XIII. A NOTE ON THE CALCIUM AND PHOSPHORUS REQUIREMENT OF RACHITIC RATS

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A QUESTION it will be of interest to discuss in connexion with the experiments given in the preceding paper (p. 101) is how far the daily requirement is satisfied by the absorbed amounts of Ca and P. Karelitz & Shohl [1927] have discussed this in connexion with their metabolism studies on rachitic rats fed on a Steenbock-Black diet modified by the addition of 10% fat, but their reasoning is open to criticism, and a recalculation is needed. This must be based on the daily requirement of the growing rat, and the data obtained by Sherman *et al.* [1925; 1926] will be used for this purpose. They find the following figures for the Ca content of the whole rat: 0.7% at the age of 30 days, 0.8% at the age of 60 days and 1.0% at the age of 90 days. When growth is retarded, owing to deficiency in any growth-promoting factor, the percentage of Ca in the body increases, but the absolute content is always kept lower than in the body of normal rats of the same age. The rats used for production of experimental rickets are generally 30–60 days old. We can therefore assume an average Ca content in these rats of 0.75%. Retarded growth will, according to the above-mentioned observation, give rise to a negligible error only. For each g. increase in body weight the requirement of the rat will be 7.5 mg. Ca. The rats fed on a Steenbock-Black diet grow on an average 1 g. daily in the first weeks, mostly independently of the addition of vitamin D to the diet. The daily requirement will therefore be 7.5 mg. Ca. A calculation of the daily requirement of P in the same way gives the daily need 4.5 mg.

The amount of Ca absorbed in normal rats is 34 mg. per day, or nearly five times the amount needed. The rachitic rats absorb about twice their daily requirement. The fate of this surplus of Ca is well illustrated by Karelitz & Shohl's experiments, performed however on rachitic rats only. These rats absorbed during 5 weeks 15 mg. Ca daily, and lost 5 mg. daily in the urine, an amount far above the normal for a rat. It is of interest in this connexion to mention that Pollak [1934] found kidney and bladder stones in nearly all normal rats fed the same amount of CaCO_3 as is contained in the Steenbock-Black diet.

The absorbed amount of P, on an average, just covers the requirement of normal rats, and is about 70% below the requirement of the rachitic rats. It is in accordance with this that Karelitz & Shohl find only 0.3 mg. P excreted per day in the urine.

The criticism to which one must subject the calculation of Karelitz & Shohl is that they calculated the requirement according to the growth rate of a young rat fed on a diet good in every respect. The growth rate is then about 3 g. daily, as compared with about 1 g. on a Steenbock-Black diet even with an ample supply of vitamin D. Karelitz & Shohl conclude that their rachitic rats retain

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only 50 % of the requirement of Ca, and only 20 % of the P. This in spite of their observation: "The rats did not gain regularly, nor were their gains uniform. For the two last weeks they lost weight."

It is at least possible that rats, if rickets could be induced in them when growing at a rate of 3 g. a day, would then also be able to absorb more Ca. Not only would the intake increase, but also the activity of the digestive tract, including a quicker flow of the digestive juices, upon which the ability to dissolve and therefore absorb CaCO_3 depends.

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