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SOME OBSERVATIONS ON THE RELATION OF THE COMPOSITION OF THE DIET TO LACTATION

P. D. WILKINSON AND V. E. NELSON

The previous paper reports a series of experiments in which three different varieties of soy beans were fed to rats at levels from ten to seventy-three and three tenths percent as the sole source of vitamins B and G. Normal growth was observed on all the levels of each variety of soy bean. The high mortality of the adults on the ten percent level of Virginia soy bean indicated a border line supply of vitamins B and G. Satisfactory lactation was not obtained on any of the experiments where soy beans were included in the diet as the only sources of vitamins B and G. It was therefore deemed advisable to ascertain if the soy bean rations could be supplemented by a single food stuff so that lactation would be normal.

McCollum, Simmonds, and Pitz (1) fed various levels of kidney, liver, and muscle to rats as the sole source of both protein and vitamin B. They succeeded in raising four generations of animals, although there was a high mortality amongst them. Watson (2) employed a diet of one hundred percent of ox meat and reported difficulty with both reproduction and lactation. Hitchcock (3) tried supplementing the diet of nursing mother rats with meat. He does not report the composition of the balance of the diet, but from the text it appears to have been his regular stock ration. He observed an increased rate of growth of the young. It is not necessary to review all of the literature on the role of meat in the diet, since it is extensive and has but little application to the problem at hand.

The evidence of many previous workers seems to indicate that animals do not have the ability to store vitamins B and G. Pregnant females from our breeding stock were therefore used as the experimental animal. The stock animals had been raised on a mixture of feeds that has proven comparatively adequate over a period of years. The litters were delivered from one to five days after the animals were placed in individual cages on the experimental diets. Each female was given six young to wean. This number, six, was arbitrary but seemed sufficient for any one mother to

care for and should place an equal burden on all of the females so that interpretation of the results ought to be more easy of accomplishment. The animals had access to distilled water and the experimental rations at all times. The young were considered weaned at thirty days. Records were kept for each experiment of the number of litters born, the number of young born, time of death of the young, number of young weaned, and the average weight of the young on each ration when weaned. Observation has shown that occasionally females kept on the growing ration refuse to nurse their young and even kill them at birth. For this reason the calculation of the percent mortality of the young is based on the number surviving on the eighth day.

The control diet consisted of the following: — casein eighteen percent, salt mixture 185, three and seven-tenths percent, filtered butter fat five percent, Virginia soy bean (cooked for three hours with steam at atmospheric pressure, dried and ground) fifteen percent, and dextrin fifty-eight and three-tenths percent. The mortality of the young on this ration was eighty-eight percent. The average weight of the four young that were weaned was twenty-two grams. The other rations were similar in composition to the control diet, except that part of the dextrin was replaced by the various organs under investigation. The organs tested were the following: — lung, spleen, pancreas, brain, kidney, thymus, liver and heart. They were obtained from hogs and cattle.

Hog lung, hog spleen, hog pancreas, and beef thymus had very poor supplementary value for lactation. The percent mortality of the young from the mothers receiving these products was high, and the weight of the young when weaned was low. The percent mortality was eighty-three, seventy-five, seventy-two, and sixty respectively, whereas the weight of the young when weaned was for hog lung twenty-two grams, hog spleen twenty-two grams, hog pancreas twenty-nine grams, and for beef thymus twenty-six grams. Beef pancreas seemed to give slightly better results than hog pancreas. The average weight of the young when weaned from mothers on beef pancreas was higher (forty-one grams) and the percent mortality lower (fifty-four percent). The percent mortality of these young, however, was still considerably higher than on many other rations. Brains, both beef and hog, gave better results than any of the organs so far mentioned. The percent mortality on hog brain was twenty-six, whereas on beef brain it was thirty-four. The young from mothers on hog brain averaged thirty-nine grams when weaned, while the young from mothers

receiving beef brain averaged twenty-eight grams when weaned. The mortality of the young from mothers receiving beef heart was eighty-seven percent, while the three young that were weaned averaged fifty-one grams at thirty days. This is a higher weaning weight than was obtained on any of the organs so far mentioned for any one female with a comparable number of young to wean. The best results in this series of experiments were obtained on diets supplemented with twenty-five percent of either hog kidney, beef liver, or hog liver. With the exception of the animals on hog liver the percent mortality was low, and on all three diets the average weaning weight was above sixty grams. The mortality of the young was for hog liver fifty-three percent, for beef liver, twenty-eight percent, and for hog kidney twenty-four percent. Thymus gland from young cattle gave results similar to beef pancreas. The mortality on beef thymus was sixty percent, and the average weight of the young at thirty days was twenty-six grams.

The effect of different levels of liver was next tried. The same basal ration containing fifteen percent of soy bean was used, and the other rations contained hog liver from five to thirty percent in place of an equivalent amount of dextrin. The mortality on the basal ration was eighty-eight percent, on the five percent hog liver fifty percent, on the fifteen percent level of hog liver fifty-five percent, fifty-three percent on the twenty-five percent hog liver, while only six percent mortality was obtained on the thirty percent hog liver. The average weaning weights in the same order were twenty-two grams, thirty-eight grams, fifty-seven grams, sixty-one grams, and sixty-six grams. The weaning weight increased as the amount of liver in the diet was increased.

Guest, Nelson, Parks, and Fulmer (4) made extensive studies on various grains as the only source of vitamin B. They employed a highly purified diet consisting of casein, butter fat, salt mixture, various amounts of grain, and sufficient dextrin to total one hundred percent. They found lactation very unsatisfactory on these diets. The effect of liver in supplementing one of the diets of the above investigation was therefore attempted. The ration used was the one containing thirty percent of wheat as the sole source of vitamins B and G. Another group of rats received this same ration with five percent of liver in place of an equal quantity of dextrin, whereas two other lots received fifteen and twenty-five percent of liver for an equivalent quantity of dextrin. The mortalities on the rations in the order named were fifty, seventy, ten,

and eight percent; and the average weights when weaned were twenty-four grams, thirty-four grams, fifty-one grams, and fifty grams. The results indicate a marked supplementing action of liver and wheat when the latter constitutes the only source of vitamins B and G.

SUMMARY

Lactation is unsatisfactory on a basal synthetic ration containing fifteen percent of Virginia soy bean as the sole source of vitamins B and G.

Hog lung, hog spleen, hog and beef pancreas, and beef thymus did not supplement the fifteen percent of soy bean so as to render satisfactory lactation.

Beef and hog liver and hog kidney markedly improved the lactation of the soy bean ration.

Thirty percent of wheat as the only source of vitamins B and G did not permit of satisfactory lactation.

The thirty percent wheat ration was markedly improved for lactation by the addition of liver.

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