THE EXPERIMENTAL FEEDING OF DRIED BREAST MILK.

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(Received for publication, June 17, 1924.)

In a previous communication (1) an experimental method for drying breast milk by a modification of the Just-Hatmaker roller process was presented. It had long been felt that could human milk be preserved in some way another step forward towards the solution of the nutritional problems of infancy would be provided (2).

It was found that the drying of the milk was entirely practicable and a powder could be obtained which was completely dehydrated and showed no appreciable change in its chemical composition. The following feeding experiments were undertaken to find out how much of the antiscorbutic value of the milk would be lost by drying and by ageing.

The experimental data which are herewith presented are based on the feeding of young, growing guinea pigs of approximately 250 gm. weight with a standard diet which uniformly produces scurvy in 15 to 20 days, and death in 18 to 25 days. It is the diet recommended by Givens and Cohen (3), Hess (4), and other investigators of these nutritional problems. It consists of a soy bean flour (autoclaved at 20 pounds for 1 hour) to which are added 3 per cent each of dried brewer's yeast, sodium chloride, and calcium lactate. 4 per cent of filter paper is added to give bulk, and the fat-soluble vitamin is supplied by milk, either raw or in the powdered form.

To the basal diet varying quantities of breast milk were added to estimate its antiscorbutic value. The milk was supplied raw or dried. One series included milk which had been freshly dried and another, dried milk which had been kept for 2 years. The results are incorporated in Charts 1 to 4. The experiments were
controlled by a comparable series of guinea pigs fed on the same basal diet but to which cow's milk was added in similar quantities as in the case of the breast milk. Both raw milk and Dryco were used. Finally all the experiments were controlled by a series of animals to which the basal diet alone, and the basal diet plus 10 cc. of orange juice, were given.

**Chart 1.** Experiment 1. Basal scorbutic diet plus 60 cc. of breast milk.

All the animals were run in triplicate. The accompanying charts, which show the weight curves of these guinea pigs, represent the average in each instance. All the animals were killed at the end of the experimental period, and a microscopic study of their tissues was made to determine the presence or absence of any scorbutic lesions.
In view of the vast literature on these nutritional experiments, which deals with the methods followed here, it does not seem necessary to enter in detail into the protocols of the individual animals. A brief discussion of the results in each group of cases

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**Chart 2.** Experiment 2. Basal scorbutic diet plus 120 cc. of breast milk.

Experiment 1.—Basal scorbutic diet plus 60 cc. of fresh breast milk or its equivalent in dry powder (Chart 1). Breast milk provided (1) raw, (2) freshly dried, and (3) preserved dry for 2 years.

Object of experiment: To note the relative value of minimal amounts of the dried milk products in preventing scurvy.
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Results.—With minimal amounts of breast milk the gain in weight is subnormal. This is inversely proportional to the age of the dried milk, although no demonstrable scorbutic lesions are found at the end of a 5 weeks experimental diet period in any of the animals. There has been apparently a further loss of some nutritional factor in the drying, which even in the fresh milk is inadequate in the amounts fed, as evidenced by the slow growth curve. This does not have a measurable caloric value, as the diet is in excess of estimated caloric needs of the animals. It must, therefore, be vitaminic in character. We feel that proba-

![Chart 3. Experiment 3. Control experiment. Basal scorbutic diet plus 100 cc. of cow's milk.](http://www.jbc.org/)

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bly had the animals lived long enough on this diet they would have developed rachitic or scorbutic lesions.

Experiment 2.—Basal scorbutic diet plus 120 cc. of fresh breast milk or its equivalent in dry powder (Chart 2). Breast milk provided, as in previous experiment, raw and powdered.

Object of experiment: To note the relative value of theoretically adequate amounts of the dried milk in preventing scurvy.

Results.—With an adequate amount of fresh milk the gain in weight is normal. With an equivalent amount of the dried milk
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a somewhat slower gain in weight is noted. This again is felt to be due to partial vitamin deficiency as the caloric values are adequate, and as the gain in weight is slowest in the animals fed on milk powder kept for 2 years. No scorbutic changes are noted in any of the animals during the experimental period of 5 weeks.

Experiment 3.—Basal scorbutic diet plus 100 cc. of cow’s milk (Chart 3). Milk supplied (1) raw (certified Walker-Gordon product) and (2) powdered (Dryco from The Dry Milk Co.).

Object of experiment: A control experiment to check the relative value of breast milk as compared to cow’s milk in preventing scurvy.

Results.—Normal growth curves are obtained in the control experiments using fresh cow’s milk and Dryco in adequate amounts. No scorbutic lesions are noted in the animals at the end of the experimental period of 5 weeks.

Experiment 4.—Basal scorbutic diet alone and with addition of 10 cc. of orange juice (Chart 4).

Object of experiment: A control experiment to prove that the basal diet is deficient only in antiscorbutic vitamin.

Results.—Animals fed the basal diet alone show typical scorbutic lesions within 21 to 25 days. Those on the basal diet in similar amounts with the addition of 10 cc. of orange juice as an antiscorbutic present normal growth curves. These control experiments prove that the diet is adequate and that the slow gain in weight of the animals fed on the dried breast milk is due solely to an inadequate vitamin content.

SUMMARY AND CONCLUSIONS.

The data of feeding experiments utilizing young 250 gm. growing guinea pigs are presented, with their weight curves. These show that breast milk dried by the method described retains about 80 per cent of its antiscorbutic value when first prepared and about 40 per cent of its original antiscorbutic content after “ageing” for a period of as long as 2 years.
BIBLIOGRAPHY.

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