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Secondary Calcium Phosphate Prevents and Cures Rickets Without Vitamin D. 3. Solubility Studies.

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In the experiments here reported, artificial digestion of calcium salts was carried out by shaking an excess of the respective salts with water or hydrochloric acid of 0.1, 0.2, and 0.4% strength. Ten grams of the calcium salt were digested for 24 hours in 100 cc. of the solvent at a temperature of 38°C. The strength of acid and the temperature thus simulated conditions encountered in the animal organism. The suspensions were shaken at 15-minute intervals during the day, but remained undisturbed over night. That this procedure resulted in complete saturation was demonstrated by the repetition of some of the experiments, employing a shaking machine contained in an air thermostat adjusted at 38°C., which corroborated the solubility figures to be reported. At the completion of the digestion the suspensions were rapidly centrifuged and the clear supernatant liquids analyzed for calcium and phosphorus.

In so far as the solubility of these salts in the acid medium of the stomach is concerned, the results indicate that calcium in the form of unrefined dicalcium phosphate* is from 1.7 to 2.7 times as avail-

TABLE I.
Available Calcium in Solutions of Different Salts in Hydrochloric Acid and Water at 38°C.

Solvent	Salt	Cal. per 100 cc. Filtrate
		mg.
Water	Dicalcium Phosphate (unrefined)	39.5
	Dicalcium Phosphate (refined)	15.1
	Tricalcium Phosphate	15.8
	Bone Meal	8.0
0.1% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	154.8
	Dicalcium Phosphate (refined)	131.6
	Tricalcium Phosphate	68.3
	Bone Meal	56.7
0.2% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	266.6
	Dicalcium Phosphate (refined)	247.2
	Tricalcium Phosphate	119.6
	Bone Meal	130.3
0.4% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	503.0
	Dicalcium Phosphate (refined)	484.7
	Tricalcium Phosphate	252.0
	Bone Meal	290.4

* Dicapho, manufactured by the Bay Chemical Co., New Orleans, La.

TABLE II.
Available Phosphorus in Solution of Different Salts in Hydrochloric Acid and Water at 38°C.

Solvent	Salt	Phos. per 100 cc. Filtrate
		mg.
Water	Dicalcium Phosphate (unrefined)	36.0
	Dicalcium Phosphate (refined)	24.6
	Tricalcium Phosphate	55.6
	Bone Meal	1.9
0.1% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	104.8
	Dicalcium Phosphate (refined)	93.9
	Tricalcium Phosphate	55.3
	Bone Meal	13.2
0.2% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	187.3
	Dicalcium Phosphate (refined)	183.0
	Tricalcium Phosphate	60.3
	Bone Meal	37.1
0.4% Hydrochloric Acid	Dicalcium Phosphate (unrefined)	354.8
	Dicalcium Phosphate (refined)	340.8
	Tricalcium Phosphate	82.5
	Bone Meal	100.9

able as the calcium in bone-meal; and that the phosphorus in unrefined dicalcium phosphate is from 3.5 to 8.0 times as available as the phosphorus in bone meal. Refined dicalcium phosphate† is slightly less soluble in the acid media than is unrefined dicalcium phosphate. The tricalcium phosphate used in these experiments showed better solubility than bone meal in the weaker dilutions of hydrochloric acid, but this superiority diminished with increasing strength of acid.

Conclusions. From the standpoint of solubility in hydrochloric acid solutions of the concentration and at the temperature of gastric juice, unrefined dicalcium phosphate is greatly superior to bone meal. The calcium and phosphorus of unrefined dicalcium phosphate are also more available than these elements in the form of tricalcium phosphate. Refined dicalcium phosphate bears a similar relation to these salts as unrefined dicalcium phosphate does, although the solubility figures for the latter are slightly higher.

† Dicalfos, manufactured by the Bay Chemical Co., New Orleans, La.