The distillate consisted of two layers, the lighter forming about ·80 per cent. of the whole and showing a spec. grav. of 0.86 at + 21°C. The heavier liquid had a specific gravity near 1.01 at the same temperature.

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THE INFLUENCE OF TARTRATES AND LACTATES UPON THE DIGESTION OF ALBUMINOIDS.

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In the digestion of albuminoids the chief agent is the gastric juice : upon its composition as regards strength in acid and in the amount of pepsin present depends the rapidity of its action and the completeness of the change it induces in the conversion of albuminoids into peptones.

It is obvious, therefore, that any chemical compound dissolved in the gastric juice which either modifies its acidity or influences by its action the pepsin itself will exert a corresponding effect upon gastric digestion.

Prof. Chittenden of Yale University has published (*Philadelphia Medical News*, February 16, 1889) data concerning the retarding influence of many chemical substances on the peptic digestive process. It may be stated as a general rule with but few exceptions that in experiments with hydrochloric acid pepsin solution the addition of soluble salts exercises an inhibitory action on the conversion of albuminoïds into peptones.

Not only is a certain acidity necessary for the best digestive action, but the character of the acid is even more important than the strength. Hydrochloric acid, the natural acid of the gastric juice is, as many experimenters have shown, the most powerful of the acids in its proteolytic action when combined with pepsin. As a generalization from the experiments recorded it may be remarked that the mineral acids have been found to favor digestive action in their combination with pepsin to a larger extent than the milder organic acids. Thus with oxalic acid one and one-half per cent. ($1\frac{5}{10}\%$) "dissolves about three-fourths as much proteid as the same amount of pepsin with 0.1 per cent. hydrochloric acid (Chittenden). In reference to acetic acid the same experimenter states "it is practically worthless."

In the course of an investigation made during the present year on the influence of the residues from baking powders upon the digestion of albuminoids some results were obtained which may be of interest and which certainly have a practical bearing on some of the questions which have been raised in the consideration of this class of food products. As is well known the amount of these saline residues is large in using any baking powder but larger in some classes than in others; thus, in proportion to the amount of carbonic acid liberated, the soluble residues of the cream of tartar class largely exceed that of either the alum or phosphate. In the experiments undertaken I have endeavored to obtain some data regarding these residues from cream of tartar powders, alum, and alum and phosphate powders. In addition experiments were undertaken with lactic acid in preference to other organic acids since it is the acid of sour milk and upon its percentage in the milk depends its degree of sourness and the quantity required for neutralizing any given amount of cooking soda. *A priori*, we could reason that the digestive power of gastric juice would be lessened by the residue in bread or biscuit raised with sour milk and soda and the experiment proves this to be a fact.

In some comparisons it has been the practice to compare the action of a certain quantity (*i. e.*, a gramme) of one substance with the same amount of another. This, while of value for some purposes, is also very misleading unless some one versed in the matter both interprets the results and reports them, since, as mentioned before, the residues of the various powders do not always correspond in quantity with their leavening powders. To say then that one gramme of a certain residue inhibits digestion as much as a gramme and a half of a certain other residue may be really to make the better powder appear the worse, since the quantity of residue to a given weight of bread may vary so widely. I have, therefore, taken the weights of residue produced in neutralizing a like weight of sodium bicarbonate as the proper weights to be compared.

To raise well one quart of flour requires about forty (40) grains of sodium bicarbonate (Cornwall), which is equivalent to $2\frac{6}{10}$ grammes. I therefore prepared the following solutions:

I. $2\frac{6}{10}$ grms. sodium bicarbonate and $5\frac{7}{10}$ grms. cream of tartar in 250 c.c. of water.

II. $2\frac{6}{10}$ grms. of sodium bicarbonate and enough acetic acid to neutralize it in 250 c.c. of water.

III. $2\frac{2}{10}$ grms. of sodium sulphate and $\frac{7}{10}$ grms. ammonium sulphate in 250 c.c. of water.

We thus have in the quarter litre in I. the water-soluble residue when a quart of flour is raised with cream of tartar and soda, in II. when the same quantity is raised with sour milk and soda, and in III. the corresponding amount of soluble residue when burnt ammonia alum is used.

