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# EFFECT OF COMPLETE FEED DEPRIVATION ON FIVE BLOOD SERUM CONSTITUENTS OF NEW HAMPSHIRE COCKERELS

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High environmental temperatures and disease are stress factors which may partially or completely limit feed intake in poultry. Squibb *et al.* (1955) found a significant depression of several blood serum constituents of poultry infected with Newcastle, coryza and cholera. Since such a depression of blood serum constituents could be related to reduced feed intake, in the present studies New Hampshire cockerels were subjected to complete feed deprivation and serum levels of five blood constituents were observed.

## METHOD

Thirty 5-month old New Hampshire cockerels were selected on the basis of weight and physical appearance. These were divided into two groups: group 1, controls (10 birds); and group 2, feed-deprived (20 birds). Ten extra birds were assigned to group 2 to cover expected mortality. The birds were randomly assigned to all-wire individual cages where they received water and feed *ad libitum* for a 5-day preliminary period. The feed was a commercial mash to which 3% dehydrated kikuyu grass (*Pennisetum clandestinum*) was added to increase the vitamin A activity of the ration. Proximate analyses show the mash to contain:

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moisture, 8.4; crude protein, 20.1; ash, 7.2; fat, 2.1; N.F.E., 55.9; and fiber, 6.3%.

Blood samples (3 ml.) were obtained from each of the birds at (1) the start of the trial which followed the preliminary period; (2) following a 10-day starvation period during which the birds of group 1 received feed and water *ad libitum* while the birds of group 2 received water but were deprived of feed; and (3) at the end of a 14-day recovery period during which the birds remaining in group 2 were again fed *ad libitum*. The blood was allowed to clot and then immediately centrifuged to obtain the sera. Each sample was analyzed for total proteins (Lowry and Hunter, 1945), ascorbic acid (Lowry *et al.*, 1945), riboflavin (Burch *et al.*, 1948) and total carotenoids and vitamin A (Bessey *et al.*, 1946).

## RESULTS AND DISCUSSION

Comparison of the data at the end of the 10-day starvation period for groups 1 and 2, Table 1, shows that complete feed deprivation significantly (5% level) increased serum riboflavin and depressed serum ascorbic acid and total carotenoids. Total serum proteins and vitamin A were depressed although not significantly. Five birds out of 20 died during this period. Blood serum ascorbic acid, total carotenoids and vitamin A levels of the control birds were significantly increased during the experiment, indicating that the experimental ration supplied a higher level of these nutrients than the previous diet of the birds. Blood serum proteins and riboflavin of the starved birds returned to normal following the 14-day recovery period. Significantly higher serum ascorbic acid, total carotenoids and vitamin A of both groups were a reflection of dietary intake.

The starvation period was terminated at the end of 10 days since 25% of the birds had died and clinical evidence indicated a possible complete mortality for the entire group if the trial were continued. It is recognized that a sudden complete and continued deprivation of feed is not fully representative of the effect of high environmental temperatures and disease on feed intakes, which in most cases only partially limit feed intake. Nevertheless, it is interesting to note that not one of the five blood serum constituents studied reflected the physical state of the birds. The observed increase in serum riboflavin with starvation may have been the result of mobilization from the tissues. The depression of serum carotenoids and ascorbic acid was statistically significant but did not reach physiological critical levels; the actual values were similar to those reported

TABLE 1.—*Effect of complete feed deprivation on blood serum constituent levels of New Hampshire cockerels*

| Group | Start of Trial | | Period 1[1] | | Period 2[2] | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 | 2 |
| Total proteins, g./100 ml. | 5.07 | 5.13 | 5.00 | 4.85 | 5.01 | 5.33 |
| Riboflavin, mcg./100 ml. | 1.44 | 1.11 | 1.11 | 2.19[3] | 1.75 | 1.56 |
| Ascorbic acid, mg./100 ml. | 2.08 | 2.01 | 2.07 | 1.35[3] | 2.56 | 2.40[3] |
| Carotenoids, mcg./100 ml. | 303 | 348 | 367 | 249[3] | 481[3] | 503[3] |
| Vitamin A, mcg./100 ml. | 29 | 36 | 32 | 31 | 48[3] | 54[3] |
| Number of cockerels | 10 | 20 | 10 | 15 | 10 | 15 |
| Mortality | 0 | 0 | 0 | 5 | 0 | 0 |

[1] 10-day period, group 1 fed *ad libitum*, group 2 feed-deprived.
[2] 14-day recovery period, groups 1 and 2 fed *ad libitum*.
[3] Indicates that change from initial level is significant at the 5% level.

previously for well-fed chickens (Squibb *et al.*, 1953).

## REFERENCES

Bessey, O. A., O. H. Lowry, M. J. Brock and J. A. López, 1946. Determination of vitamin A and carotene in small quantities of blood serum. J. Biol. Chem. 166: 177–188.

Burch, H. B., O. A. Bessey and O. H. Lowry, 1948. Fluorometric measurements of riboflavin and its natural derivatives in small quantities of blood serum and cells. J. Biol. Chem. 175: 457–470.

Lowry, O. H., and T. H. Hunter, 1945. Determination of serum protein concentration with a gradient tube. J. Biol. Chem. 159: 465–474.

Lowry, O. H., J. A. López and O. A. Bessey, 1945 Determination of ascorbic acid in small amounts of blood serum. J. Biol. Chem. 160: 609–615.

Squibb, R. L., M. Guzmán, F. Aguirre and N. S. Scrimshaw, 1953. The constituents of the blood stream of well-fed white rats, chickens, swine, sheep and horses in Guatemala. Am. J. Vet. Res. 14: 484–486.

Squibb, R. L., J. E. Braham, M. Guzmán and N. S. Scrimshaw, 1955. Blood serum, total proteins, riboflavin, ascorbic acid, carotenoids and vitamin A of New Hampshire chickens infected with coryza, cholera or Newcastle disease. Poultry Sci. 34: 1054–1058.