protein was replaced by cereal protein, fruit and cream remaining the same, the total calories being equalized by variations in the amount of sugar and corn starch taken. Wheat products gave slightly better replacement values than oats and corn products.

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Vitamine studies with menhaden fish meal and menhaden oil.

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Experiments were carried out with white rats in which the value of menhaden fish meal and menhaden oil was tested as a preventive or cure of Xeropthalmia, using various basal rations. Without exception the results were as follows:

1. Fish meal fed at levels of 10, 20 and 30 per cent did not prevent Xeropthalmia, nor cure it.
2. Menhaden oil fed at levels from 2 to 30 mg. daily both prevented and cured Xeropthalmia.
3. An alcoholic extract of fish meal fed at levels which made the fat content of the basal ration equal to that of the above mentioned menhaden oil rations, did not cure nor prevent Xeropthalmia.

The fish meal used in these studies was a product that had been on hand for some time. In showing that as small an amount as 2 mg. daily of menhaden oil prevented Xeropthalmia, it became evident that originally the fish meal must have contained vitamin A, since considerable of the oil is left in the residue after pressing. However, since neither the high percentage of fish meal fed, nor the concentrated alcoholic extract was effective, it must be concluded that the vitamin remaining in meal after pressing is destroyed in later processing or in storage.

Further studies were carried out to observe the influence of fish meal and menhaden oil on calcification. For these studies the fish meal and menhaden oil were obtained directly from the manufacturer, the menhaden oil having been expressed from the sample of fish meal in question.

Steenbock's rachitic ration consisting of yellow corn 76, wheat gluten 20, calcium carbonate 3, and sodium chloride 1, was used. Forty-eight rats were divided into four groups as follows: group 1, basal ration; group 2, basal ration plus 2 mg. menhaden oil daily; group 3, basal ration plus 2 mg. cod liver oil daily; group 4, basal ration in which 20 per cent of fish meal was substituted. At the end of 1, 2 and 3 weeks four rats were removed from each group and the ash content of the femur and tibia determined—a measure of calcification suggested by Dutcher.[1] The results were as follows:

AVERAGE ASH CONTENT OF FEMURS.

Ration	No. of weeks		
	1	2	3
Basal	43.86 ± .61	39.42 ± .89	40.19 ± .31
Basal + 2 mg. menhaden oil	44.29 ± .76	36.67 ± .39	37.50 ± .41
Basal + 2 mg. cod liver oil	39.83 ± .61	45.45 ± .28	44.99 ± .76
Basal + 20 per cent fish meal	49.79 ± .84	52.08 ± .71	57.14 ± .26

Over the three-week's period the ash content decreased with the basal ration and was increased by the addition of cod liver oil, as was expected. The addition of the 2 mg. of menhaden oil had little influence in increasing the ash content over that of the basal ration. Thus the amount of the oil which proved adequate for curing Xeropthalmia had no apparent influence on calcification.

Because of the large percentage of fish meal used in the fourth ration the calcium and phosphorus relations were made somewhat more favorable for calcification than was the case with the basal ration, and the increased calcification obtained with the fish meal ration is not proof that the meal contains the antirachitic factor. Further studies of this question are in progress.

[1] Dutcher, R. A., *Penn. An. Rpt.*, 1925.