

Effect of Pasture, Dehydrated Ramie Meal, and Sex on Five Blood Serum Constituents of New Hampshire Chickens in Guatemala¹

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FORAGES have long been used to supplement poultry rations. Pasture and dried forage meals supply protein, carbohydrates, and minerals and are rich in vitamin A activity and riboflavin.

In Mississippi, where the climatic conditions during certain parts of the year are similar to those of tropical America, Sipe and Polk (1941) found that putting hens on pasture reduced their feed requirements for egg production 5 to 10 percent. Although the grazing crops studied did not influence hatchability or size of eggs, they did reduce mortality and deepen the color of the egg yolk.

The difficulties of compounding adequate poultry rations in tropical America have been described previously by Squibb *et al.* (1950). Owing to the lack of local

animal protein and vitamin supplements, many poultrymen in Guatemala and other countries of the American Tropics are importing ever-increasing quantities of poultry concentrates containing 35 to 45 percent protein. These concentrates are then mixed with local carbohydrate sources and mineral mixtures to make laying and broiler mashes containing 18 to 21 percent protein.

In three experiments reported here the effect of supplementing an imported concentrate with ground sorghum, pasture, and a dehydrated ramie meal on the serum levels of several blood constituents of New Hampshire hens was determined. In the course of the studies, observations were made on the effect of sex on the levels of these constituents.

PROCEDURE AND RESULTS

Experiment 1.—Forty 6-month-old New Hampshire pullets were selected from a flock of 200 birds which were on green pasture. These were divided into 2 groups of 20 each. One group was housed in a standard-type chicken house and had access to green pasture of kikuyu grass (*Pennisetum clandestinum*); the other group was housed in individual wire cages with raised screen bottoms. Both groups received fresh water and the same laying mash *ad libitum*. The laying mash consisted of an imported concentrate,³ 40 percent, and ground sorghum, 60 percent; it contained moisture, 8.40; protein, 20.1; ash, 7.15; fat, 2.22; and fiber, 6.25.

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³ Name of the mash will be supplied upon request.

