubation period are also shown. It can be seen that the total inositol in an egg did not increase significantly during the period of embryonic development. However, the proportion which is free increased. All of the inositol in aqueous extracts of eggs before incubation was free, and hence it was concluded that the combined inositol in such eggs was present as one of the water-insoluble forms. The fact that nearly all of the inositol in a hatching chick is free is of interest when it is recalled that in many tissues only about half of the vitamin is in the free state.[6]

Summary. The total content of inositol in a hen's egg does not increase during incubation, but the proportion of the total amount which is free and extractable by water does increase.

13622

Glycine Requirement of the Chick.

H. J. ALMQUIST AND E. MECCHI.

From the Division of Poultry Husbandry, College of Agriculture, University of California, Berkeley.

It has been shown that glycine is required in the diet of the young chick for an optimum rate of growth.[1, 2, 3] Experiments have been

[1] Almquist, H. J., Stokstad, E. L. R., Mecchi, E., and Manning, P. D. V., *J. Biol. Chem.*, 1940, **134**, 213.

continued in an effort to obtain an estimate of the amount of glycine needed for this purpose. The diet used in these studies, except for the sources of protein to be mentioned, has been previously described in detail.[4]

A series of diets were made up containing 25% casein which had been washed with dilute acetic acid and with water, then dried in a current of air at 30°C. ½% of arginine monohydrochloride, and varying levels of synthetic glycine were also added. S. C. White Leghorn chicks were reared for 7 to 10 days on a practical diet, then carefully selected for uniform weight and condition, divided into groups of the same average weight and given the experimental diets. Rate of growth was determined by individual daily weights. Results obtained with the casein diets are given in Table I.

The results in Table I contain several features of interest. When no added glycine was present in the diet, the growth rate of chicks was distinctly low. Glycine added at levels of 0.5 and 1.0% did not result in optimum rates of gain. This optimum was attained in both series at 1.5% of added glycine. On the other hand, 2.0% glycine seemed to be harmful in that the rate of gain was distinctly lowered. There have been indications previously that 2% or more of uncombined glycine might be detrimental to chicks.[1]

Although receiving less than 1/10 the glycine given the most rapidly growing group, the basal group attained in each case approxi-

TABLE I.
Growth-Promoting Effects of Glycine in Chick Diets.

Supplement	Level %	Exp. 1* Avg gain per chick per day g	%	Exp. 2† Avg gain per chick per day g	%
None	—	3.9	4.9	4.3	5.2
Glycine	0.5	4.4	5.2	—	—
,,	1.0	4.9	5.9	5.5	6.3
,,	1.5	5.9	6.6	5.9	6.8
,,	2.0	—	—	4.9	5.9
Glycylglycine	1.0	—	—	6.0	6.8

*At the start of the experiment each group contained 5 chicks with an average weight of 61 g. The experiment lasted 11 days. The percentage gain is calculated on the average of initial and final weights.

†At the start of the experiment each group contained 6 chicks with an average weight of 51 g. The experiment lasted 10 days.

2 Almquist, H. J., and Mecchi, E., *J. Biol. Chem.*, 1940, **135**, 355.

3 Hegsted, D. M., Hier, S. W., Elvehjem, C. A., and Hart, E. B., *J. Biol. Chem.*, 1941, **139**, 863.

4 Almquist, H. J., and Mecchi, E., PROC. SOC. EXP. BIOL. AND MED., 1941, **48**, 526.

TABLE II.
Rates of Gain of Chicks in Relation to Combined Glycine Content of Diet.

Protein or glycine source	Level %	Calc.* glycine content of diet %	Avg gain per chick per day %
Edestin	25	1	6.9
Casein	5		
Edestin	20	1	7.0
Casein	10		
Glycine	0.2		
Casein	20	2.6	6.8
Gelatin	10		
Casein	25	1.6	6.9
Gelatin	6		
Casein	25	1.1	6.8
Gelatin	4		
Arachin	25	1.3	6.9
Gelatin	5		

*Based upon summarized data for proteins as given by Calvery, H. O., *Chemistry of the Amino Acids and Proteins* (edited by C. L. A. Schmidt), Charles C. Thomas, publisher, Baltimore, Maryland, first ed., p. 217.

mately ¾ of the optimum rate of gain. This suggests that the chick has a limited ability to synthesize glycine; however, a critical test of such ability must await studies with glycine-free diets. Evidence for the synthesis of glycine by chick embryos has been reported.[5]

Glycine fed in combination may be somewhat more effectively used as compared to free glycine. For example, glycylglycine at a level of 1% (equivalent to 1.1% glycine) was as effective in growth promotion as free glycine at 1.5%. Other dietary combinations of proteins that have been tested in similar amino acid studies give further evidence that 1% of glycine in protein combination is adequate for an optimum rate of gain. (Table II.) While these results were not obtained in the same series of tests, they represent maximum rates of growth on diets and under conditions that were otherwise similar.

Summary. The glycine requirement of the young chick for optimum rate of growth is approximately 1.5% of the diet when provided as free glycine, and 1.0% when provided in combination as in gelatin, edestin, casein and glycylglycine. The young chick probably has a limited ability to synthesize glycine.

The authors are indebted to Merck and Co., Inc., for donation of the arginine monohydrochloride used in this work.

5 Patton, A. R., and Palmer, L. S., *J. Nutrition*, 1936, **11**, 129; Patton, A. R., *J. Nutrition*, 1937, **13**, 123.