

#### NUTRITIVE VALUE OF SOYA-BEAN AND RELATED PRODUCTS

WITH reference to your review<sup>1</sup> of the Report of the Soya-bean Sub-Committee of the Indian Research Fund Association, the following account of our recent work would be of some interest.

Practically all the work done by the Soya-bean Sub-Committee related to the use of the whole bean in the steamed or otherwise cooked condition as a *dhal*. In this direction soya-bean has proved disappointing and the conclusions reached by the Sub-Committee have been confirmed both by us at Bangalore and by investigators in other parts of the world.

In countries where soya-bean is finding very large application as an article of human food, it is mostly used either as a milk or as a

sauce. The former is a natural emulsion incorporating the protein, fat and minerals of the bean, while the latter is a pre-digested product. The work of the Soya-bean Sub-Committee had not included these two products.

The authors of the present note were present at the last meeting of the Soya-bean Sub-Committee which met in Delhi towards the end of November 1946. This meeting discussed the draft report of the Sub-Committee which was then being got ready for publication. It was the unanimous feeling of the Committee that a great deal more work on different aspects was needed, but that as the Committee had already completed a certain programme of work, the available material should be published. The draft report had gone beyond the actual work done by the Committee and as already fresh evidence was coming forth to reveal the higher nutritive value of soya-bean in a processed form, the report was modified in a number of places to provide scope for fresh developments. In fact, even at this meeting, both we from Bangalore and Dr. K. P. Basu from Dacca adduced evidence to show that soya-milk had a supplementary value when added to a rice diet, whereas the whole soya-bean had none.

At their meeting during the Autumn of 1944, the Soya-bean Sub-Committee had decided to close their work. Reference to this may be found in their earlier report. With this as a background, we started our work, about twenty months ago, studying the effect of each step in processing on the nutritive value of the resulting product. Independent evidence was also accumulating, chiefly in America, to show that the biological value of the protein was not a constant entity, but depended on the method of processing employed. By incorporating a number of improvements such as incipient germination, extraction to remove colouring matter and bitter principle, fine mechanical pasting, adjustment of reaction, and boiling under certain standard conditions, we showed that it is possible to obtain a vegetable milk which has the same properties as animal milk, at a fraction of the cost of the latter. We showed that the protein of the milk has a higher digestibility than that in cow's milk; that the biological value is not much lower and that the net values of the two proteins are practically the same; that the vitamin B complex of the two milks are of the same order; that, when added to the poor rice diet, soya-milk has a supplementary value corresponding to about 80 per cent. of that of the best cow's milk; that extended germination to about three days yields a protein with a higher biological value than that in cow's milk; that supplementing with calcium leads to further increase in nutritive value. We have also studied the effect of combining soya-bean with the commoner pulses, legumes and cereals with a view to producing a still better milk, but that part of the work is not relevant to the present subject.

We did not merely stop with the laboratory work and animal feeding experiments. We conducted an extended series of consumer trials

with the milk, curd and related products. Thousands of people have sampled our products. The various products and, particularly the sour curd, have been much appreciated by all the users. Food preparations incorporating soya-milk or curd are indistinguishable from those prepared out of cow's milk.

With the above as a background and with the collaboration of the Health authorities of the C. & M. Station, we have been conducting a series of feeding experiments with the children in the local Welfare Centres. Soya-milk is being compared with cow's milk for feeding children ranging in age from a few months to seven years. The study is not yet complete, but the trends show that, especially in very young children, soya-milk produces better response than cow's milk. Experiments have also been recently started providing soya-curd and rice as a mid-day meal to well over a thousand primary school children. The number of children would have been much larger but for the fact that we are not at present in a position to supply more than about 400 lbs. of curd per day. In this connection, it may be mentioned that the panel of selection (which included the Rationing Adviser to the Government of India) actually preferred the rice prepared with soya-curd to that with cow's milk curd. Experiments will also be soon started comparing soya-milk with cow's milk in children's hospitals. Preliminary trials have already shown that children and invalids digest soya-milk more easily than cow's milk and that there is absolutely no ill-effect resulting from the use of the latter.

Side by side with the above, the technological side relating to the large-scale production of milk is being developed. Even with the limited equipment at our disposal, we could now produce over 1,000 lbs. of milk per day. Our present production is about 550 lbs., but we hope to double it at a very early date.

Thanks to the generous support of the Council of Scientific and Industrial Research, the Food Department, the Lady Tata Trustees and the C. & M. Station, Bangalore, we have already got a fairly big team of research workers on the subject. Further support will soon be forthcoming. Every aspect of the subject will be studied not only with a view to providing a complete scientific background but also to standardise the conditions for preparing a completely balanced vegetable milk that will have a higher nutritive value than the best grade dairy-fed cow's milk. We have already obtained promising results in this direction.

During the past twelve months, we have published some technical and popular articles bearing on the milk problem in the country;<sup>2</sup> the importance of processing in determining the nutritive value of soya-bean;<sup>3</sup> preparation of soya-bean milk;<sup>4</sup> Our technical papers relating to the preparation of soya-sauce,<sup>5</sup> biological value of soya-milk protein,<sup>6</sup> vitamin B complex of soya-milk,<sup>7</sup> supplementary value of soya-milk to rice diet,<sup>8</sup> and *in vitro* digestibility of soya-milk<sup>9</sup> are under publication. Further work bearing on the effect of combining soya with groundnut as also certain cereals and pulses, and on the calcium fortification of soya-milk

has been completed and is now being written up for publication.

S. S. DE.  
V. SUBRAHMANYAN.

Dept. of Biochemistry,  
Indian Institute of Science,  
Bangalore,  
July 8, 1946.

---

1. *Curr. Sci.*, 1946, **15**, 158. 2. *Sci. and Cult.*, 1946, **11**, 692. 3. *Ibid.*, 1945-46, **11**, 437. 4. *Curr. Sci.*, 1945, **14**, 204; *Ind. Farming*, 1946, **7**, 17; *Bull. 7 of the Food Conservation League, C. & M. Station, Bangalore*, 1946. 5. *Ind. Farming*, 1946, under publication, 6-9. *Annal. Biochem. and Expt. Med.*, 1946, accepted for publication.