

HAIR-LOSS AS EFFECTED BY DIET WITH PARTICULAR REFERENCE TO THE EFFECT OF GOSSYPOL*

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During comparative studies of the growth rates of rats on various diets containing raw cotton seeds, loss of hair by the animals was observed to be of frequent occurrence. Loss of hair as a result of special diet has been reported by several early investigators including McCollum (1), Boas (2), and Hartwell (3), the latter concluding that the loss of fur in growing rats is closely correlated with the quality and quantity of the dietary protein. More recent investigations have shown that hair loss may result from diets which are deficient or unbalanced with respect to minerals and vitamins.

The depilation observed in the present study occurred in rats on nutritionally adequate basal diets in which 10 and 15 per cent of cotton seeds were incorporated. Omission of the cotton seeds from the diet prevented the loss of fur and resulted in an increased rate of growth. This fact suggested the presence of some factor in the seeds which either directly or indirectly was responsible for the loss of hair. Gossypol, the toxic principle present in the seeds, at once suggested itself in this role.

EXPERIMENTAL

Young Albino rats weighing between 50 and 60 gm. were fed for periods of 2 or 3 months on diets which contained 10 per cent raw cotton seeds. The composition of Diet 40 which was used extensively in these studies was as follows: Cotton seeds 10, Starch 49, Casein 24, Crisco 5, Mineral Mixture 3.5, Yeast 5 and Cod-liver Oil 3.5.

A total of 119 rats were given Diet 40 for a period of 60 days. Of these, ten were unable to make satisfactory growth during the first 30 days and were therefore excluded from the experiment. The remaining 109 rats made irregular gains in weight which averaged about 1.5 gm. per day during 60 days. Thirty-eight rats, or approximately 34 per cent of those completing the experiment, lost hair during this period. Loss of hair was not related to gain in weight.

There were no signs of hair loss among the control animals which received Diet 40 without cotton seeds and of the 92 rats started, all finished the 60 day period with an average gain of 123 gm. for females and 186 gm. for males.

The average length of time required for the onset of depilation occurring in the rats which received cotton seeds was between 5 and 6 weeks, when the animals were about 10 weeks old. In some instances the animals began to lose hair within 2 weeks, and occasionally rats have lost hair only after 10 weeks on the experimental diet.

Loss of hair varied in severity from a depilation of small, irregularly distributed areas to an almost complete denudation of the animal. Depilation was usually most pronounced on the ventral side, although loss also occurred on the head, neck, back and sides. No skin lesions were observed and the denuded areas were not bilaterally symmetrical. Many of the animals regained their hair, either partially or completely, within 4 to 6 weeks without any alteration in the diet.

To determine whether or not the loss of hair was due to the gossypol of the seeds, experiments were carried out with a control diet made up

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with seeds from which the gossypol had been extracted and the oil so removed replaced by refined cotton seed oil. This diet was used in paired feeding experiments carried out with rats which had lost hair on a diet containing 10 per cent cotton seeds. One animal of each pair was replaced on the control gossypol-free diet, its food intake being controlled by that of the second animal which was continued on the original cotton seed diet. In the rats on the gossypol-free diet, new hair appeared within 10 days or less and in several cases recovery was complete within 14 days; those which were continued on the unextracted cotton seed diet showed further loss and did not regain their hair until two weeks after the recovery of the former. The fact that only rats receiving cotton seeds lost hair and that hair was rapidly regained following the removal of the gossypol from the diet is evidence that this toxic constituent of the seed is responsible for the condition.

Since the long continued ingestion by rats of a diet containing gossypol results in a lowered food intake, it might be argued that this results in a deficiency of some dietary constituent essential to the growth of hair. Two factors, an insufficiency of which has been reported to result in loss of hair, are at once suggested, e.g. vitamin G and protein.

To determine the efficacy of vitamin G in accelerating the recovery of hair, 9 rats, eight of which had lost hair while on Diet 40, were given 0.5 gm. of yeast daily in the form of a pill for a period of 25 to 33 days. Five of these animals recovered their fur in about 2 weeks, one after 3 weeks, and 3 suffered further loss of hair during the period of yeast feeding, one of these not having lost hair until 2 weeks after the diet was supplemented by the additional yeast. Although in 5 cases the yeast appeared to hasten the recovery of hair somewhat, the fact that some animals continued to suffer further losses during the period of yeast feeding indicates that the depilation may not be attributed to a lack of vitamin G.

Experiments were then conducted with gossypol and control diets in which the level of protein was progressively raised from 7 to 20 per cent. The decreased protein did not result in a more severe loss of hair than was produced by the diets of higher protein content. Furthermore none of the animals on the control diets of low protein content lost hair even when their food intake was limited to that of the experimental animals.

These experiments were extended to include observations of the effect on hair loss of an increased amount of cystine in the diet. Twelve rats, 9 of which had lost hair on cotton seed diets were given 15 mg. of cystine daily for a period of from 4 to 6 weeks. In 8 rats recovery took place within from 2 to 3 weeks. One animal failed to regain its hair during the period of cystine administration and the three animals in which depilation had not previously occurred began to lose hair after 3 weeks of cystine feeding.

SUMMARY

A loss of hair has been observed in rats on diets which were adequate in all known dietary constituents but which contained 10 per cent cotton seeds. Recovery of hair without alterations in the diet usually occurred within 4 to 6 weeks. The extent of the depilation was not related to the protein (casein) content of the diet or to the food intake and character of growth of the animals. Daily supplements of yeast in addition to that supplied in the diet did not prevent depilation or shorten the time required for the recovery. Likewise, daily doses of cystine proved ineffective.

That gossypol, the toxic principle of cotton seeds, was responsible for the depilation was clearly demonstrated. It is concluded that the

physiological disturbance produced by gossypol and resulting in loss of hair may be entirely different than that produced by faulty protein or lack of vitamin G.

REFERENCES

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