the wood of belladonna root are fully comparable with the results on chestnut wood on the more aqueous mixtures. With the more highly alcoholic liquids there is less swelling in the case of belladonna wood than in the case of chestnut wood. It would seem that woody tissues may differ more in behavior to alcohol than to water. The effects of mixtures of liquids on the swelling of the wood of belladonna root are in accord with previous conclusions that the effect of a mixture of two liquids is practically an average of the effects of the liquids themselves when allowance is made for the relative proportions. It is noteworthy that glycerin causes considerable swelling of the belladonna wood in two hours (60% as much as caused by water) whereas glycerin causes only a very slight swelling of chestnut wood (5% as much as caused by water). It should be noted that alcohol had exactly the reverse effect, causing no swelling in the case of belladonna wood but giving considerable swelling with chestnut wood (75% as much as caused by water). The opposite behavior of the two liquids with the two kinds of woody tissue is an example of a principle of colloidal chemistry, *i. e.*, that the swelling of gels is a process of highly selective character. Each gel shows an ability to take up a certain particular liquid (3). Further study of the swelling of drugs should lead to a better understanding of the fundamental principles involved and of their significance in the processes of drug extraction.

The results on percolation of belladonna root with alcohol-water mixtures are in general agreement with the work of Farr and Wright (4). A search of the literature shows that alcohol alone has not been favored as a menstruum for this drug, the trend having been toward the use of 50% to 85% alcohol.

SUMMARY.

A study has been made of the swelling of the wood of belladonna root in binary mixtures of water, alcohol and glycerin. Percolation tests show that within the limits of No. 20 and No. 80 powder, the finess of powder is of minor importance in the extraction of belladonna root. By a series of percolations of belladonna root, using various alcohol-water mixtures, it was found that mixtures ranging from alcohol 5 vol.—water 1 vol. to alcohol 1 vol.—water 1 vol. give the best results.

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COMPARATIVE STUDIES ON THE UTILIZATION OF DIFFERENT MAGNESIUM SALTS.*

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Although considerable work has been done on magnesium metabolism little data are available concerning the relative utilization of the naturally occurring

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magnesium compounds of foodstuffs as compared with the lactate and citrate and the inorganic magnesium compounds. Contrary to the usual conception certain magnesium salts are apparently well absorbed from the intestinal tract. Hirschfelder and Haury (1) found on an average in man 42.6 per cent of a purgative dose of Epsom salt excreted in the urine in 24 hours. Carswell and Winter (2) fed 8 Gm. of magnesium lactate to adult men and found approximately 50 per cent absorbed. Barbour and Winter (3) conclude that dogs absorb magnesium lactate and gluconate far more readily than magnesium oxide.

The purpose of the present investigation was to determine if the magnesium compounds of natural foodstuffs differed in their absorption and utilization from the lactate and chloride, young white rats being used as experimental animals. Calcium and phosphorus balances were carried on at the same time as the magnesium studies and in several cases the effect of marked dietary alkalinity on the utilization of these elements was studied. The calcium, phosphorus and magnesium concentrations of the various diets were kept relatively constant, the calcium concentration being approximately 450 mg., phosphorus 500 mg. and magnesium 240 mg. per 100 Gm. of ration.

Diets.—All of the diets with the exception of that used in experiment Number 4 were prepared from the following stock diet.

Yellow corn meal	710 Gm.
Meat meal	100 Gm.
Dried milk	50 Gm.
NaCl	5 Gm.
KCl	2.5 Gm.
Small amount of iron and trace of KI	

Dicalcium phosphate or calcium inosite-hexaphosphate (a commercial preparation known as calciphos being used) was added to this stock diet to give an adequate calcium and phosphorus content. Magnesium lactate or chloride was added to supply the magnesium. Wesson oil to the extent of 10 per cent of the diet was added to increase the fat content. In some cases sodium carbonate to the extent of 2 per cent was also added. The diet used in experiment Number 4 was made up as follows, alfalfa and linseed meal supplying most of the magnesium content.

