

**BLOOD MEAL AS A LYSINE SUPPLEMENT TO
ALL-VEGETABLE PROTEIN RATIONS
FOR CHICKS**

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Blood Meal as a Lysine Supplement to All-Vegetable Protein Rations for Chicks

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BLOOD meal has been reported to be inferior to other packing house by-products as a supplement in poultry rations (Titus *et al.*, 1936). Subsequently Grau and Almquist (1944) have demonstrated that the inferior quality of blood meal is due to the red cell components which constitute approximately 70 percent the weight of the meal. The remaining serum proteins were found by them to be of good quality.

Although blood meal may be inferior to other packing house by-products as a general protein supplement, it is an excellent source of lysine (Almquist, 1945), one of the principal limiting amino acids in poultry rations compounded of Guatemalan feedstuffs (Squibb and Wyld, 1950). The value of lysine in local all-vegetable protein rations was confirmed in this study and the effect of blood meal as a lysine supplement was also observed.

METHODS AND RESULTS

Three day old straight-run New Hampshire chicks were used in the experiments reported here. The chicks were distributed

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by weight among the experimental groups and were housed in special all-wire cages with raised screen bottoms. Each cage held 12 birds. Feed and water were provided *ad libitum*. The low lysine and the supplemented rations used in experiments 1 and 2 are presented in Table 1 and those for experiments 3 to 6 in Table 2. The birds of all experiments except 2 were fed for 5 week periods. In experiment 2 the feeding period was 10 days.

Dehydrated desmodium meal and L-lysine,³ were first included singly and in combination (experiment 1) in all-vegetable protein rations containing sesame oil meal or a combination of sesame, cottonseed and corozo-oil meals as the principal sources of protein. The data of Table 1 show that the desmodium meal, L-lysine, or cottonseed and corozo oil meals added to the basal diet significantly increased the rate of growth of the chicks. Lysine was observed to have a significant effect over and above that of the desmodium meal or the combination of cottonseed and corozo oil meals. It was also observed in this trial that approximately 85 percent of the chicks of the control group had notched beaks while birds fed desmodium meal, L-lysine or a combination of corozo, cottonseed and sesame oil meals showed no evidence of the disease.

In experiment 2, 3 percent blood meal⁴ and 4 percent dehydrated ramie meal were compared with L-lysine during a 10 day feeding period. Since this trial was of

³ L-lysine monohydrochloride.

⁴ Prepared from bovine blood, contains: moisture 13%, crude protein 77%.

TABLE 1.—*Effect of desmodium, ramie and blood meals and L-lysine in all-vegetable protein rations for baby chicks*

| Ingredients | Experiment 1 | | | | | | Experiment 2 | | | |
|--|--------------|------|------|------|------|------|--------------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 |
| Corozo oil meal | — | — | — | 28.0 | 28.0 | — | — | — | — | — |
| Sesame oil meal | 40.0 | 40.0 | 40.0 | 14.0 | 14.0 | 40.0 | 35.0 | 35.0 | 35.0 | 35.0 |
| Cottonseed oil meal | — | — | — | 14.0 | 14.0 | — | — | — | — | — |
| Corn (ground) | 56.0 | 39.0 | 55.5 | 40.0 | 23.0 | 38.5 | 61.8 | 58.8 | 57.8 | 61.3 |
| L-lysine ¹ | — | — | 0.45 | — | — | 0.45 | — | — | — | 0.45 |
| Blood meal ² | — | — | — | — | — | — | — | 3.0 | — | — |
| Desmodium meal ³ | — | 17.0 | — | — | 17.0 | 17.0 | — | — | — | — |
| Minerals ⁴ | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Vit. B ₁₂ -antibiotic supplement ⁵ | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.1 | 0.1 | 0.1 | 0.1 |
| Cod liver oil ⁶ | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | — | — | — | — |
| Ramie meal ⁷ | — | — | — | — | — | — | — | — | 4.0 | — |
| B complex vitamins ⁸ | x | x | x | x | x | x | — | — | — | — |
| Vitamin supplement ⁹ | — | — | — | — | — | — | 0.1 | 0.1 | 0.1 | 0.1 |
| Crude protein percent | 20.5 | 21.3 | 20.4 | 20.0 | 20.9 | 21.3 | 18.9 | 21.1 | 18.6 | 18.9 |
| Number of chicks | 48 | 48 | 48 | 48 | 48 | 48 | 12 | 12 | 12 | 12 |
| Average weight in grams | 116 | 260 | 354 | 307 | 232 | 354 | 72 | 93 | 72 | 101 |
| Feed conversion ¹⁰ | 3.54 | 2.47 | 1.98 | 2.87 | 2.63 | 2.25 | — | — | — | — |

