

Accelerated Rat Growth Rate on Dietary Nitrogen Obtained from Pancreas.*

ABRAHAM WHITE AND MARION A. SAYERS.

From the Department of Physiological Chemistry, Yale University School of Medicine, New Haven.

During the course of an investigation of the problem of the parenteral utilization of nitrogen derived from protein sources, it became of importance to obtain a readily-available, nutritively-adequate protein as starting material for these studies. One of the methods employed for establishing the nutritive value of the various proteins has been a study of the comparative rates of rat growth on diets which differed from one another only in the kind of dietary protein nitrogen. The standard level of protein used has been 18% of the basal diet, and for each protein source the protein content was calculated on the basis of percent nitrogen of the preparation multiplied by the factor 6.25. Each source of protein nitrogen was thus incorporated in the basal diet in comparable quantities, and, although this nitrogen was not, in all instances, entirely in the form of protein, the various diets used were approximately equivalent in their protein content.

The preliminary data which have been obtained are striking in that they reveal a marked rate of rat growth on a basal diet in which the nitrogen is furnished by a protein preparation derived from pancreas tissue. Indeed, in terms of rate of rat growth, this pancreas product is definitely superior to casein insofar as its capacity to promote the growth of the rat is concerned.

Experimental. Male, white rats of the Yale strain were placed at weaning on one of the several basal diets shown in Table I. In addition, each animal received a daily supplement of 400 mg of dried yeast† and 200 mg of cod liver oil. The basal diets were

fed *ad libitum*. The rats were weighed twice weekly; an accurate measure of food consumption was kept.

The pancreas materials used were kindly furnished by The Laboratory of Biochemistry, Medical-Research Division, Sharp & Dohme, Inc.; the preparation and preliminary characterization of these products will be found in the preceding communication.¹ This same laboratory also supplied the soy bean protein and the beef serum preparations.‡ The heat-coagulated beef serum protein was obtained as follows: Whole dried serum was heated to boiling in water solution at pH 5.0. After centrifugation, the gummy, lipid-containing material that floated to the top was skimmed off and discarded. The coagulated protein was washed with water and dried with acetone. The soy bean protein was prepared essentially as described by Smith and Circle.² Commercial "soy bean protein" was extracted with 0.05 N NaOH (16 liters per kg of protein). The extract (pH 7.8) was filtered and adjusted to pH 4.1-4.2 with sulfuric acid and the precipitate ("glycinin") filtered, washed with water and dried with acetone. The dried protein was placed in the oven at 105°C for 100 min. This "toasting" procedure was used because of the report³ that "toasted" soy bean protein has a higher nutritive value than does unheated material.

¹ Kazal, L. A., Westfall, R. J., Ciereszko, L. S., Risley, E. A., and Arnow, L. E., *Proc. Soc. Exp. Biol. and Med.*, 1942, **51**, 268.

‡ The whole dried beef serum was made available to Sharp & Dohme through the courtesy of Dr. David Klein of the Wilson Laboratories.

² Smith, A. K., and Circle, S. J., *Ind. Eng. Chem.*, 1939, **31**, 1284.

³ Wilgus, H. S., Jr., Norris, L. C., and Heuser, G. F., *Ind. Eng. Chem.*, 1936, **28**, 586.

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† Northwestern Yeast Co., Chicago, Illinois.

TABLE I.
Percentage Composition of Basal Diets Employed in Growth Studies.

Diet	A	B	C	D	E	F	G
Sucrose	15	15	15	15	15	15	15
Salts (Osborne and Mendel*)	4	4	4	4	4	4	4
Crisco	25	25	25	25	25	25	25
Starch	34.6	38	34	34	30	31	35
Commercial Casein	21.4						
Pumpkin seed globulin		18					
Pancreas protein (P-1)			22				
Pancreas protein (P-2)				22			
Dried whole beef serum					26		
Heat-coagulated beef serum protein						25	
Soy bean protein							21

*Osborne, T. B., and Mendel, L. B., *J. Biol. Chem.*, 1919, **37**, 557.

TABLE II.
Average Daily Weight Gains and Food Consumptions of Rats on Various Basal Diets.

Diet	No. of animals	Avg daily wt gain, g	Avg daily food consumption, g
A (commercial casein)	3	4.4	8.0
B (pumpkin seed globulin)	5	2.3	5.7
C (pancreas protein; P-1*)	14	5.9	10.8
D (pancreas protein; P-2)	4	3.0	7.0
E (dried whole beef serum)	4	2.5	5.7
F (heat-coagulated beef serum protein)	3	1.9	4.7
G (soy bean protein)	4	1.0	5.5

*The various P-1 preparations mentioned in the preceding paper¹ appear to be equally effective in maintaining an accelerated growth rate.

The casein was a commercial product.[§] Pumpkin seed globulin was prepared from *Cucurbita moschata*.⁴

In Table II are summarized the data obtained for growth and food consumptions of the animals during the first 28 days on the diets after weaning. It is apparent that young rats ingesting a basal diet in which the so-called whole pancreas residue product (P-1) supplies the protein nitrogen (except for that derived from the daily yeast supplement) exhibit a marked rate of growth. This rate is considerably better than that observed for animals on basal diets containing a variety of other kinds of protein. The food consumption of rats ingesting the basal diet containing the pancreas preparation is also markedly higher than that of animals eating any one of the other basal diets.

It may be added that, although the data in Table II represent only the growth rate

for a 28-day period, the rats on the pancreas and casein basal diets have been permitted to continue on these rations. In these experiments, the daily vitamin supplement has been doubled for each animal as it reached a body weight of 125 g. The animals ingesting the whole pancreas protein residue-containing basal diet continue to exhibit the same high rate of body weight gain until a body weight of approximately 200 to 250 g has been attained. After this time, the rate of weight gain becomes less but continues to be definitely greater than that of litter-mate animals of the same age on a casein-containing basal diet. For example, one of the animals on the diet containing the whole pancreas protein residue has at this writing attained a body weight of 640 g at an age of 145 days, having shown a total weight gain of 600 g since weaning; casein-ingesting, litter-mate controls of the same age now weigh, on the average, 490 g. The ratio of body length to body weight of all animals is quite similar.

[§] Lister Bros., New York.

⁴ Vickery, H. B., Smith, E. L., Hubbell, R. B., and Nolan, L. S., *J. Biol. Chem.*, 1941, **140**, 631.