Yellow corn meal	1000 Gm.
Meat meal	200 Gm.
Alfalfa	200 Gm.
Linseed meal	600 Gm.
Calcium lactate to give an adequate calcium concentration.	

During the experimental period the rats, two per cage, were kept in round metabolism cages beneath which was a wire gauze and glass funnel to collect feces and urine, respectively. The separation of urine and feces was, as a rule, quite complete but a small amount of spattered food was usually present in the urine. The collection of urine and feces was made at weekly intervals. The supporting funnel was always washed down with dilute hydrochloric acid and water so as to dissolve any precipitated salts, the washings being added to the urine. Distilled water was given at will and five drops of cod liver oil fed daily per cage.

Methods of Analysis.—Food and feces analyses were carried out by Morris, Nelson and Palmer's method (4). Urines were always acidified, when necessary, diluted to a definite volume, and aliquots taken for calcium and phosphorus analysis. Urine magnesium determinations were carried out on the calcium supernatant fluid in exactly the same manner as used for food and feces.

Remarks.—Experiment No. 1.—Diet contained $CaHPO_4$ and Mg lactate, Ca:P:Mg ratio was 1:1.066:0.593.

TABLE I.—UTILIZATION OF CA, P AND MG BY RATS.

Expt. No.	Cage.	Duration, Weeks.	Av. Gain per Week, Gm.	Average Daily Intake, Mg. Ca.	P.	Mg.	Average Daily Retention. Mg. Ca.	P.	Mg.	Per Cent. Ca.	P.	Mg.	% Mg Absorbed.
1	1	6	17	43	46	25	26	22	7.0	60	48	28	39
	2	6	20	45	48	27	31	22	7.6	69	46	28	41
2	1	5	18	43	45	19	29	24	3.5	67	53	18	30
	2	5	13	36	38	16	25	20	3.7	69	53	23	34
	3	5	12	46	48	20	28	21	3.4	61	44	17	31
3	1	6	21	42	45	25	22	19	5.1	52	42	20	30
	2	6	22	45	48	27	26	19	5.9	58	39	22	35
4	1	6	15	55	57	27	21	28	6.2	38	49	23	31
	2	6	14	58	60	28	22	31	6.8	38	50	24	30
5	1	5	25	55	59	31	32	35	5.4	58	59	17	29
	2	5	19	45	48	26	29	18	4.7	64	37	16	30
	3	5	17	46	49	27	29	18	4.7	63	36	16	30

Experiment No. 2.—Diet similar to Experiment No. 1, except that Ca:P:Mg ratio was 1:1.055:0.445. Same as in cages 1 and 2, plus 2 per cent Na_2CO_3.

Experiment No. 3.—Diet contained $CaHPO_4$ and $MgCl_2$, Ca:P:Mg ratio was 1:1.066:0.595.

Experiment No. 4.—Alfalfa and linseed meal diet, Ca:P:Mg ratio was 1:1.036:0.490.

Experiment No. 5.—Calcium inosite-hexaphosphate and Mg lactate diet, Ca:P:Mg ratio was 1:1.074:0.580. Experiment No. 6.—Same as foregoing, plus 2 per cent Na_2CO_3.

CONCLUSIONS.

It will be seen from Table I, which records the average weekly determinations of calcium, phosphorus and magnesium retention, that,

1. The different magnesium compounds used do not differ materially in either absorption or utilization. The variation in average daily retention is apparently not significant, since the greatest and least retentions were obtained with the same magnesium salt, Experiments 1 and 2.

2. The magnesium absorption, as measured by the sum of the urinary and retained magnesium, averaged 32.5 per cent of the intake, and varied between the limits of 29 and 41 per cent.

3. Carswell and Winter (2) have shown that after oral administration of magnesium lactate one may obtain either high calcium, low magnesium or low calcium, high magnesium retentions. Therefore, it is probable that the apparent effect of the naturally occurring magnesium compounds in linseed meal and alfalfa to produce a low calcium, high magnesium retention is not due to any difference of behavior of these compounds from that of the others.

4. Addition of sodium carbonate to the diet to the extent of 2 per cent had no unfavorable effect on the utilization of calcium, phosphorus or magnesium.

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