CLXXV. A COMPARISON OF THE VALUES OF YEAST AND OF ORANGE JUICE WITH THOSE OF MARMITE AND OF DECITRATED LEMON JUICE, RESPECTIVELY, IN THE CALCIFICATION OF THE SKELETON.

BY VLADIMIR KORENCHEVSKY AND MARJORIE CARR.

From the Department of Experimental Pathology, Lister Institute.

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AT the Lister Institute, as a source of vitamin B in diets intended to be free from fat-soluble factor, marmite or dried yeast is used, and as a source of vitamin C, orange juice or decitrated lemon juice¹.

Sometimes large differences were observed in the calcium content and rachitic changes of the skeleton of rats kept on a diet deficient in fat-soluble factor. In accordance with our previous investigations [1921, 1922, 1923], we attributed this difference almost entirely to the diet of the mother rats during pregnancy and lactation. Nevertheless, it seemed that the rats looked better and resisted accidental infections more successfully on a diet deficient in fat-soluble factor, when yeast was used instead of marmite. This might suggest the presence of a very small amount of fat-soluble factor in yeast, which amount is probably not present in marmite. This suggestion is confirmed at the Lister Institute by recent unpublished experiments of Smedley MacLean and Luce, who found a small amount of fat-soluble factor in yeast fat.

Osborne and Mendel [1920, 1922] are doubtful whether lemon juice contains more than traces, if any, of the fat-soluble vitamin. Their experiments showed the presence of vitamins A, B, and C in orange juice. They also indicated the proportions of these different vitamins present; taken volume for volume orange juice is as rich as milk in vitamin B, but somewhat less rich in vitamin A.

Taking these facts into consideration, we performed experiments to discover whether the quantity of fat-soluble factor present in the amount of yeast and orange juice used in the deficient diet could influence the deficient calcification of the skeleton of rats kept on that diet.

Two litters of rats were used for the experiment, each litter being divided into four groups: — *A*, — *AL*, — *AM*, — *ALM*. Group — *A*, consisting of four rats, received the usual diet deficient in fat-soluble factor [Korenchevsky, 1922, 2, pp. 7–9], containing yeast and orange juice.

¹ Decitrated lemon juice is prepared by the addition of CaCO_3 in excess to lemon juice to neutralise and precipitate citric acid. It is then filtered and the filtrate used for the diets.

Group — *AL*, consisting of four rats, had the same diet, but orange juice was replaced by the same amount of decitrated lemon juice.

The diet of group — *AM*, consisting of five rats, contained marmite instead of yeast.

The diet of group — *ALM*, consisting of five rats, contained decitrated lemon juice and marmite, instead of orange juice and yeast.

The rats were put on these special diets at the age of 26 days (litter I), and at the age of 35 days (litter II). The special feeding was continued over a period of 54 days for litter I and 56 days for litter II. When the rats were killed at the end of the experiment, it was impossible to find by gross investigation any appreciable difference in their weight and other features. Spontaneous fractures of the ribs were found in several groups. The results of the chemical investigation of the skeleton of the rats are summarised in Table I. Histological examination revealed in all four groups a picture of slight rickets with osteoporosis. This pathological condition was more accentuated in the group — *AM* (marmite instead of yeast).

Table I. *Average chemical composition of the skeleton of the rats in each of the four groups.*

No. of the group of rats	Litter I In bones			Litter II In bones		
	H ₂ O %	Fresh Ca %	Dry Ca %	H ₂ O %	Fresh Ca %	Dry Ca %
— <i>A</i> (Orange juice and yeast)	52.7	7.4	15.6	47.7	8.6	16.4
— <i>AL</i> (Decitrated lemon juice and yeast)	50.4	7.9	15.9	47.3	8.2	15.6
— <i>AM</i> (Orange juice and marmite)	52.6	7.1	14.9	46.2	8.1	15.1
— <i>ALM</i> (Decitrated lemon juice and marmite)	46.6	7.9	14.7	47.7	8.0	15.3
Normal rats of about the same age on normal diet	43.8	11.5	20.5	39.0	13.2	21.5

Taking chiefly into consideration the calcium content of the dry bone, we may draw the following *conclusions* from the above experiments:

1. The presence of yeast in the diet deficient in fat-soluble factor instead of a corresponding amount of marmite, only very slightly increases the calcification of the skeleton.
2. This small difference may be within the limits of the usual fluctuations in the calcification of the skeleton of rats kept on this diet. If it is possible to ascribe any significance to such a small difference, it may suggest a slightly higher content of fat-soluble factor in yeast than in marmite.
3. The presence of orange juice instead of decitrated lemon juice in an otherwise identical diet does not have any definite influence on the calcification of the skeleton.

4. For the ordinary practical purpose of preparing diets deficient in fat-soluble factor it makes no difference whether yeast is used instead of marmite, or orange juice instead of decitrated lemon juice.

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