Secretion of Radioactive Calcium in the Hen's Egg[1]

C. L. Comar[2] and J. Clyde Driggers

Florida Agricultural Experiment Station, Gainesville

The availability of pile-produced Ca^{45} has facilitated investigation of the economically and fundamentally important problem of the secretion of this element in the hen's egg. Approximately 1 mg of calcium as a solution of the chloride, with an activity of 15 μc, was administered into the lower esophagus of the fasted bird. For a period of 20 days after dosage, each egg laid was analyzed for total calcium and Ca^{45} uptake in the yolk, white, and shell.

The entire yolk was wet ashed with concentrated HNO_3, the solution evaporated to near dryness, the fat removed with ether, and the dried residue ashed at 750° C for 8 hrs; the ash was dissolved in dilute HCl and the calcium precipitated as the oxalate (*2*). The white was treated similarly, except that the ether extraction was omitted. The shell was wet ashed in concentrated HNO_3, the solution evaporated to near dryness and prepared directly for the oxalate precipitation step. The calcium oxalate was collected on filter paper over a uniform area for measurement of total calcium by weight and of radioactivity with a thin mica-window Geiger counter (*1*). Self-absorption and decay corrections were made in the usual manner.

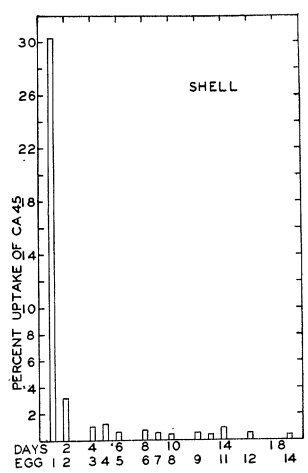

FIG. 1. Percentage of Ca^{45}, fed as a single dose, appearing in shell of successive eggs.

Single dosage studies were made with two birds and a multiple feeding trial with another; the results were in fair enough agreement, so that for clarity data from only one bird are presented. Fig. 1 shows the percentage uptake of administered Ca^{45} in the shells of the successive eggs. In an egg laid 15 min after dosage, the shell contained a detectable amount of the labeled calcium representing 0.07% of the dose. It was observed that the shell of the 24-hr egg contained 30–35% of the dosage, the values thereafter falling sharply and leveling off at about 0.5%. It is considered from the time factor and the constancy of the values that the labeled calcium found in the shells after the fourth day reached there via the body stores.

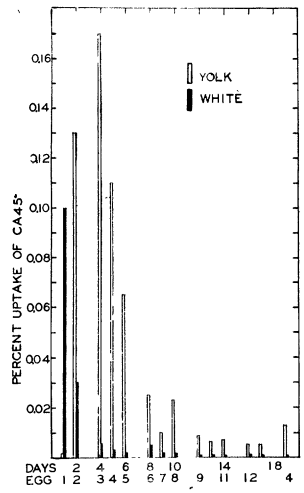

FIG. 2. Percentage of Ca^{45}, fed as a single dose, appearing in yolk and white of successive eggs.

Fig. 2 shows the percentage uptake of administered Ca^{45} in the yolk and white of successive eggs. No labeled calcium was detected in the yolk and white of an egg laid 15 min after dosage. In the 24-hr egg it was noted that the white contained about 70 times as much Ca^{45} as did the yolk, which probably reflects the prior maturity of the latter. The situation was reversed in the egg laid at 48 hrs, and thereafter the yolk always showed a somewhat greater accumulation of labeled calcium than did the white. The total percentage accumulations in the yolks, whites, and shells of the 14 eggs collected after dosage were 0.7, 0.2, and 40, respectively. This emphasizes the ability of the hen to incorporate a large percentage of the ingested soluble calcium into the shell of the egg. It was calculated from the total dietary calcium intake and output in the eggs and the reported data that a maximum of from 60 to 75% of the calcium in the egg reached there directly from the ingested calcium, the remainder probably being drawn from the body stores. Bone analysis at the termination of the experiment indicated that considerable skeletal storage had occurred; the left pubis contained about 1 μg of labeled calcium/gm of bone. About 0.005% of the dose was found in the blood at termination.

[1] Published with the permission of the director of the Florida Agricultural Experiment Station. The Ca^{45} was obtained from the Oak Ridge National Laboratory on allocation from the Atomic Energy Commission.

[2] Present address: University of Tennessee, Knoxville.

References

1. MACKENZIE, A. J., and DEAN, L. A. *Anal. Chem.*, 1948. **20**, 559.
2. *Methods of analysis.* Washington, D. C.: Association of Official Agricultural Chemists, 1945.