

electric method for the quantitative estimation of glucuronic acid and conjugated glucuronides in human urine. They made use of the color developed by the reaction of the glucuronide with naphthoresorcinol on being heated with hydrochloric acid.

The experimental procedure was as follows: 24-hour urine samples of normal male subjects were collected for 4 days. On the fifth day, 5 g of phenylacetic acid—which is as much as can be conveniently tolerated—previously neutralized with 0.2 molar NaOH, were ingested. The urine was collected for the next 5 days. The amount of glucuronide was determined in each 24-hour sample according to the method previously referred to.⁵ The analyses were carried out in a photoelectric colorimeter of the type described by Withrow, Shrewsbury, and Kraybill.⁶ The results with 8 subjects are shown in Tables I and II.

Conclusion. Dealing first with normal (control) urines, the amount of glucuronic acid in 24-hour samples varied from 350-650 mg, with an occasional lower or higher figure. These results agree well with those obtained by Maughan, Evelyn, and Browne⁶ and by Roe and Hall.⁷ Next, with regard to the effect of ingesting 5 g of phenylacetic acid, we find that this results in an average increase of 535 mg, an amount which corresponds to a detoxication by glucuronic acid of 7.5% of the phenylacetic acid ingested.

11235 P

Metabolic Studies in Dermatomyositis, with a Note on the Effect of Wheat Germ.*

A. T. MILHORAT, F. C. WEBER AND V. TOSCANI.

From the Russell Sage Institute of Pathology in affiliation with the New York Hospital, and the Departments of Medicine, Psychiatry and Pharmacology, Cornell University Medical College, New York.

Patients with dermatomyositis frequently have extensive changes in the skin, muscles and bones. In addition, many patients have symptoms of Raynaud's Disease. The muscular disability in dermatomyositis can be as marked as that occurring in advanced pro-

⁶ Withrow, R. B., Shrewsbury, C. L., and Kraybill, H. R., *Ind. Eng. Chem., Analyt. Edition*, 1936, **8**, 214.

⁷ Roe, J. H., and Hall, J. M., *J. Biol. Chem.*, 1939, **128**, 329.

* Aided in part by a grant from the National Foundation for Infantile Paralysis, Inc.

gressive muscular dystrophy with extreme wasting and weakness. On radiographic examination, the bones often show areas of rarefaction, and in some instances complete absorption of the distal phalanges of the fingers. Deposits of calcium in the subcutaneous tissues are a frequent finding. Despite the extensive lesions that occur in dermatomyositis, few studies of the metabolism of patients with this condition have been made.

The object of the present investigations was to obtain a clearer understanding of the changes occurring in the muscles and bones. The studies included complete balances of calcium, phosphorus and magnesium at different levels of intake. In addition, the urinary excretion of creatinine and creatine was determined daily over periods of several months while the patients were receiving various substances that were being studied for their possible therapeutic effects.

Observations and Discussion. Calcium, Phosphorus and Magnesium: The data on the balance of calcium and phosphorus are shown in Table I. The most significant finding was the relatively low urinary excretion of calcium in both patients. Whereas the ratio of urinary calcium to fecal calcium in normal subjects usually is of the order of 1:5, the ratio in both patients was about 1:13. The metabolism of phosphorus is of interest, although probably of less significance, in that there appeared to be a diminished ability to store phosphorus when the daily intake was around 2.0 g. The magnesium balance was normal.

Creatinine and Creatine: The data on the metabolism of creatinine and creatine are presented briefly in the chart (Fig. 1). In both patients, the urinary excretion of creatinine was diminished, and ap-

TABLE I.

Balance of Calcium and Phosphorus at Different Levels of Intake.

There were 5 days in each period during which the diet was constant. Each period was preceded by a preliminary period of 5 days during which the diet was similar to that of the experimental period.

