

STUDIES ON THE INFLUENCE OF SUPPLEMENTATION OF CURD TO THE POOR SOUTH INDIAN DIET ON THE INTESTINAL SYNTHESIS OF VITAMIN B₁ IN RATS

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SUMMARY AND CONCLUSIONS

With a view to elucidating the influence of curd as a supplement to poor South Indian Diet on the intestinal synthesis of vitamin B₁, some studies were conducted and the results obtained are given below:

1. The urinary and faecal excretions of vitamin B₁ of rats receiving curd were found to be much higher than those of the control group rats receiving pure vitamin B₁ solution as supplement.

2. The storage level of vitamin B₁ in liver was also higher in the curd-fed animals.

The results appear to point out that curd favours the bacterial synthesis of vitamin B₁.

The extremely inadequate nutritive value of the common poor South Indian Diet, consisting mostly of polished rice, has been the subject for investigation for quite a long time. Experiments conducted by different workers in the field, have brought to light very clearly the marked response when various food factors, like yeast, casein, calcium, vitamins, etc., are used as supplements.^{1,2} Milk and curds have also been reported to confer important benefits under such conditions.³

During the past two decades, considerable attention is focussed on problems relating to intestinal synthesis of B group vitamins. The influence of different dietary factors in bringing about a change in the type of the intestinal flora as also the role of these bacteria in synthesising the desirable accessory food factors have received intensified attention.⁴⁻⁶

Our work on the nature of flora developing with milk and curd⁷ has shown that curd feeding gives rise to a preponderance of coliform organisms, which are known to be the best thiamin synthesisers, while milk encourages the development of lactobacilli, which are not useful for thiamin production. These observations therefore indicate that consumption of curd is in fact more advantageous than milk. The investigations reported in this paper

were taken up to study the correlation between growth and intestinal synthesis of vitamin B₁ in rats receiving curd as a supplement to poor South India Diet.

EXPERIMENTAL

The milk supplied by the Indian Dairy Research Institute, Bangalore was used throughout the experiment.

Curd was prepared as follows: Milk was first heated to 70–80° C. allowed to cool to 35–40° C. and was then inoculated with a thin suspension of butter-milk and left for about 20 hours at room temperature.

Vitamins B₁ and B₂ from 5 random samples were analysed, by the methods of Harris and Wang⁸ and Kodicek and Wang⁹ respectively and the average values were used for controlling the intake of these vitamins by the animals.

Fourteen young rats, weighing from 40–50 gm. and one month old, were divided into two groups A and B. The B group rats were kept on the poor South Indian Diet plus 3 γ of synthetic vitamin B₁. The A group rats were maintained on the poor rice diet supplemented by 8 gm. of curd (equivalent to 3 γ of vitamin B₁). The additional amount of riboflavin which was supplied to the A group animals by the curd was added to the B group rats in the form of a pure vitamin B₂ solution so that all the conditions of the experiment were the same.

Composition of the Poor South Indian Diet Used

Constituent	Amount in gm.
Polished rice	78.5
Non-leafy vegetables	8.2
Leafy vegetables	2.1
Tur dhal	5.0
Cocoonut oil	5.0
Common salt	0.3

Preparation of the Diet.—Required amounts of the various constituents were taken on the basis of 10 gm. (dry weight) of diet to each rat. About three times the water was kept boiling in a vessel. Tur dhal and vegetables were put in it first. When the dhal was well cooked, rice was added and the contents were stirred well with the use of a ladle. When the rice was well cooked and almost all of the water used up, the vessel was removed from the heater, salt was added and mixed well. Then the oil was also mixed with the diet. The cooked diet was weighed and distributed equally between the rats.

The amount of cooked diet corresponding to 10 gm. of dry weight supplied about 8.0 γ of vitamin B₁, so that after supplementation the total daily intake of each rat was 11.0 γ . Two drops of Adexolin were given to each rat twice a week.

The rats were kept on the corresponding diets for a preliminary period of three weeks and afterwards urinary and faecal collections were carried out for two weeks separately. At the end of the experiment three rats from each group were killed and their livers analysed. Urinary, faecal and liver thiamine was estimated by the thiochrome methods described by Mawson and Thompson,¹⁰ 'Methods of vitamin assay' by the Association of Vitamin Chemists (1947) and Greenberg and Rinehart¹¹ respectively.

The results of the excretions and liver storage levels of vitamin B₁ of the animals are presented in Tables I and II.

