DRIED SKIMMED MILKS AND KWASHIORKOR


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In a previous investigation concerning the dietary treatment of kwashiorkor, it appeared that an imported spray-dried acidified skimmed milk was superior to a local roller-dried skimmed milk in initiating cure. The imported milk, however, was supplied in air-proof and moisture-proof containers, whereas the roller-dried milk was packed in bags not impermeable to moisture. The possibility that the Maillard reaction had occurred in the latter case could therefore not be excluded. In this reaction, which occurs in the presence of excessive moisture, lysine and possibly other amino acids become inactivated. It was further pointed out that lactic acid was added during the manufacture of the spray-dried milk, whereas in that of roller-dried milk lactic acid was added at the time of preparation of the feeds.

Another factor which may possibly have influenced the results obtained is that the majority of the patients who received the spray-dried milk were treated during the winter months, when infective diarrhoea is not a big problem. We have previously stressed the difficulty in establishing criteria of severity in kwashiorkor and the possibility cannot be excluded that the patients who received the spray-dried milk may have been less severely affected than the patients in the other groups.

Since factors other than the method of manufacture of the dried skimmed milk might have been responsible for the good results obtained with the spray-dried milk it seemed desirable that the earlier results should be confirmed or clarified. The roller process is cheaper than spray-drying, especially in installation cost. At least 15,000 gallons of milk must be processed daily to make spray-drying economical. The erection of large spray-drying plants is thus limited by the supplies of milk available and by transport costs, a major economic consideration. Although roller-drying requires skilled attention for the operation of the driers, this process can be employed economically on a smaller scale (5,000 gallons per day).

As the incidence of protein malnutrition parallels that of poverty, it seemed important to ascertain whether good-quality roller-dried skimmed milk is as effective in initiating cure of kwashiorkor as the more expensive spray-dried variety. The high temperature (about 250°F) prevailing on the drums in the roller process causes considerable denaturation of the protein although the product is exposed to this temperature for only about one second. During this process, lysine, and possibly to a lesser extent other amino acids as well, may be damaged. During spray-drying heat treatment of the milk takes place at about 130°F and lasts only a fraction of a second. Nevertheless, with the improvements which have been introduced from time to time, drum drying can yield a dried milk of high quality.

MATERIAL AND METHODS

The criteria used in the selection of patients were identical with those described previously. Sixty patients suffering from kwashiorkor were divided at random into 3 equal groups, one of which received roller-dried skimmed milk, another spray-dried skimmed milk, and the third spray-dried acidified skimmed milk. No vitamin or other supplement was given.

The 3 varieties of dried skimmed milk were high-quality products. They were manufactured by the usual processes, but according to special directions. The production of the roller-dried milk was performed by one of the authors (S.G.W.). The dried milks were packed in tins, each of which contained approximately 26 lb., and stored at room temperature. Unfortunately, owing to a misunderstanding, the degree of acidity of the spray-dried acidified milk was only about 2% instead of the desired 4%. Lactic acid was therefore added at the rate of 1/2 minims of 85% lactic acid per fl. oz. of the reconstituted formula, during the preparation of the feeds for the patients in this group.

Therapeutic Regimen

In the first 12-18 hours after admission, all patients received Hartman's solution with 5% dextrose by mouth, as well as 1-2 g. of potassium chloride, before the milk formulae were introduced. The fluid intake prescribed was approximately 2 1/2 oz. per lb. body-weight per 24 hrs. The 3 dried milks were prepared so as to provide approximately 10 calories per fl. oz., but within a couple of days the feeds were strengthened to 15 calories per fl. oz. (1/2 oz. of dried milk per 10 oz. of water). On admission, 1,200,000 units of benzathine penicillin G (Bicillin) were given intramuscularly, and sulphadiazine was given orally for 7 days at a dosage of 1 1/2 gr. per lb. body-weight per day. Broad-spectrum antibiotics were prescribed in a few cases only; intravenous therapy with electrolyte solutions and/or plasma and blood was instituted when indicated.

Criteria of Successful Treatment

The term 'initiation of cure' is used here as previously defined by Brock et al. Briefly, it can be said to have taken place when the patient's downhill course has been changed to an upward one. By this time, usually after from 12 to 21 days, rapid increases have taken place in the concentration of albumin in the serum and in the serum amylase activity and the patient has lost his oedema, has become interested in his surroundings, and has regained his appetite.

Analytical Methods

The methods used for the determination of serum proteins and serum amylase activity were identical with those prescribed previously. Nitrogen in the food, faeces and urine was estimated in duplicate by a modification of the macro-Kjeldahl method. The following methods were used for the analysis of the dried skimmed milks:

Moisture: A sample of 3 g. of dried milk was dried at 85-88°C for 6 hours or until constant in weight.

Fat: The method described by Stodt was used.

Total Solubility: The method used was that described in Richmond's Dairy Chemistry.

Degree of Acidity: 4 g. of dried skimmed milk were dissolved in 32 ml. of water and the mixture titrated with N/9 NaOH (1 ml. of N/9 NaOH = 0.1% lactic acid).
the 3 varieties of skimmed milk were carried out, on the technique of Han-

sens,7 were performed on 2 male patients in each group. The studies were commenced on the day after admission and separate collections of urine and faeces were made over a 3-day period. Carmine was used to mark the faeces.