Least significant difference (5%) for experiment 1 was 28.2 grams and for experiment 2, 6.1 grams.

¹ L-lysine monohydrochloride.

² Prepared from bovine blood, contains: moisture 13%, crude protein 77%.

³ (*Desmodium intortum*) dehydrated meal.

⁴ Calcium carbonate 1%, bone meal 1%, salt 1% and trace elements.

⁵ Aurofac, courtesy of Dr. T. H. Jukes and the Lederle Laboratories.

⁶ 1,800 I.U.'s vitamin A and 200 vitamin D per gram.

⁷ (*Boehmeria nivea*) dehydrated, cut at 20 inches in height.

⁸ Contains (mg. per 100 grams feed): 0.20, thiamine; 0.35, riboflavin; 1.20, calcium pantothenate; 1.50, nicotinic acid; 0.35, pyridoxine; and 125.00, choline.

⁹ Vita Rich (Starter grower), claimed by manufacturer (Thompson Hayward Chem. Co.) to contain (grams per pound): 0.3, riboflavin; 0.25, pantothenic acid; 10, choline; 0.02, thiamine; 0.30, niacin; and 0.005, vitamin B₁₂; also 90,800, A.O.A.C. chick units vitamin D and 90,800 U.S.P. units vitamin A.

¹⁰ Feed conversion: Grams feed to produce 1 gram gain in weight.

short duration, the chicks were weighed individually every 2 days. As may be seen in Table 1, the 4 percent ramie meal had no beneficial effect while both 3 percent blood meal and 0.45 percent lysine significantly increased the growth rate of the baby chicks. There was no significant difference in the final weight of the chicks fed the lysine or the blood meal during this short term feeding period.

In experiment 3, blood meal was included at 0, 2, 4 and 8 percent of a basal ration containing sesame oil meal as the principal source of protein. The blood meal replaced a part of the protein of the sesame oil meal and the ground corn. The data of Table 2 show that 2 percent blood meal increased the growth rate of the

chicks approximately 160 percent over the control groups, while the 4 and the 8 percent levels increased growth an additional 10 percent. The feed conversions were the highest in the groups fed either 2 or 4 percent blood meal and lowest in the control group.

In experiment 4, corozo oil meal was included as the principal source of protein in 4 different rations containing 0, 2, 4 and 8 percent blood meal, Table 2. The data of this table show that 4 percent blood meal in combination with corozo oil meal produced excellent growth. There was no additional effect on growth when 8 percent blood meal was fed even though the total protein of the diet was increased from 16.9 to 19.8 percent.

TABLE 2.—*Effect of blood meal in baby chick rations containing sesame, corozo and cottonseed oil meals*