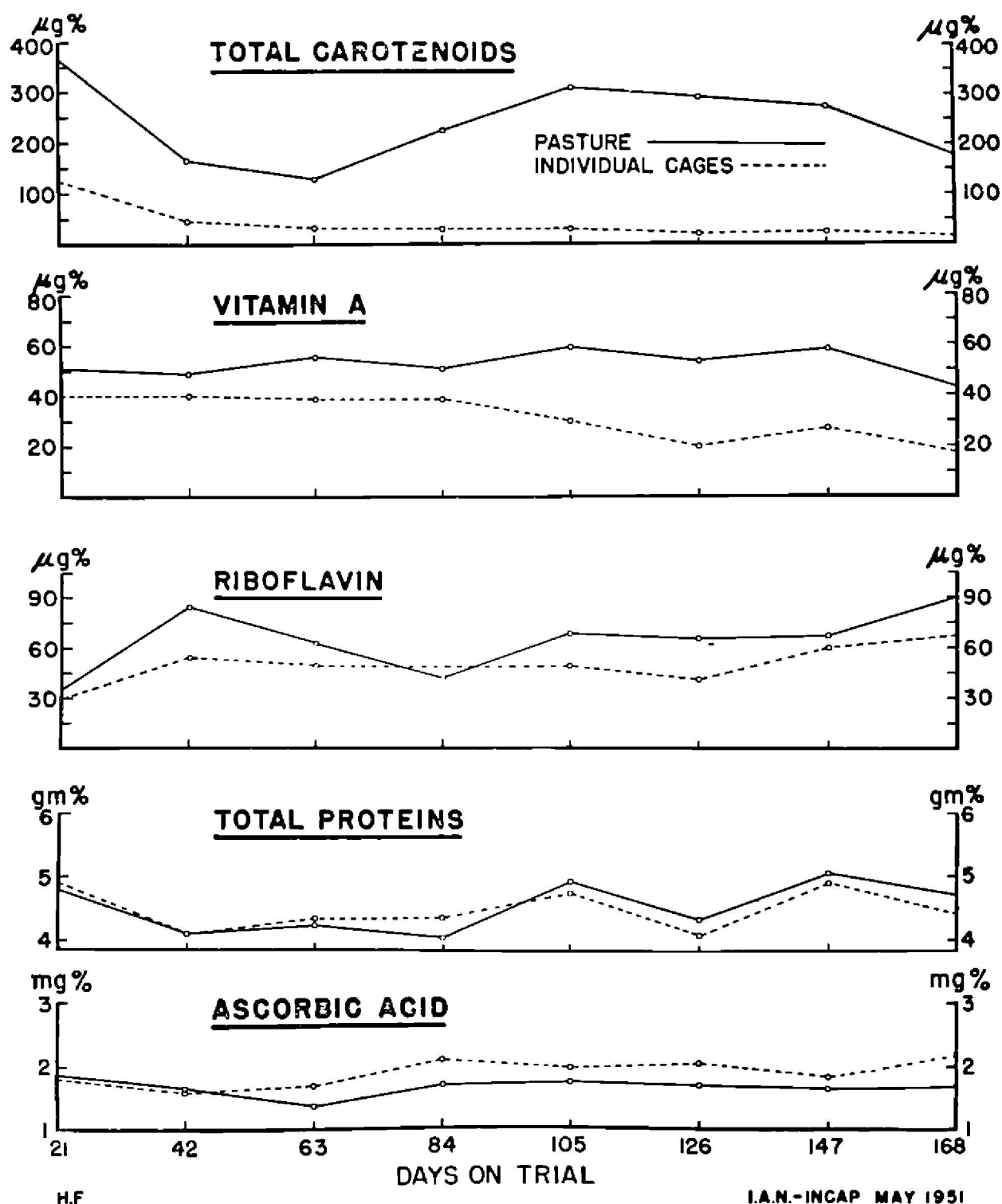


FIG. 1. Effect of pasture on blood serum levels in hens.

At the end of 21 days on this diet the hens of both groups were bled from the large wing vein. Serum from these samples was analyzed for total carotenoids and vitamin A by the method of Bessey *et al.* (1946); for riboflavin, by the method of Burch *et al.* (1948); for total proteins, by the method of Lowry and Hunter (1945); and for ascorbic acid, by the method of Lowry *et al.* (1945). The method for ascorbic acid was modified by using a solution of copper sulfate and thiourea instead of norite.

The trial was originally designed for only one blood sampling. But, since data from the first trial indicated possible differences for several of the blood constituents, the experiment was extended and each hen was bled at 21-day intervals for a total period of 168 days.

Considerable differences were evident between the two groups for several constituents of the blood serum (Figure 1). Twenty-one days after being removed from pasture, hens in cages showed significantly lower serum levels of carotenoids

TABLE 1.—*Effect of dehydrated ramie meal on blood serum levels of carotenoids, vitamin A, total proteins, and ascorbic acid in New Hampshire hens*

Ration	Carotenoids		Vitamin A		Total proteins		Ascorbic acid	
	Start	End	Start	End	Start	End	Start	End
	$\gamma/\%$		$\gamma/\%$		gms./%		mg./%	
Check ration	11	19	18	20	4.3	4.6	2.1	2.2
Ration with								
2% ramie	14	64	19	27	4.3	4.6	2.7	2.2
4% ramie	20	209	15	39	4.4	4.6	1.8	1.9
8% ramie	20	301	16	35	4.6	4.7	1.9	1.9

and vitamin A. For the experiment as a whole, hens on pasture had significantly higher serum levels of carotenoids, vitamin A, and riboflavin. In total proteins the two groups showed no significant differences; in ascorbic acid the hens in cages showed slightly higher serum levels, though not significantly higher.

Experiment 2.—At the end of experiment 1, the hens in cages were divided at random into 4 groups of 5 hens each. Group 1 was continued on the same laying mash that had been used in experiment 1. The same mash was fed also to Groups 2, 3, and 4 except that a dehydrated ramie (*Boehmeria nivea*) forage meal was added to replace part of the ground sorghum: 2 percent for Group 2, 4 percent for Group 3, and 8 percent for Group 4. The ramie meal had been made

from the whole plant cut at a height of 16 to 20 inches.

After the hens had been on these diets for 10 days, they were bled from the wing vein. The blood serum was analyzed for total carotenoids, vitamin A, total proteins, and ascorbic acid (Table 1).

Addition of the ramie meal significantly increased the serum levels of carotenoids and vitamin A. Adding 2 percent ramie meal increased the total carotenoids 3 times; adding 4 percent, 10 times; and adding 8 percent, 15 times. In the groups fed 4 and 8 percent, vitamin A levels almost doubled as a result of the increased intake of carotenoids.

On neither total proteins nor ascorbic acid, however, did the ramie meal have any apparent effect.

