CHANGES IN BLOOD CALCIUM, PHOSPHORUS, MAGNESIUM, SODIUM, AND POTASSIUM LEVELS RESULTING FROM EGG PRODUCTION IN THE BROAD BREASTED BRONZE TURKEY[1]

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Blood analyses data for turkeys have been reported by Scott, Serfontein, and Seiling (1); and by Rhian, Wilson, and Moxon (2). Previous work from this laboratory (2,3) has shown variations in the blood constituents of laying and non-laying turkeys. Charles and Hogben (4) indicated that there was some evidence for a transitory rise of plasma magnesium values in Leghorn chickens, but apparently no values for magnesium in turkey blood have been published.

Experimental

Ten turkey hens approximately 8 months old were selected and 20 cc. blood samples were taken on February 25, before the laying season began. Samples were taken again on April 6, at what appeared to be the height of the production period as determined by egg records. All of the birds were fed a mash which has given excellent results as a breeding ration.

TURKEY ALL-MASH BREEDING RATION

Ground yellow corn	47.5
Ground oats	2.5
Wheat bran	7.5
Wheat middlings	7.0
Meat scraps	7.5
Soybean meal	5.0
Alfalfa meal	15.0
Dried buttermilk	5.0
Ground limestone	1.75
Salt mixture	1.0
Fish oil concentrate	0.25

Each sample was collected in two tubes (10 cc. each) using a minimum of sodium citrate in one and potassium oxalate in the other (as anti-coagulant) to facilitate sodium and potas-

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sium determinations, Analyses were begun immediately after the samples were collected, and where possible, both whole blood and plasma values were determined.

The titration method of Clarke and Collip (5)was employed in the calcium determinations; the method of Fiske and Subbarow (6) was used for phosphorus, slightly modified for use with the Evelyn photoelectric colorimeter; and magnesium was determined colorimatically after the method of Kunkle, Pierson, and Schweigert (7). Sodium and Potassium were determined with a Perkin-Elmer flame photometer.

Discussion

Significant rises in the plasma levels of calcium, phosphorus and magnesium are apparent in Figure I, accompan-

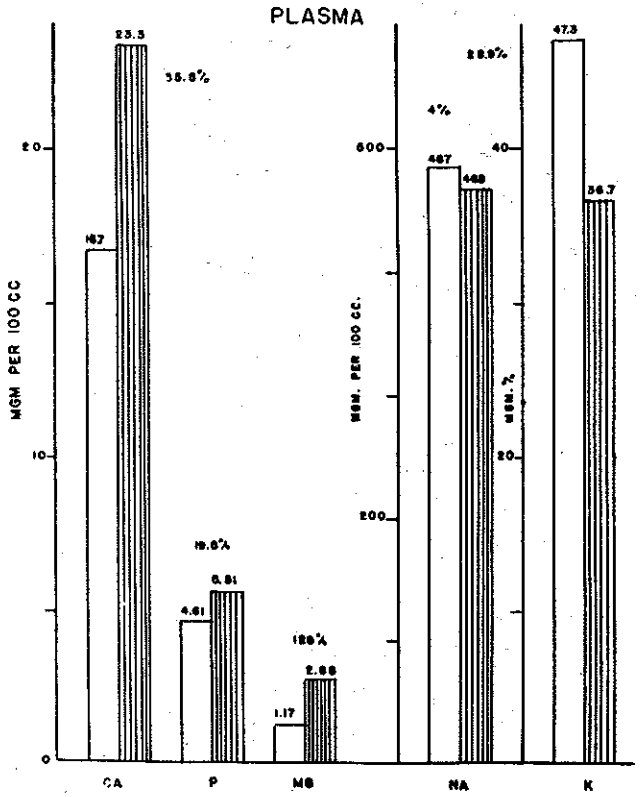

Fig. 1. Average plasma values for calcium, phosphorus, magnesium, sodium and potassium.

ied by decreased values for sodium and potassium. Whole blood values for magnesium and sodium increase while phosphorus and potassium values decrease as shown in Figure 2.

The values for calcium, sodium, and potassium reported herein, compare favorably with results from this laboratory and others (1,2,3). Table I shows the relationship between plasma calcium and egg production. For the most part, these data represent the normal values present in the pre-production and peak production periods. However, as can be seen in table I, some birds (No. 638 and 639) were slow in starting to lay, and one (631), had passed peak production and became broody 3 days after the second bleeding date. Averages reported here include these three birds.