| Ingredients | Experiment 3 | | | | Experiment 4 | | | | Experiment 5 | | | | Experiment 6 | | | |
|--|--------------|------|------|------|--------------|------|------|------|--------------|------|------|------|--------------|------|------|------|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Corn (ground) | 52 | 54 | 56 | 60 | 41.3 | 39.3 | 37.3 | 33.3 | 32 | 30 | 28 | 24 | 54 | 49 | 44 | 39 |
| Corozo oil meal | — | — | — | — | 50.0 | 50.0 | 50.0 | 50.0 | 30 | 30 | 30 | 30 | — | — | — | — |
| Cottonseed oil meal | — | — | — | — | — | — | — | — | 15 | 15 | 15 | 15 | — | — | — | — |
| Sesame oil meal | 40 | 36 | 32 | 24 | — | — | — | — | 15 | 15 | 15 | 15 | 35 | 40 | 45 | 50 |
| Blood meal ¹ | 0 | 2 | 4 | 8 | 0.0 | 2.0 | 4.0 | 8.0 | 0 | 2 | 4 | 8 | 3 | 3 | 3 | 3 |
| Minerals ¹ | 3 | 3 | 3 | 3 | 3.0 | 3.0 | 3.0 | 3.0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Ramie meal ¹ | 4 | 4 | 4 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Vitamin supplement ¹ | 1 | 1 | 1 | 1 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Vit. B ₁₂ -antibiotic supplement ¹ | — | — | — | — | 0.7 | 0.7 | 0.7 | 0.7 | — | — | — | — | — | — | — | — |
| Crude protein % | 20.9 | 21.0 | 21.2 | 21.5 | 14.0 | 15.5 | 16.9 | 19.8 | 21.3 | 22.7 | 24.2 | 27.0 | 21.5 | 23.0 | 24.6 | 26.2 |
| Number of chicks: | | | | | | | | | | | | | | | | |
| at start | 47 | 47 | 47 | 47 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 47 | 47 | 47 | 47 |
| at end | 47 | 47 | 47 | 47 | 43 | 45 | 46 | 43 | 46 | 46 | 46 | 46 | 47 | 47 | 47 | 47 |
| Average final weight in grams | 189 | 305 | 323 | 313 | 263 | 290 | 308 | 308 | 294 | 327 | 325 | 297 | 330 | 336 | 320 | 310 |
| Feed conversion ¹ | 2.85 | 2.26 | 2.25 | 2.42 | 3.22 | 2.90 | 2.99 | 3.05 | 2.58 | 2.50 | 2.50 | 2.71 | 2.46 | 2.45 | 2.50 | 2.66 |

¹ See notes of Table 1.
 Least significant difference (5%) for experiment 3, 21.1 grams; experiment 4, 25.9 grams; experiment 5, 26.6 grams and experiment 6, 23.8 grams. The linear and quadratic components for experiment 3 were highly significant. The quadratic component was highly significant for experiments 4 and 5.

In experiment 5, the supplemental effect of adding 0, 2, 4 and 8 percent blood meal to rations containing corozo, cottonseed and sesame oil meals was observed. It is evident from the data of Table 2 that the growth rate and the feed conversions of the chicks increased with the addition of 2 or 4 percent blood meal. However, there was no apparent supplemental effect when 8 percent blood meal was added even though the total protein content of this ration was 3 to 5 percent greater than those containing either the 2 or 4 percent levels of the blood meal.

Experiment 6 was designed to determine the most efficient percentage of sesame oil meal to use in rations containing dried blood meal. In this experiment, 35, 40, 45 and 50 percent sesame oil meal was fed in combination with 3 percent blood meal. The data of Table 2 show that 35 to 40 percent sesame oil meal was most effective. The feed conversions were also superior in this range. When 45 to 50 percent sesame oil meal was fed there was an apparent depression of growth and a decreased feed conversion in spite of the higher protein content of these rations.

DISCUSSION

The data of the experiments reported here demonstrate that even though blood meal contains protein of poor quality, it is a good lysine supplement in simplified all-vegetable protein rations for baby chicks.

Blood meal was found to be most effective and economical when fed at 2 to 4 percent. When 8 percent was included in the ration, not only the cost was increased but also no growth or a depression of growth was observed. A similar phenome-

non has been observed by Bird and Groschke (1942) who showed that chicks grew better when soybean oil meal was fed alone and not in combination with blood meal. These authors used 6 percent blood meal in their experimental rations.

The data of experiment 4 confirm an earlier report (Squibb and Wyld, 1952) of the excellent quality of corozo oil meal protein.

The reason for growth depression or the lack of response of baby chicks fed excessive quantities of blood meal was not determined in these studies. These phenomena may be due to an amino acid imbalance or the operation of some other unknown factor(s).

SUMMARY

Blood meal was found to be a satisfactory source of lysine in all-vegetable protein rations for baby chicks. The meal was most effective when fed at 2 to 4 percent of the rations. A level of 8 percent resulted in either no supplementary effect or in a depression of growth.

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