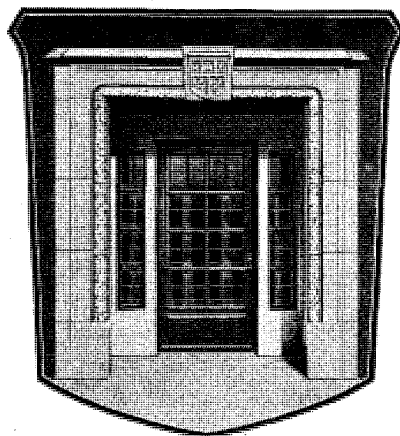


*The Effect of Aluminum Compounds
in Foods*

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THE EFFECT OF ALUMINUM COMPOUNDS IN FOODS

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The action of aluminum compounds that may be present in food products intended for human consumption has for many years been a matter of much difference of opinion. Dr. Harvey W. Wiley, the first head of the U. S. Food and Drug Administration, suspected that aluminum compounds were harmful ingredients of any food product and tried to establish regulations that would eliminate foods adulterated with aluminum salts from interstate commerce.

Expert investigators however, always were able to testify that little or no absorption of aluminum occurred from the ingestion of foods containing such salts, and thereby aluminum was given the benefit of the doubt, from a legal standpoint.

To properly understand what biochemical disturbances occur in the human economy as a result of the use of aluminum-tainted foods, we must first establish a few basic principles.

(We offer herewith a theory, based upon these premises, which we believe to be true, therefore we tentatively state them as facts.)

- Fact No. 1. The most stable salt of aluminum is the phosphate. The soluble salts of aluminum if put into a mixture containing food phosphates, will rob those phosphates of phosphorus.
- Fact No. 2. Aluminum phosphate is useless in nutrition as a source of phosphorus, and is insoluble and unassimilable.
- Fact No. 3. Calcium is normally absorbed as a soluble salt (lactate, malate, succinate, tartrate, phytate), is oxidized to bicarbonate and later becomes a physiological phosphate by reaction with another phosphate such as sodium phosphate, or the phosphorus radical in some organic combination as a lecithin. (Insoluble forms of calcium phosphate, such as tricalcium phosphate, are practically unassimilable according to carefully conducted animal tests.) (1)
- Fact No. 4. Calcium is distributed in the blood as a phosphate attached to a protein molecule, and as such is non-diffusible into the tissues, represents a blood calcium reserve, and accounts for about 70% of the blood calcium. About half is ultra-filtrable, though non-diffusible, and probably represents that part that is available to the lymphatic system in addition to the diffusible component of blood calcium (as bicarbonate, which is also present in two forms — ionized and non-ionized.) (2)
- Fact No. 5. From this blood reserve of calcium must come the calcium for maintaining a balance of the autonomic nervous system, in which the potassium in the body fluids maintains the action of the parasympathetic group, and the calcium supports the sympathetic. (3) Phosphorus deficiency would impair this calcium supply to the tissues.

It now becomes apparent that aluminum can be of definite detriment even though never entering the blood stream, for substances in the alimentary tube are often spoken of by physiologists as being outside the jurisdiction of the tissues, although within the jurisdiction of the digestive processes. Aluminum salts in the intestinal contents apparently can deprive the body of phosphorus, and destroy phosphorus compounds that are exceedingly vital to health. The effect is similar to the action of mineral oil, considered for many years as the most harmless of all laxatives because it "could not be absorbed." Now we know it picks up and eliminates fat soluble vitamins, particularly the vitamin A complex, and can be an exceedingly insidious poison.

In a similar way, the unwitting ingestion of aluminum salts apparently can open another Pandora's box of disease.

In fact, the two causes would be cumulative, for vitamin A deficiency aggravates acidosis by inhibiting the renal function of ammonia synthesis, and phosphorus deficiency causes acidosis by overstimulating the production of gastric acid, by causing a degree of paralysis of the sympathetics, with consequent overaction of the opposing parasympathetics. This gastric hyperchlorhydria is considered by good authorities the immediate cause of peptic ulcers. A recent issue of Science News Letter (June 8, 1946, p. 367) contains the announcement of a surgical remedy for peptic ulcer, the cutting of the parasympathetic nerve branch to the stomach. This is a pretty crude remedy for a deficiency state, for in another recent reference the statement is made that test animals deficient in vitamin A are "nearly always afflicted with stomach ulcers." (Vitamin E in the diet also aids in preventing such ulcers, it was found.) (Science 103(2680): 586-587, 1946.) In older subjects, the same causes are considered responsible for cardiovascular disease (Coronary thrombosis and myocardial failure). (4)

It is obvious how a diet high in alum baking powder biscuits and corn syrup so prevalent in certain sections of this country as the source of a major part of the calories with its practically zero content of minerals and vitamins, can be extremely effective in creating misery, disease, and hardship for the unwitting victims.

