HIGH PROTEIN FEEDING IN KWASHIORKOR*

BY

FRANK WALT and MICHAEL HATHORN

*From the Paediatric Department, McCord Zulu Hospital, Durban
and the Department of Physiology, University of Natal, Durban*

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The highly satisfactory results with skimmed cow's milk in the treatment of uncomplicated kwashiorkor are well documented. Dean (1953) stated that a patient needed 50 g. protein daily, but in 1956 recommended that fat be added as well. It has been suggested that very high protein intake, by supplementing cow's milk with concentrated powdered milk protein, may hasten the cure of the disease. Many hospitals still use this expensive therapy. Pretorius, Hansen, Davel and Brock (1956), however, did not observe benefit from supplementing skimmed milk, and it has also been suggested that too high a protein diet may cause harm and even sudden death (Gyorgy, 1955; Sncal, 1958).

It was therefore decided to study this problem as part of an investigation, initiated in November, 1957, into anaemia in kwashiorkor (Walt, 1959). Alternate cases were given a protein supplement and a comparison of the total daily protein and caloric intake, daily weight change and weekly serum protein estimations in cases in each group was undertaken.

Material and Methods

Six hospital beds were made available for the study and as each bed became vacant, a new patient with kwashiorkor was admitted to the trial. All the patients were ill, necessitating admission to hospital. Many had superimposed infections.

A full clinical examination was carried out on every patient by the first author, and, without his prior knowledge, allotted alternately to the two treatment groups.

From November 22, 1957, to June 29, 1958, 45 patients were admitted to the trial. Five patients in each treatment group died, leaving 35 cases for analysis. These cases were observed for 28 days.

Treatment Groups. Skimmed lactic acid milk only (SLAM) was administered in 17 cases; skimmed lactic acid milk plus protein supplement (SLAM + PS) was administered in 18 cases.

From July 15, 1958, to June 22, 1959, a further 48 cases, comprising the second series, were admitted. There were 12 deaths; two cases were excluded because of tuberculosis and two cases because of unreliable records. This left 32 cases for analysis. These cases were observed for 42 days: skimmed lactic acid milk, plus injectable iron (SLAM + Fe) was administered from the eighth hospital day to 13 cases; skimmed lactic acid milk plus protein supplement (SLAM + PS) ('Tervamix'), as in the first series to 19 cases.

It will be noted that the only difference between the first and second series of cases was the addition of iron injections after the eighth day to the non-supplemented group. Table 1 shows that the severity of kwashiorkor was similar in both groups, as was the number of patients requiring intravenous therapy and/or blood transfusions. There was a similar proportion of infections in the two groups. The average age for the SLAM + PS group was 18 months and for the other 20 months. All the patients were of African (Bantu) origin. An analysis of the deaths among the total of 93 cases admitted showed that the median days of death in the SLAM group and SLAM + PS groups were the fourth and third days respectively. Statistically there was no significant difference in the death rates of the two groups.

TABLE 1

Cases	Treatment	
	SLAM	SLAM + PS
Cases admitted	46	47
Deaths	14	8
Cases excluded	2	2
Cases analysed	30	37
Mean age (months)	20	18
Severity of illness on admission:		
Mild	9 (30%)	12 (32%)
Moderate	16 (53%)	19 (52%)
Severe	5 (17%)	6 (16%)
Cases requiring intravenous therapy	6	9
Blood transfusions	3	3
Cases with infections:		
In first week	10 (33%)	16 (43%)
During hospitalization	21 (70%)	26 (70%)

Feeding. Lactified skimmed cow's milk (Walt, Wills and Nightingale, 1950) was offered to all patients. They were encouraged and coaxed to drink as much as they wished by the nursing staff, who are taught to be

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kindly and patient with these difficult children. The minimum quantities offered for the first three days were 1½, 2 and 2½ oz. per lb. body weight respectively. Full ward diet was introduced on the 15th day.

The alternate patients received a supplement of 'Tervamix', a powder containing 68% milk protein (casein), obtained from skimmed milk. It was added to the lactified milk in the proportion of 1½ g. per lb. body weight, thus providing an extra 1 g. protein per lb. body weight per day.