TABLE I

Influence of Supplementation of Curd and Pure vitamin B₁ to the Poor South Indian Diet on the Intestinal Synthesis of Thiamine in Rats

(a) *Observations on the urinary and faecal excretions during the first week of metabolism studies*

Rat No. & group	Total urinary excretion of vitamin B ₁ in γ	Total weight of faeces in g.	Total faecal excretion of vitamin B ₁ in γ	Vitamin B ₁ excreted per g. of faeces in γ
A ₁	8.2	2.99	7.48	2.50
A ₂	7.8	2.75	6.32	2.30
A ₃	7.6	2.80	6.86	2.45
A ₄	8.4	2.73	6.55	2.40
A ₅	6.9	2.87	7.75	2.70
A ₆	7.5	2.12	6.04	2.85
A ₇	7.0	2.35	6.32	2.69
B ₁	5.5	2.06	2.90	1.41
B ₂	5.2	2.15	3.10	1.47
B ₃	4.9	1.88	2.85	1.52
B ₄	4.6	2.53	4.20	1.66
B ₅	5.2	2.45	4.00	1.63
B ₆	5.8	2.24	3.40	1.51
B ₇	4.8	2.18	3.21	1.43

A Poor South Indian Diet + 8 gm. of curd (Equivalent to 3 γ of vitamin B₁)
 B " " " + 3 γ of synthetic vitamin B₁.

(b) Observations on the Urinary and faecal excretions during the second week of metabolism studies

Rat No. and group	Nett increase in weight in g.	Total urinary excretion of vitamin B ₁ in γ	Total weight of faeces in g.	Total faecal excretion of vitamin B ₁ in γ	Vitamin B ₁ excreted per g. of faeces in γ
A ₁ ..	11	8.8	2.54	5.97	2.35
A ₂ ..	11	9.0	2.65	6.98	2.45
A ₃ ..	12	7.8	2.62	6.80	2.50
A ₄ ..	11	8.4	2.51	6.88	2.54
A ₅ ..	9	7.6	2.94	7.23	2.46
A ₆ ..	9	8.0	2.22	5.82	2.62
A ₇ ..	12	8.2	2.16	5.57	2.58
B ₁ ..	8	5.6	2.34	3.52	1.51
B ₂ ..	7	5.8	2.57	3.75	1.46
B ₃ ..	6	5.0	2.78	3.83	1.38
B ₄ ..	6	4.6	2.28	3.42	1.50
B ₅ ..	6	4.9	2.55	3.57	1.40
B ₆ ..	7	5.2	2.27	3.55	1.56
B ₇ ..	8	5.7	2.40	3.43	1.43

TABLE II

Vitamin B₁ Content of Liver of the Animals at the End of the Experiment

Rat number and group	Total vitamin B ₁ content of liver in γ
A ₁ ..	3.65
A ₂ ..	3.85
A ₃ ..	3.60
Average ..	3.70
B ₁ ..	2.30
B ₂ ..	2.20
B ₃ ..	2.40
Average ..	2.30

RESULTS AND DISCUSSION

It can be seen from Table III—where the average values of vitamin B₁ excretion are presented—that the urinary excretion of vitamin B₁ of rats receiving curd is higher than in the control group. The total intake of vitamin B₁ of all the rats being maintained the same, the percentage intake of vitamin B₁ excreted (10.36%) is also higher in the curd group (the value for the other group being 6.75%).

TABLE III

Average Weekly Urinary and Faecal Excretions of Vitamin B₁ of Rats Receiving Curd and Synthetic Vitamin B₁ as Supplements to Poor South Indian Diet

Group	Total urinary excretion of vitamin B ₁ in γ		Total faecal excretion of vitamin B ₁ in γ		Vitamin B ₁ excreted per gram of faeces in γ	
	1st week	2nd week	1st week	2nd week	1st week	2nd week
Curd	7.63 \pm 0.316	8.26 \pm 0.261	6.76 \pm 0.246	6.32 \pm 0.366	2.56 \pm 0.038	2.50 \pm 0.008
Pure vitamin	5.14 \pm 0.173	5.26 \pm 0.206	3.38 \pm 0.279	3.58 \pm 0.024	1.52 \pm 0.009	1.46 \pm 0.004

The possibility that the higher excretion in the curd group may be due to poor absorption is ruled out by comparison of the rates of growth, the average weekly increase in weight of the A and B group rats being 10.8 and 6.8 gm. respectively. Moreover, the values of the vitamin B₁ content of liver of the two groups show that there is less of depletion in the curd group rats. Taken together, all these results indicate that there is a greater amount of bacterial synthesis occurring in the curd group rats which is reflected in the higher urinary excretion of vitamin B₁.

Very significant difference can be noticed in the total faecal excretions of the two groups, the values of A and B groups being 6.54 γ and 3.48 γ respectively. This difference is also observed when calculated on the basis of excretion per gram of faeces, the values being 2.53 γ and 1.49 γ for the A and B groups respectively.

Assuming that all the faecal vitamin B₁ excretion is due to intestinal synthesis (Leong¹²), it can be concluded that curd favours the intestinal synthesis of vitamin B₁. This favourable influence of curd is probably due to the type of flora it produces in the intestines of rat.⁷

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