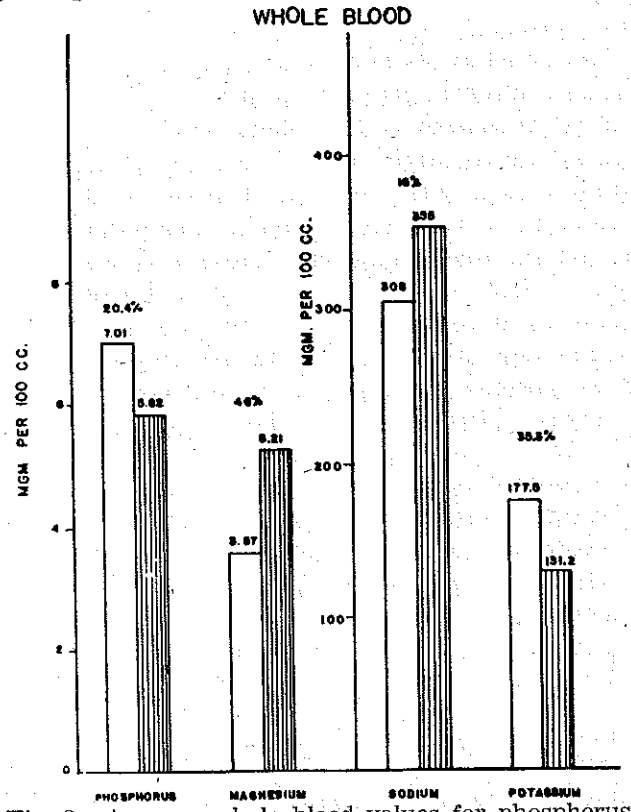

Fig. 2. Average whole blood values for phosphorus, magnesium, sodium and potassium.

TABLE I

Relationship of Plasma Calcium to Egg Production April 1-12

Bird No.	Ca level* 2-25-49 Mg. %	Date of Laying 1949	1	2	3	4	5	6	7	8	9	10	11	12	Ca level 4-6-49 Mg. %
616	24.8	3-11	0	0	0	0	0	0	0	0			0	0	24.2
622	15.6	3-17	0	0	0		0	0	0		0	0	0	0	19.8
624	13.2	3-29	0	0		0	0	0	0		0	0	0	0	22.6
628	22.3	3-21	0	0	0	0	0	0		0	0	0	0	0	33.0
630	10.0	3-26	0	0	0		0	0	0	0		0	0	0	25.5
631	17.3	3-13	0		0	0	0	0		0	Broody				19.6
637	17.3	3-8			0	0	0	0	0	0	0		0	0	19.5
638	16.4	4-1	0		0		0	0	0	0	0	0	0	0	24.2
640	15.2	3-25		0	0	0	0	0	0	0	0	0	0	0	19.8
649	14.8	3-28	0	0	0	0		0	0	0	0	0		0	24.8

*Bleeding dates.

Many observers have pointed out that the magnesium, calcium relationship of the blood exists in a narrow physiological range, and that alterations in one constituent require concomitant variations in the other (8,9).

Here we see, as might be expected, sharp rises in plasma magnesium values corresponding directly to the increased plasma calcium. The observations of Altman and Hutt (10) indicate that the rise in plasma calcium is governed through a hormonal effect of accumulated yolk estrogens on the parathyroid in anticipation of the heavier demands for calcium during egg production. This parathyroid effect may then offer a possible explanation for the rise in plasma magnesium levels. However, there is no evidence supporting a similar effect in mammals.

Decreases in sodium and potassium are the result of a balance between plasma and cells, in view of the increased plasma levels of calcium phosphorus and magnesium.

Satisfactory correlation of whole blood and plasma values cannot be made until hematocrit data are obtained. Further studies are planned to clarify these points.

Summary

1. Plasma and whole blood values for sodium, potassium, calcium, magnesium and phosphorus were determined for the broad breasted bronze turkey.
2. During egg production, calcium, and magnesium levels are elevated markedly.
3. Sodium, potassium and phosphorus values for both whole blood and plasma vary slightly. The decreases in plasma values for sodium and potasium probably result from increases in plasma calcium, megnesium, and phosphorus.

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