Additional Routine Therapy on Admission. The following was administered to all patients: procaine penicillin 300,000 units intramuscularly daily for seven days; triple sulphonamide 90 mg. per lb. body weight daily for seven days; vitamin C, 50 mg. daily; potassium chloride, 5 gr. three times per day for seven days; folic acid ('Folvite') 7.5 mg. intramuscularly daily for three days, followed by 5 mg. orally three times per day for 25 days; intramuscular iron ('Imferon'), on the recommended basis, was given from the eighth day to the patients in the second series not receiving protein supplement (SLAM + Fe).

Measurements. All patients were weighed by the paediatric registrar daily just before the 9 a.m. feed, at the same time as the protein supplement was weighed. The daily quantity of feed taken by each patient was accurately measured and recorded allowing the daily protein and caloric intake to be estimated (Fig. 1).

Serum Proteins. Serum protein estimation and electrophoresis were performed on admission and weekly thereafter by the methods of Joubert, Hookins and Hunter (1959).

Results

The addition of injectable iron to the patients in the non-supplemented group in the second series apparently did not affect the protein and caloric intakes, weight changes and serum protein levels materially. Therefore, for purposes of analysis, the results of the non-supplemented groups in the first and second series of cases have been combined and compared with the results of the protein-supplemented cases from both series. Figs. 1, 2 and 3, and Table 2 summarize some of the findings in the two groups.

Response to Treatment. All 67 cases recovered well and were discharged from hospital at the end of the period of observation; many could have been discharged earlier. The patients had their diuresis between the fourth and 12th days; clinical oedema tended to disappear earlier in the protein-supplemented group. By the end of 14 days, the skin lesions were healed and the patients smiling, a sign of recovery which we find very useful; their appetites were good and dispositions happy unless some infection supervened. These infections were a constant source of worry, and in the majority of cases necessitated the use of appropriate antibiotics.

Differentiation between dietetic and infective diarrhoea is admittedly difficult but the former never appeared to be an important cause of illness. Those patients given supplementary protein did not suffer an obvious increase in diarrhoea.

FIG. 1.—Mean calorie and protein intakes of both groups.

○ = SLAM: skimmed lactic acid milk; ● = SLAM + PS: skimmed lactic acid milk plus protein supplement.

FIG. 2.—Mean percentage change in body weight in both groups.
○ = SLAM; ● = SLAM + PS.

Protein Intake. (Fig. 1.) By the 10th day of treatment the mean protein intake of the SLAM + PS group was 30% more than in the SLAM group (3.7 g. as compared with 2.8 g./lb. body weight).

Caloric Intake. (Fig. 1.) Likewise by the 10th day of treatment the mean caloric intake of the SLAM + PS group was higher than in the SLAM group (32.5 as compared with 28.4 cal./lb. body weight).

FIG. 3.—Mean serum proteins and fractionation in both groups.
A = on admission; numerals refer to number of weeks after admission.

Weight Change. The percentage change in body weight (Fig. 2) in the two groups showed that those given protein supplement did not gain as well as those fed skimmed milk only. By the 28th day, the SLAM + PS group was only about 1% above their admission weight, but the SLAM group (without supplement) was 5.6% over the admission weight. This difference was probably significant ($p < 0.05$).

In the second series of cases which were weighed up to 42 days, there was still a difference between

TABLE 2

Cases	Treatment	
	SLAM	SLAM + PS
Mean weight (lb.):		
On admission	19.3	20.0
At 28 days	20.5	20.2
At 42 days	22.4	21.6
Mean protein intake at 10 days (g./lb. body weight)	2.8	3.7
Mean caloric intake at 10 days (cal./lb. body weight)	28.4	32.5

the two groups, but this was no longer significant (Fig. 2).

Serum Proteins. Fig. 3 compares the serum protein levels of the two groups. There was no greater rise in those cases receiving protein supplement.

Discussion

Adequate control groups are essential when a trial of varied treatments is undertaken. In this investigation random allocation of cases resulted in similar age and weight distributions and severity of kwashiorkor in the two treatment groups. Thus the only difference between the groups was the diet.