Patient	Period	Intake		Output				Balance	
		Ca mg	P mg	Urine		Feces		Ca mg	P mg
				Ca mg	P mg	Ca mg	P mg		
1	I	1149	1485	61	830	806	368	+282	+287
	II	102	627	30	467	214	197	-142	-37
	III	2016	1900	92	1222	1560	640	+364	+38
2	I	1016	1441	49	800	760	458	+207	+183
	II	102	627	21	454	188	178	-107	-3
	III	2007	2060	96	1205	1700	888	+211	-33

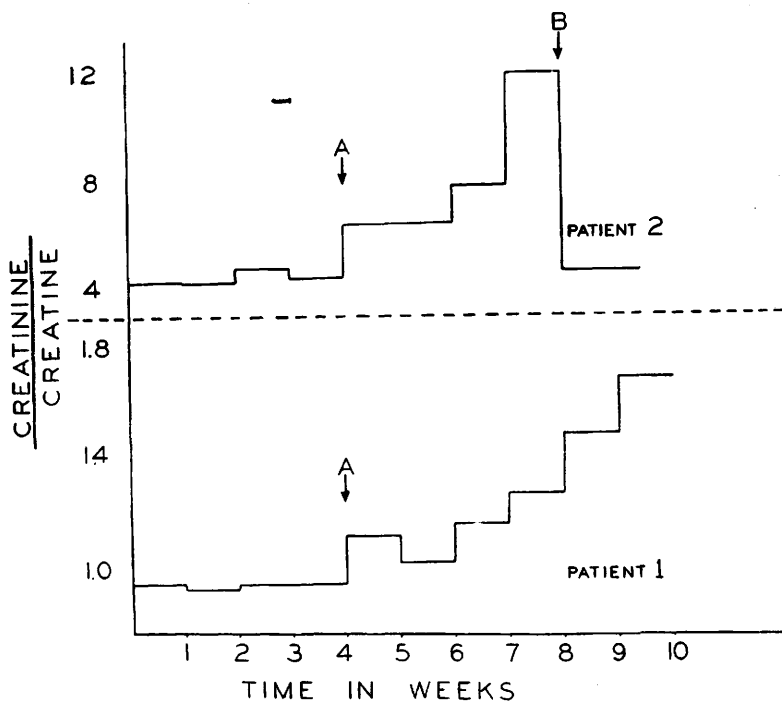


FIG. 1.

Effect of wheat germ on the ratio, $\frac{\text{urinary creatinine}}{\text{urinary creatine}}$. Administration of 125 g wheat germ daily started at "A," and stopped at "B."

peared to be proportional to the amount of muscular wasting. In Patient 1, both the amount of muscular wasting and the decrease in urinary creatinine were of the same order as those seen in patients in the advanced stages of progressive muscular dystrophy. In this patient the amount of daily creatinine was only 0.300 g, and the creatinine index was only 7.

Both patients excreted considerable amounts of creatine and showed an impaired ability to retain ingested creatine. Patient 1, with the more extensive muscular changes, excreted the larger amounts, namely, around 0.350 g daily, and of an ingested dose of creatine only 30% was retained.

Effect of Wheat Germ: Wheat germ was found to have a significant effect on the metabolism of creatine and creatinine in both patients (chart). The patients each were given 125 g of wheat germ mixed in tomato juice daily. After a period of about 2 weeks, there was a striking and progressive decrease in the creatinuria with a

slower rise in the creatinine excretion. Concomitant with these metabolic changes, the clinical condition of the patients improved steadily. Muscular function increased, the tightness of the skin diminished, and the patients were able to perform muscular tasks that had been impossible for a long time.

In one series of experiments a year ago the wheat germ was incubated with normal gastric juice at 37°C for about one hour before it was administered. Patient 1 showed a definite response to wheat germ prepared in this manner. However, untreated wheat germ appeared to be equally effective when given in large amounts. When the administration of wheat germ to Patient 2 was discontinued, the creatinuria increased to the level observed before the period when wheat germ was given.

The parenteral administration of riboflavin and vitamin B₆ daily for 6 weeks was without effect.

Patients with dermatomyositis often improve spontaneously. However, the results of this study are suggestive and warrant further investigations along these lines. Since dermatomyositis is a comparatively rare condition it is hoped that other workers will study these effects of wheat germ.

Summary. Two patients with dermatomyositis showed a decreased excretion of urinary calcium and an apparent impaired ability to store phosphorus. The amounts of urinary creatinine were diminished proportionally to the amounts of muscular wasting. Both patients had considerable creatinuria and an impaired creatine tolerance. Prolonged administration of large amounts of wheat germ was followed by decrease in creatinuria, increase in urinary creatinine, and definite clinical improvement.