RESULTS

The therapeutic effect of the 3 varieties of skimmed milk were assessed on the basis of their abilities to initiate cure and to increase the serum-albumin concentration and the serum amylase activity and in addition, in those cases where balance studies were carried out, on the basis of their effects on absorption and retention of nitrogen.

Analysis of the Skimmed Milks

The results of analysis of the 3 varieties of dried milk are shown in Table I. The well known difference in solubility between milks prepared by the two processes is clearly illustrated. The fat content was fairly high in all 2 samples analysed. The riboflavin contents of all 3 types of dried milk were remarkably low. There was no appreciable difference in lysine content between the 3 varieties of dried skimmed milk. This amino acid is liable to be damaged if overheating occurs during drum drying.

Effects of Experimental Diets on Initiation of Cure

The results have been summarized in Table II according to a modification of the method described by Brock et al.8 In this Table group I includes all cases where dietary treatment

<table>
<thead>
<tr>
<th>Table I. Analysis of the Dried Skimmed Milks</th>
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<tbody>
<tr>
<td>Type of Skimmed Milk</td>
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<td></td>
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<tr>
<td>Spray-dried skimmed milk</td>
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<tr>
<td>Roller-dried skimmed milk</td>
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<td>Acidified skimmed milk</td>
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**TABLE II. SUMMARY OF CLINICAL RESULTS**

<table>
<thead>
<tr>
<th>Diet</th>
<th>No. of cases</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III (Deaths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roller-dried skimmed milk</td>
<td>20</td>
<td>14</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Spray-dried skimmed milk</td>
<td>20</td>
<td>17</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Spray-dried acidified skimmed milk</td>
<td>20</td>
<td>14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>45</td>
<td>5</td>
<td>10</td>
</tr>
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was successful and in which cure was fully initiated within 21 days; group II all cases in which additional supportive transfusion of plasma and blood was necessary to initiate cure; and group III all the cases which died. (No deaths occurred within 48 hours.)

For the purpose of statistical analysis all cases not classed as a group-I cure were regarded as failures. A test of significance between the 2 percentages (14 and 17) P1 = 70% (14/20×100) and P2 = 85% (17/20×100), showed no significant difference. According to this analysis, therefore, no significant differences could be established between the 3 varieties of skimmed milk in initiating cure.

Effects of Diets on Serum Albumin Concentration and Serum Amylase Activity

In Tables III and IV are shown the average values, and the equations representing the regression lines, for rise of serum-albumin concentration and increase in serum amylase activity during treatment. Application of the t-test revealed no significant differences in the serum amylase activity between the 3 groups during the 3 weeks of treatment. On admission, the average values for serum albumin concentration of the 3 therapeutic groups did not differ significantly, but one or two weeks after admission the average value for the patients who received the spray-dried skimmed milk was significantly higher than the corresponding values for the other 2 groups. At the end of the third week, however, there were no significant differences between the values obtained for the 3 groups and it seems reasonable to conclude that the rise in serum albumin concentration was satisfactory in all 3 groups. The average values obtained for the patients who received roller-dried milk was almost identical with that for the group receiving spray-dried acidified milk.

<table>
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<tr>
<th>TABLE III. INCREASE IN SERUM ALBUMIN CONCENTRATION DURING TREATMENT</th>
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<tbody>
<tr>
<td>Type of Skimmed Milk</td>
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<td>-----------------------</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Roller-dried</td>
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<tr>
<td>Spray-dried</td>
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<tr>
<td>Spray-dried acidified</td>
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</table>

* These equations represent regression lines of rise of serum albumin (Y) against time (X) during treatment with the three varieties of dried milk.

The results have been summarized in Table II according to a modification of the method described by Brock et al.8 In this Table group I includes all cases where dietary treatment
obtained for the 3 groups. Nitrogen balance studies, performed on 2 male patients from each group, showed high retention of nitrogen in all cases. The results therefore indicate that roller-dried skimmed milk of high quality which has been properly packed and stored can be as effective in initiating cure as spray-dried skimmed milk either with or without added lactic acid. This finding is of economic importance because drum-drying is cheaper than spray-drying.

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REFERENCES


DERMATOLOGISTS AND RADIOThERAPY*

M. WEINBREN, B.Sc., M.R.C.S., L.R.C.P., F.F.R., D.M.R.E., JohannesbuRg

1. Dr. Loewenthal's paper is but a continuation of the discussion in the Journal during 1950-51 on a portion of Dr. Charlton's paper which dealt not only with skin diseases, but also with radiation therapy in benign conditions generally.

2. Dr. Loewenthal did not give the references to those who took part in the discussion or even to Dr. Charlton's paper but merely referred to 'one radiologist' and 'another radiologist' and 'a dermatologist,' so that radiologists and dermatologists who were present at the meeting in Durban, and many of your readers who wished to do so, could not check Dr. Loewenthal's version of what took place.

3. Why Dr. Loewenthal had to brood for 8 years on this subject before joining the discussion it is difficult to understand. When he had the opportunity 7 years ago to discuss the matter, his only contribution was a few lines of verse, which contained neither medicine nor dermatology nor radiology nor poetry.

The arguments and the terminology used by Dr. Loewenthal are so strikingly similar to the letters by Sulzburger and others in their controversy with Professor Chamberlain, which Dr. Loewenthal calls the 'first attack on dermatologists,' that one cannot help feeling that it was the publication of these letters...