Another vitally important end result of disruption of autonomic nerve balance is the disturbance of fat metabolism.

Experimenters have proven that by the cutting of certain branches of the vegetative nervous system the deposition of fat may be stimulated, and by cutting others fat may be caused to absorb in the areas that are supplied by such nerve branches. (5) In all probability we have here the explanation of that common disease of the modern human, pathological obesity. The obesity that persists despite all attempts to control it by dietary limitations, which necessarily are bound to fail, for more deficiency cannot cure the result of deficiency.

Further, it is very significant to our hypothesis that a CALCIUM deficit in the blood can cause fat deposits, for the rise in blood calcium that follows the administration of parathyroid hormone or that follows the feeding of calcium is found to experimentally produce an absorption of fat by the blood stream, which is apparently destined for oxidation. (6)

This may be why the use of such agents is often effective in reducing the appetite. A high blood fat could reasonably be expected to inhibit hunger sensations.

If aluminum acts to deprive the body of phosphorus, and thereby secondarily impairs the assimilation of calcium, or impairs its availability as it appears to do from the foregoing, it certainly should act as a powerful influence to promote obesity. The evidence may not as yet be conclusive, but it is certainly more than suggestive.

As to the functional reactions of autonomic unbalance, the following table is offered; the degenerative changes that would follow a long continued unbalance can only be imagined:

SYMPATHETICOTONIA

(Opposed by potassium, normally available from green leafy vegetable.)

Dry mouth; saliva flow decreased but with heavier concentration of organic substance.

Paralysis of muscles of accommodation. Exophthalmos.

Reduced lachrymal secretion.

Infrequent winking; staring.

Wide palpebral fissure with dilated pupil (mydriasis).

Unable to maintain convergence.

No oculocardiac reflex.

Dryness of nasal membranes.

Pale, undernourished mucous membranes.

Pale, shell-like ears.

Respond violently to unexpected noise.

Nervousness, strong light irritates.

Neurasthenia.

Mentally alert; quick.

Increased temperature.

Basal metabolism apt to be plus.

Fever is raised easily.

Rapid respiration.

Blood pressure higher.

Tachycardia.

Low carbohydrate tolerance.

Cholesterol low.

Leucopenia.

Blood sugar increased.

Blood calcium decreased.

Slow-clotting time; bleed easily.

Abrasions heal slowly.

Menstrual flow too frequent.

Dehydration.

Diminution in amount of urine.

Calcium accumulation.

Tissue rest.

Alkalosis.

Pilomotor muscles activated (goose-flesh).

PARASYMPATHETICOTONIA

(Opposed by calcium, unavailable to the tissues if phosphorus is lacking.)

Excessive salivation, with watery saliva.

Spasm of muscles of accommodation.

Enophthalmos; puffiness; edema of lids.

Increased lachrymal secretion; tears.

Frequent winking; blinking.

Narrow eye slits (widening sometimes), with contracted pupil (myosis).

Normal convergence.

Oculocardiac reflex present.

Cilio-spinal reflex is abolished (no pupillary dilatation when skin of neck is stimulated).

Nasal membranes moist, sometimes congested; nose "runs."

Normal or flushed mucous membranes.

Normal or flushed ears.

Sluggish nervous system; asthenic type.

Difficulty in concentrating.

Sluggish; finds it hard to make decisions.

Lowered temperature.

Lowered basal rate.

Does not raise fever easily.

Irregular respiration.

Blood pressure lower.

Bradycardias; arrhythmias; palpitation.

Irregular pulse.

Increased carbohydrate tolerance.

Cholesterol high.

Leucocytosis.

Blood sugar decreased, or normal.

Blood calcium increased, or normal.

Rapid clotting.

Healing takes place rapidly.

Amenorrhea occurs.

Hydration; circumscribed edema.

Incontinence of urine.

Calcium dissimulation.

Tissue activity.

Acidosis (hyperacidty by alkali-retention test).

Pilomotor reflex sluggish.

Extremities cold and clammy.
Skin moist, with subjective feeling of heat.
Generally pallor of skin; sweating occurs, but may be of "cold sweat" type.

