

$\pm .078$ . It must also mean the simultaneous laying down of more protein and carbohydrate, for the following reasons: (1) the amount of ether extract found in tubers is insufficient to account for all the increase in dry matter; (2) the protein and carbohydrate are sufficient to account for it; (3) the protein and carbohydrate are not correlated with the dry matter, but are correlated with each other negatively. As these organic constituents are increased the minerals are decreased, as is evidenced by the coefficient of  $-.380 \pm .076$  between the ash and dry matter. In fact the ash bears a negative relation to all the other factors studied, although in the majority of cases the coefficient is too small to be of significance.

From the above data we can conclude that it should be entirely possible to improve the potato tuber as regards protein, provided the dry matter be increased. Mealiness can then still be maintained. This improved tuber will probably be spheroidal, instead of long in shape, since the longitudinal diameter is correlated positively with the starch content.<sup>1</sup>

TABLE I. SUMMARY OF CORRELATIONS AMONG THE VARIOUS FACTORS IN POTATO TUBERS.

	Dry Matter.	Nitrogen.	Ash.	Ether Extract.	Starch plus Sugar.
Specific gravity	$+0.637 \pm 0.054$	$-.233 \pm 0.084$	$-.311 \pm 0.082$	$-.164 \pm 0.087$	$+0.218 \pm 0.086$
Dry matter....		$+0.034 \pm 0.090$	$-.380 \pm 0.076$	$+0.333 \pm 0.078$	$+0.059 \pm 0.090$
Nitrogen.....			$-.052 \pm 0.090$	$+0.216 \pm 0.086$	$-.590 \pm 0.058$
Ash.....				$-.116 \pm 0.088$	$-.223 \pm 0.085$
Ether extract..					$+0.004 \pm 0.090$

176 (1923)

### Yeast as a source of vitamine-B for the growth of rats.

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Yeast is commonly considered the richest source of vitamine-B for the growth of young animals. We have fed groups of rats

<sup>1</sup> Renski, M. D., Abs. in *Exp. Sta. Rec.*, 1911, xxiv, 439.

in colonies on a basal diet of purified casein 18 per cent., salts 3.7 per cent., agar 2 per cent., butter fat 5 per cent., with dextrin to make 100 per cent., and have supplied the vitamine-B in the form of dried yeast of various sources, both as an integral part of the diet or separately in the form of a tablet. Our results were as follows:

Air-dried Fleischmann's baker's yeast containing 40 per cent. yeast in the dried product failed to produce normal growth in all cases when the ration contained 4 per cent. or less of the dried product. and certain individuals even failed to make normal growth when the dried yeast formed 10 per cent. of the diet. Out of 20 rats, 9 were females, and none of these produced young during the 2 to 4 months of the experiment.

When the same yeast was fed separately, 0.6 gram per day per rat was required to secure normal growth. Two out of 4 females on this diet produced young (total of 3 litters) but all the young were destroyed by the mothers.

A dried brewer's yeast prepared by us from a wet mixture of bottom yeast and wort secured from a local brewery produced only about one-half normal growth when fed as high as 10 per cent. of the diet, but when these rats were transferred to a mixed diet of grains and milk their growth curves rose sharply towards the normal. When the same yeast was fed separately to other rats at the rate of 0.2 and 0.4 gram per day per rat the results were little better than when the yeast was incorporated in the diet at the rate of 10 per cent. There was no reproduction.

*Saccharomyces cerevisiæ* was grown by us in a wort of malt extract which also contained a little extract of hops. The filtered, washed yeast was air-dried. When fed at the rate of 0.2 gram a day as a supplement to the basal vitamine-B-free ration the rats made a continuous slow growth but the mature rats were undersized, the males averaging about 200 grams and the females about 160 grams. One female had 2 litters, but the young all died in the first case and in the second case they were so poorly nourished that they had not left the nest after 4 weeks. These young rats later died in convulsions after they had become large enough to eat their mother's ration.

Young rats fed a dried distiller's yeast at the rate of 0.2 gram daily made poor growth or none at all during a period of 4 weeks.

Fleischmann's starch-free yeast air-dried by us did not produce normal growth when 0.2 gram of the dried yeast was fed daily. Growth was not stimulated appreciably even when the amount was increased to 0.6 gram daily although one female produced a litter of 3, two of which died soon after birth and the remaining one of which never grew normally. Better results were secured for a time in the case of other rats fed 0.2 gram daily of dried starch-free yeast furnished us by the Fleischmann Yeast Co. in the dried form but this growth was not maintained when the yeast was increased to 0.4 gram daily. At the end of 16 weeks all these rats were undersized and no young were produced.

Our results show clearly that yeast is a variable source of vitamine-B for growth and cannot be accepted as a standard product in experiments in which a vitamine-B preparation is required. Its efficacy depends upon the manner in which it is fed, the species of yeast, and apparently also on the character of the wort in which it is grown. Our results do not support the general belief that yeast is an unusually rich source of vitamine-B for growth.

Especially striking were the consistent failures of the rats fed yeast as the sole source of vitamine-B to reproduce normally. In fact, in most cases no reproduction was secured, although each colony contained animals of both sexes. These results, especially, have raised grave doubts in our minds as to the suitability of yeast as a source of vitamine-B in nutrition experiments.