Experiment 3.—When the blood data

TABLE 2.—*Effect of sex on several blood serum constituents of New Hampshire chickens*

Age and sex	Number	Total carotenoids	Vitamin A	Riboflavin	Total protein	Ascorbic acid
		$\gamma/\%$	$\gamma/\%$	$\gamma/\%$	gm./%	mg./%
6 weeks:						
Male	10	539	42.0	0.46	3.86	1.84
Female	10	362	31.8	0.58	3.54	1.96
12 weeks:						
Male	10	345	31.1	0.84	4.74	1.96
Female	10	504	56.1	1.38	4.87	1.98
48 weeks:						
Male	10	130	52.5	1.12	4.63	1.71
Female	10	88	48.7	43.77	4.39	1.42
72 weeks:						
Male	15	107	44.7	0.70	4.71	1.74
Female	15	179	47.7	25.80	5.22	1.85

for hens in experiments 1 and 2 were compared with data for roosters in routine blood tests, there were indications that serum levels of some of the constituents might be due to sex differences. Therefore the blood of New Hampshire males and females of 4 different ages—6, 12, 48, and 72 weeks—was sampled and analyzed for the serum constituents studied in experiments 1 and 2. In each group males and females had been housed and fed together ever since they were 1 day old.

When all age groups were considered, no significant differences appeared between males and females in levels of carotenoids, vitamin A, total proteins, and ascorbic acid. In riboflavin, however, the variation between males and females was highly significant (Table 2). Twelve-week-old pullets had significantly higher levels than cockerels of the same age. These differences were even greater among the mature male and female birds. Laying hens, aged 48 and 72 weeks, had significantly higher riboflavin levels than pullets aged 6 and 12 weeks. Cocks, however, showed no significant riboflavin differences between age groups: riboflavin levels were about the same in cocks 72 weeks old as in those 6 weeks old.

DISCUSSION

Experiment 1 showed that kikuyu grass pasture maintained high blood serum levels of carotenoids, vitamin A, and riboflavin—the nutrients most deficient in local animal diets.

Obviously kikuyu grass is an excellent pasture for poultry. Dehydrated meals made from this grass are palatable and are high in food nutrients (Squibb *et al.*, 1953). Under Guatemalan conditions kikuyu grass has been found to be more resistant to drought than the local Bermuda grass. Besides, it is aggressive and

may easily be kept at a height of 2 inches with a lawn mower.

Pasture becomes even more valuable in areas where poultrymen must depend on imported feed concentrates; for, under adverse conditions of transfer and storage, these concentrates may lose some of their value.

The value of ramie meal in chick diets has been demonstrated by Mehrhof *et al.* (1950), who included in chick rations the tops and leaves of the ramie plant, by-products of the Florida fiber industry. Squibb *et al.* (1952) have proposed that ramie be considered a forage plant in its own right. When the ramie plant is cut at less than 20 inches in height, it has been shown to contain less fiber than alfalfa and more protein. Ramie meal therefore may replace alfalfa meal as a source of vitamin A activity in poultry rations, a fact that is confirmed both by experiment 2, reported here, and by still another study reported by Squibb *et al.* (1953).

Sex apparently is not responsible for differences in blood serum levels of total carotenoids, vitamin A, total proteins, and ascorbic acid in New Hampshire chickens similarly fed and housed. For serum riboflavin, however, a variation between males and females was apparent when the birds were 6 weeks old and was large enough to be significant when the birds were 3 months old. These sex differences for riboflavin are in accord with those observed by Common *et al.* (1947), who found laying hens to have higher serum riboflavin levels than either nonlayers or cocks and determined that, whatever the source of the rise in serum riboflavin in hens, it was not explained by a decrease in concentration of riboflavin in the liver. Data obtained in experiment 3 indicate that the female begins the mobilization of riboflavin some time before she is ready

to begin laying. The riboflavin levels were significantly higher in laying hens than in pullets. This phenomenon may be an adaptive mechanism to provide sufficient riboflavin in the egg for good fertility, hatchability, and chick survival.

SUMMARY

In experiments performed in Guatemala on New Hampshire pullets and hens, kikuyu grass pasture was found to maintain high blood serum levels of total carotenoids, vitamin A, and riboflavin. It had no effects on the levels of total proteins and ascorbic acid.

Ramie, when added as a dehydrated meal to a laying mash, significantly increased the carotenoid and vitamin A levels in the blood serum of the birds; but it had no apparent effect on levels of total protein and ascorbic acid.

In an experiment to observe effect of sex on the levels of various blood-serum constituents, New Hampshire pullets and and hens were found to have significantly higher riboflavin levels than males of the same age, which had been similarly housed and fed. Riboflavin levels were higher in laying birds than in pullets. These phenomena may be the expression of an adaptive mechanism to provide sufficient riboflavin in the egg for good fertility, hatchability, and chick survival.

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