Vasoconstriction, according to degree of stimulation with compensatory dilatation elsewhere. Vasoconstriction in a given local area is associated with leucopenia and sympatheticotonia. Vasoconstriction in the splanchnics is compensated for by reflex dilation in the periphery. The control involves sympathetic nerves, since the peripheral blood vessels are not supplied with parasympathetic fibers. (Vagal fibers have not been demonstrated beyond question in the splanchnic vessels.)

Low gastric acidity (hypochlorhydria).
Gastrointestinal hypotonicity.
Spastic Sphincters (pyloric, cardiac).
Constipation (atonic type).

Vomiting infrequent.
Marked gagging reflex.
Loss of appetite generally, but this may vary and is not considered a good index. There may be gas, belching, fullness after meals, slow digestion, sour stomach and fermentation.

Esophagus relaxed.
Liver secretions decreased.
Pancreatic secretions decreased.
Reduced flow of bile.
Intestines and colon dilated, except sphincters and lower bowel.
Linear type of build predominates.
Sensitive to adrenalin.

Subject to pseudo-neuralgic pains, probably concerned with faulty sugar utilization.

Extremities warm and dry.
Circulation poor; sensitive to lowered temperatures.
Generally flushing, or sweating due to vasodilation; sweating is usually depressed except in toxic and infectious conditions.

Vasodilation in some structures, apparently part of a compensatory mechanism, vasodilation in a given area is associated with leucocytosis and vagotonia. These facts may help to explain apparent inconsistencies which are in reality simply compound syndromes due to local and general autonomic imbalances which give rise to confusing conclusions.

Hyperchlorhydria.
Gastrointestinal hypermotility.
Atonic sphincters.
Spastic constipation (hyperkinetic), or diarrhea, sometimes alternating.

Vomiting frequent.
Sluggish gagging reflex.
Good appetite generally, or poor appetite with apparently good state of nutrition. Patient eats often, or weakness and hunger pains occur. Digestion takes place rapidly.

Stenosis occurs; sometimes dysphagia.
Liver secretions increased.
Pancreatic secretions increased.
Bile increased; heartburn occasionally.
Intestines spastic; hypertonic; sphincters relaxed.

Body width-weight greater.
Sensitive to pilocarpin.
Itching of skin, with dermatographia.
Subject to colds, bronchitis, asthma, with nasal and bronchial discharges; mucous colitis is common.

The physician frequently finds patients that fail to respond to the administration of calcium in any form, even though they exhibit many symptoms of severe calcium deficiency. These cases are in all probability suffering from phosphorus deficiency, so that the calcium arriving in the blood stream as bicarbonate (by oxidation of the lactate, gluconate, levulinate, acetate, tartrate, etc.) cannot be converted into the physiological phosphate. Then, the sympathetic system becomes more or less paralyzed, and the parasympathetics are not opposed as they normally are, and parasympatheticotonic symptoms are exhibited.

Paralysis in some degree of the parasympathetic group from potassium deficiency (the green leaf mineral) on the other hand, can be followed by symptoms of sympatheticotonia.

It is improbable that an excess of either phosphorus, calcium or potassium ever causes such serious disturbances as a deficiency, in fact it is doubtful that any disturbance from an excess would follow unless a deficiency of the opposing element were present.

With a deficit of vitamins to act as an inhibitor of various biochemical processes including their impairment of endocrine function in general, and a deficit of minerals (potassium and phosphorus) to throw the autonomic balance out of gear, it is obvious that symptoms of both groups of this list may be seen at one time in one patient. Certainly cases are often found that defy classification.

To unscramble a mess of this kind by any diagnostic analysis after the patient has subjected himself to many years of punishment on common American diets, surely taxes the ability of the most competent physician. No wonder our main statistical cause of death is cardiovascular disease, no doubt the end result of broken down and degenerated innervation. We can put the blame in all probability on our universal use of refined sweets and devitalized cereals ably assisted by aluminum poisoning, for where these foods are not used, the incidence of heart and vascular disease is practically unknown. (7)

The use of enriched cereals cannot be considered a remedy, for test animals on enriched diets died quicker than those on deficient diets, where the "enrichment" was made with synthetic vitamins. (8)

It is of interest to find that even plant metabolism is poisoned by aluminum salts. More interesting is the known fact that this poisoning is corrected by adding phosphates to the soil, indicative of the same phosphate-robbing effect we have specified as a result in the human case. (9)

Further, the degree of power of aluminum compounds in soil to render phosphorus insoluble is greatly enhanced at pH values below 5.7, which explains the importance of preventing soils from becoming acid. Acidity of soil is well known to aggravate phosphorus deficiency. The alkalinity above a pH of 7 also enhances the solubility and combining power of aluminum salts, so that in the alkaline body fluids we again find a sensitive state towards aluminum.