One-fifth (50 c.c.) of each of these was added to the artificial gastric juice.

This was prepared by dissolving 100 milligrammes of pepsin in one litre of $\frac{2}{10}$% hydrochloric acid and in each experiment 50 c.c. were employed. The albumen was coagulated and passed through a 20 mesh sieve to ensure uniformity of sample and an extended surface, and ten grammes of the moist substance were taken in each case.

50 c.c. of hydrochloric acid pepsin solution was poured on 10 grms. of moist albumen; to this was added 50 c.c. of the solution of one of the various residues and the whole digested at 99° F. for $4\frac{1}{2}$ hours. The digestion was retarded in all cases as is apparent from the following table.

The *undissolved* residue, dried, weighed, using:

			Grammes.
50 c. c. Pepsin Solution	+ 50 c. c. Solution I.	....	1.045
" "	+ 50 c. c. Solution II.	....	1.020
" "	+ 50 c. c. Solution III.	......	0.935
" "	+ 50 c. c. water	....	0.770

Since the 10 grammes of moist albumen dried at same temperature yielded 1.265 grammes of dry albumen we have dry albumen dissolved under same conditions of experiment.

	Grammes.
By use of Solution I.	0.220
" " II.	0.245
" " III.	0.330
" " Water.	0.495

from which it follows that the action of the lactates and tartrates is almost precisely the same, while the soluble constituents in a corresponding strength of alum baking powder exhibit a less retarding action on digestion. The reason that only the soluble constituents in alum baking powder residue were employed was that if the insoluble residue were also employed what remained undissolved by the hydrochloric acid and pepsin solution would vitiate the result on the undissolved albumen.

A second series of experiments was now tried in precisely the same manner, but employing the residue from an alum phosphate powder. This was made up as follows, being an average formula for this class of powders and again taking 40 grains ($2\frac{6}{10}$ grammes) of sodium bicarbonate :

Sodium bicarbonate	$2\frac{6}{10}$	grammes
Burnt ammonia alum	$1\frac{4}{10}$	"
Acid calcium phosphate	$2\frac{7}{10}$	"
(Commercial powder).		

This was dissolved in water, filtered and the filtrate made up to 250 c. c., and, as before, one-fifth ($\frac{1}{5}$) was taken in the experiments. We call this Solution IV.

In the Journal of the American Chem. Soc., **9**, No. 2, will be found the reasons for considering that about one-sixth ($\frac{1}{6}$) of the alumina present in such a baking powder is dissolved in stomachic digestion and so effects the action of the gastric juice. We have therefore to add to the 50 c. c. of Solution IV. the amount of alumina which would be soluble in the gastric juice, and which was insoluble in the water solution made. This would amount to 47 milligrammes of the burnt alum, using the factor for solubility already quoted ($1\frac{4}{10}$ grammes $\times \frac{1}{6} \times \frac{1}{5} = 47$ milligrammes).

In the new experiments the conditions were the same as in the first set, except that the residues employed were from the alum phosphate powder 50 c. c. of the plain water solution in the one case (Sol. IV.), and in the other, 50 c. c., with the addition of 47 milligrammes of burnt alum. As before, a corresponding quantity of the residue from a cream tartar powder was employed for comparison. The results obtained were as follows:

10 grms. of albumen dried = 1.310 grm. dry substance.

Undissolved residue of albumen, dried, using:

	Grammes.
50 c. c. Pepsin Solution + 50 c. c. of Solution IV.	1.040
" " + 50 c. c. of Solution I.	1.065
" " + 50 c. c. of Solution IV. + 0.047 grm. burnt alum	1.065
50 c. c. Pepsin Solution + 50 c. c. Water	0.900

Showing that under the same conditions of the experiment the amount of dried albumen dissolved was with:

	Grammes.
Pepsin solution and water	0.410
" " " Solution IV.	0.270
" " " Solution I.	0.245
" " " Solution IV. + alum	0.245

It would thus appear that with the ordinary formula used for alum phosphate baking powders as manufactured in this country, the inhibitory action on stomachic digestion of the various residues is practically the same for the same leavening effect whether a cream of tartar powder, an alum phosphate powder or the old method of sour milk and soda is employed.