LETTERS TO THE EDITORS

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Riboflavin and Vitamin B_1 in Nineteenth Century Buns and Ale

RECENTLY, one of us (H.S.S.) was presented by Mr. H. W. Hedges, of Fairford, Gloucester, with two currant buns; one was baked in 1863 to celebrate the wedding of the Prince of Wales and the other in 1887 for Queen Victoria's jubilee. Both had been kept as souvenirs of the "Cakes and Ales" custom for celebrating national festivities. Except for a granite-like quality, they were in perfect condition, even to the currants, and on analysis gave the following results:

	1863 bun	1887 bun
Moisture	13·0 per cent	13·6 per cent
Protein	11·4 ,, ,,	11·3 ,, ,,
Fat	5·2 ,, ,,	4·4 ,, ,,
Fibre	0·2 ,, ,,	0·4 ,, ,,
Vitamin B_1	0·15 I.U./gm.	0·35 I.U./gm.
Riboflavin	9·3 μ gm./gm.	7·3 μ gm./gm.
*p*H (1 part bun/2 parts water)	4·4	5·0

Microscopical examination showed that both buns were made with yeast or barm. The most interesting feature of the analyses is the high value for riboflavin; the vitamin was determined microbiologically[1].

Two further buns have been examined (made 1888 and 1890) and gave the following figures (expressed on a 13 per cent moisture basis):

	1888	1890
Fibre	0·4 per cent	0·5 per cent
Vitamin B_1	0·05 I.U./gm.	0·10 I.U./gm..
Riboflavin	5·6 μ gm./gm.	4·7 μ gm./gm.

The average vitamin B_1 and riboflavin contents of the four buns are 0·15 I.U./gm. and 6·7 μ gm./gm., respectively. These figures compare with approximately 1 I.U. and 1·5–2·4 μ gm./gm. for present-day buns. The ancient buns were almost certainly made with brewers' yeast, and it is to this constituent that we must look for the explanation of the high riboflavin content. Incidentally, currants give a value of approximately 1 μ gm./gm.

Examination of a number of dried plain and debittered brewers' yeasts (12–13 per cent moisture) has given the following average results:

Vitamin B_1	33 I.U./gm.	(9·5)
Riboflavin	54 μ gm./gm.	(15)

The figures in brackets are the calculated figures for the corresponding wet yeasts (approximately 75 per cent water content).

The recipe from which the buns were made is unknown, but was possibly something similar to the Hannah Glass 1780 recipe which reads:

"Take two pounds of fine flour, a pint of good ale yeast, and three eggs beaten, knead all these together with a little warm milk, a little nutmeg, and a little fat, and lay it before the fire till it rises very light, then knead in a pound of fresh butter, a pound of rough carraway comfits, and bake them in a quick oven, in what shape you please, on floured paper."

This recipe would indicate a fat content of about 20 per cent in the dried bun, so that it must be assumed that the quantity of butter used in the buns under discussion was not so generous.

In attempting to calculate the vitamin B_1 and riboflavin contents of a "Hannah Glass bun", the difficulty is the yeast content of the "pint of good ale yeast"; despite many inquiries, we have been unable to obtain even an approximate figure. If, however, we calculate backwards, taking the riboflavin contents of flour, eggs, milk and butter as 1·5, 5, 1·5 and 0·1 μ gm./gm. respectively, and assuming $\frac{1}{4}$ lb. of butter and $\frac{1}{2}$ pint of milk in the recipe, it would follow that the pint of ale yeast contained something of the order of 8,000 μ gm./gm. of riboflavin.

As shown above, present-day wet brewers' yeast has a riboflavin value of about 15 μ gm./gm. On the other hand, it was thought that yeast grown on all-malt mashes might have a higher value. Accordingly, a sample was grown in the laboratory and gave on analysis vitamin B_1 and riboflavin figures of 9·3 I.U. and 23 μ gm./gm. (75 per cent water content), or slightly higher in riboflavin than the figure obtained for commercial yeasts. To complete the picture, four samples of present-day beer were examined and gave three values of 0·9 and one value of 1·7 μ gm./c.c. We have since been in touch with Prof. R. H. Hopkins and found that he has also obtained similar results with a wider range of beers and stouts (see p. 274). The explanation for the relatively high riboflavin content of beer has still to be worked out, but assuming there is little autolysis or 'release' of riboflavin from the yeast, it could be explained by assuming complete extraction from the malt if the latter has a value of about 8 μ gm./gm., or more than three times that of raw barley[1]. This is not unreasonable in view of the work of Davis, Laufer and Saletan[2], who found this ratio although their value for raw barley was low, namely, 1·02 μgm./gm. Whatever the explanation, it would appear that beer is not an unimportant source of riboflavin. Further, in the days when it was of much higher gravity, it may be assumed that the riboflavin content was correspondingly higher.

Taking 25 μ gm./gm. and 2 μ gm./c.c. as possible values for yeast and ale, it would follow that for a total amount of 8,000 μgm. each pint of ale yeast contained approximately 300 gm. of wet yeast. Such a quantity is, however, unlikely since it is generally assumed that 5–8 lb. of brewers' yeast for 280 lb. of flour (that is, 25 gm. per 2 lb. of flour) is the limit, at least in bread-making, before a bitter taste appears. We have, therefore, so far been unable to explain satisfactorily the riboflavin values found in these ancient buns. It is, however, due either to the high value for the yeast or beer of those days, or to the larger quantity that could be used. It is also of interest to note that the bread made at that time would probably also have a higher riboflavin content than even present National bread (approximately 1·1 μg./gm.), and this fact will be of importance in any historical survey of riboflavin intake.

The average figure of 0·15 I.U./gm. for the vitamin B_1 content of the buns shows that, unlike the riboflavin, there had been considerable destruction of this vitamin in the 50–80 year interval. It is difficult to fix with any accuracy the extraction of the flour used, but the fibre figure suggests an extraction in the region of 80 per cent.

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[1] Barton-Wright, E. C., and Booth, R. G., *Biochem. J.*, **37**, No. 1, 25 (1943).
[2] Davis, C. F., Laufer, S., and Saletan, L., *Cereal Chem.*, **20**, No. 1, 109 (1943).