It is important here to note that many perspiration deodorants owe their action to their content of aluminum acetate, which apparently can be absorbed by such use in sufficient amounts as to be definitely toxic, and has been found the cause of serious aluminum poisoning in patients where every other route of ingestion was eliminated.

Makers of aluminum cooking utensils have reported many tests intended to demonstrate that aluminum salts were harmless. These tests mean nothing, in some cases silicates were deliberately added to the schedules to act as an antidote to the aluminum salts ingested.* (10) In any case, the effect of aluminum poisoning is so slow that the amounts in baking powder or from aluminum pans cannot be very effective in a test of a few

*Silicates and aluminum seem to be mutually antidotal for each other, for aluminum powder is now used to combat silicosis (formerly known as "miner's consumption," in which silica dust has created lung inflammation, infection in fibrosis) being administered by inhalation. Furthermore, sodium silicate has long been used as a remedy for arteriosclerosis — a condition we here see may be a direct result of aluminum poisoning. (10) Also phosphorus and phosphoric acid have been very successfully used as a remedy for arteriosclerosis. (11) (12)

weeks. A pellagra producing diet must act ordinarily for years before the effects begin to be evident. The bleaching substances that destroy the vestiges of vitamins remaining in white flour also cannot be proven to have a deleterious effect. But it is the cumulative action of all these bad foods that in time cause the death or disability of the unsuspecting victim; produce partial or complete sterility, or reduce his ability to work and think.

The U. S. Supreme Court properly appraised the situation when it decided that bleached flour was a violation of the U. S. Pure Food Laws: ". . . and it is intended that if any flour, because of any added poisonous or other deleterious ingredient, *may possibly* injure the health . . . it shall come within the ban of the statute." (Notice of Judgment 3398.) (Italics ours.)

That simply means that makers of foods or utensils may not experiment on the public health by impairing foods first and finding later that their conclusions of harmlessness were incorrect. (The fact is, this Supreme Court decision was never enforced, apparently by reason of political influence over the Food and Drug Administration by commercial interests.)

The action of aluminum salts appear to be pathologically and biochemically similar to lead poisoning (though less drastic). Lead is likewise considered to act as a poison by rendering tissue phosphorus insoluble through formation of lead-phosphorous compounds. (13)

That this actually occurs in the case of aluminum is proven by experiments in which aluminum acetate added to diets of test animals kept the blood phosphorus from rising, regardless of ingested phosphates. (14)

The peripheral neuritis and paralysis of lead poisoning is therefore due to the same withdrawal of phosphorus from the tissues that aluminum salts accomplish. Since similar symptoms occur in beriberi and pellagra, it is obvious how bleached wheat flour in baking-powder biscuit form is a double insult to health, for not only is the vitamin B complex content refined out, (any balance destroyed by bleaching gas,) so that there is no possible nutritional value of vitamin nature left, but also we have the addition of a poison that aggravates the deficiency reactions, affording the greatest possible incentive for the development of disease.

It is of much interest to note that current literature is now offering references showing that vitamin E deficiency (a result of the use of white flour in place of whole wheat) causes heart disease, angina pectoris, and muscular dystrophies in human subjects, but also sudden death from heart failure in cattle and muscular dystrophy in rabbits. (15) (16)

It is evident that aluminum poisoning can be a definite contributor to our most prevalent cause of death—cardiovascular disease—and that vitamin deficiency and phosphorus deficiency are able partners. The general soil depletion of phosphorus and its diminishing content in all foodstuffs is a serious problem.

It seems to be up to us as individuals to protect our health by rigidly banning from our tables any product that fails to measure up to the obvious standards of unrefined and unprocessed natural fresh food. It is also the obligation and duty of the physician to warn his patient who comes to him in a state of partial starvation, of the need for food reform and the fate of those who may be so indifferent as to put their trust in the propaganda of commercial interests who have the power to actually halt the enforcement of the law where it interferes with their business.

SUMMARY AND CONCLUSIONS: It is highly probable that a syndrome of symptoms of phosphorus and calcium deficiency can follow a long continued intake of aluminum salts, from aluminum cooking utensils, alum baking powders, or aluminum acetate in perspiration deodorants. Aluminum salts appear to rob other food elements of their phosphorus to form insoluble and nutritionally useless compounds, just as mineral oils rob the food elements and tissues in the intestinal tract of their vitamin A content.

Such serious disorders as ulcers of the stomach and duodenum, cardiovascular disease, heart failure, obesity, and varying degrees of paralysis of the sympathetic nervous system appear to be definite consequences of aluminum poisoning.

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