We have used weight gain, a rise in serum proteins and clinical recovery as the criteria for improvement in the two groups. When observed for only 28 days those patients receiving supplementary protein did not gain as well as those receiving skimmed lactic acid milk only (Fig. 2). When, however, the patients were observed for 42 days, this difference was much less evident. Possible reasons for this difference are the slightly larger number of infections in the first week and the earlier loss of oedema in this group. Alternatively, it may be due to difficulty experienced in metabolizing the extra protein. The amount of protein taken increased daily so that by the 10th day a mean of 2.8 g. per lb. body weight daily was consumed by the control group. This was sufficient to initiate cure as defined by Brock, Hansen, Howe, Pretorius, Davel and Hendrickse (1955). It is felt therefore, that supplementation of skimmed milk with extra protein is unnecessary. This merely confirms the opinion of Pretorius *et al.* (1956), Pretorius and Smit (1958), and Béhar, Viteri, Bressani, Arroyave, Squibb and Scrimshaw (1958).

Sénécal (1958), on the other hand, has recently reported excellent results with partly skimmed milk supplemented by protein hydrolysates, but his conclusions are not supported by a controlled series of patients. He felt that his good results were due in part to the high caloric intake, 25% of which was supplied by protein. His patients took as much as 140 calories per kg. per day. In our patients no attempt was made to increase the calorie intake above that provided by skimmed milk (and extra protein), recovery occurring on 55-65 calories per kg. per day. In patients developing kwashiorkor, it is believed that the calorie intake is adequate but that protein is markedly deficient. In Sénécal's cases, one suspects that some patients were marasmic and deficient in both calories and protein. We realize, however, that the earlier introduction of a ward diet is likely to be of benefit to some patients,

and that 14 days on skimmed milk only is probably too long.

We are convinced that infection plays an important part in retarding the recovery of our patients and in the causation of a mild but persistent anaemia, as has already been suggested by Walt (1959). Although it is difficult to assess, we believe that the prophylactic penicillin and sulphonamides used in this trial were of no obvious benefit. We feel therefore that chloramphenicol is probably the drug of choice, particularly in our area where infective enteritis is common.

The total serum proteins and all fractions increased rapidly by the 14th day of the treatment; thereafter they rose only a little more to levels and ratios typical for African patients. We are at variance with Sénécal (1958), who despite a statement that the α_2 globulin decreases, produced a diagram remarkably similar to our Fig. 3. In all our cases this fraction rose steadily and rapidly.

Conclusions

In this series of patients no advantage in weight gain was demonstrated in those receiving protein supplements and therefore higher calorie intake. The minimum quantity of protein, on a body weight basis, necessary for the cure of kwashiorkor has yet to be determined, even though Dean (1953) stated that he had had some good results from as little as 25 g. protein daily. In this series, by the 10th day, 2.8 g. per lb. body weight, representing more than 50 g. protein in the average patient, was consumed and cure was initiated. It is possible that some patients would profit even more by the introduction of a full ward diet as early as the eighth day.

Because infection plays a major role in the early deaths from kwashiorkor, a series of cases receiving a broad spectrum antibiotic prophylactically needs to be studied.

We believe that 'pure' or uncomplicated kwashiorkor responds so well to skimmed cow's milk that these patients should never die. Skimmed milk is very satisfactory and much cheaper than protein hydrolysates or concentrated powdered milk protein, which have not yet been shown to be superior. The rightful place of skimmed milk appears to be as a supplement to the high carbohydrate (starch) diet of the African. Although 'Tervamix' has not been shown in this study to hasten the cure of patients with overt kwashiorkor, it may well be a useful non-bulky high protein supplementary food.

Summary

The treatment of two groups of patients with kwashiorkor is compared. Both received skimmed

lactic acid milk but one group was supplemented with concentrated milk protein.

This group did not show any advantage in clinical recovery, weight gain or rise in serum protein levels over the non-supplemented group.

It is concluded that protein supplementation of skimmed milk in the treatment of kwashiorkor is not beneficial.

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