

ABSTRACTS ON THE EFFECT OF PASTEURIZATION ON THE NUTRITIONAL VALUE OF MILK

INHERENT CHARACTERISTICS OF MILK DISTURBED BY PASTEURIZATION

"... Pasteurization was also found to affect the hematogenic and growth-promoting properties of the special milk (raw milk from specially fed cows, whose milk did not produce nutritional anemia — whereas commercially pasteurized milk did.)..."

Krauss, W. E., Erb, J. H. and Washburn, R. G., Studies on the Nutritive Value of Milk. II. The Effect of Pasteurization on Some of the Nutritive Properties of Milk, Ohio Agricultural Experiment Station Bulletin 518, page 11, January, 1933.

The Lancet, page 1142, May 8, 1937 states that resistance to tuberculosis increased in children fed raw milk instead of pasteurized, to the point that in five years only one case of pulmonary TB had developed, whereas in the previous five years, when children had been given pasteurized milk, 14 cases of pulmonary TB had developed.

"Human or cow milk added to an equal volume of agar did not support the growth or allowed only slight growth of *B. diphtheriae*, *Staph. aureus*, *B. coli*, *B. prodigiosus*, *B. pyocyaneus*, *B. anthracis*, streptococci, and unidentified wild yeast. The factors in human milk inhibiting bacterial growth ('inhibins') were inactivated by heating at 56 degrees C (pasteurization temperatures — 60 degrees — 70 degrees C) for thirty minutes or by standing twelve to twenty-four days at 5 degrees C., but not by repeated freezing and thawing. The 'inhibins' in cow's milk were not inactivated by heating at 80 degrees C. for seven minutes but were destroyed by heating at 85 degrees C. for seven minutes. Attempts have not been made to identify the natural antiseptics."

Dold, H., Wizaman, E., and Kleiner, C., Z. Hyt. Inf., Antiseptic in Milk, The Drug and Cosmetic Industry, 43,1:109, July, 1938.

"Milk, an animal product, is the essential food of all infant mammals. Mammals are so classified in the scale of living things because of the common characteristic of the female nursing her young. The infant mammal is accordingly carnivorous in his natural habits irrespective of whether the adult of the species is herbivorous or carnivorous.

"If the adults on a carnivorous diet show conditions of deficiency on cooked meat, is it not reasonable to suppose that growing infants on entirely cooked carnivorous diets will do likewise? Many experimenters, such as Catel, Dutcher, Wilson, and others, have shown such to be the case in animals fed on pasteurized milk.

"Can human infants be born of mothers who are deficient, and yet attain a fair degree of skeletal development if given a proper raw milk supply? The three infants in Figure 4 were born of mothers known to be hypothyroid. Prior to the birth of the infants shown, all three mothers had given birth to children within three years. Each of the previous children was asthmatic, showed infantile rickets, and possessed poor skeletal development. The first child shown in Figure 4 was breast fed from birth, with the mother living under excellent health-promoting conditions. The second child was on powdered milk for four weeks, and on raw certified milk after that without cod-liver oil or orange juice. Both the first and second child began supplemental feedings when they were about five months old and were very healthy babies. The third baby was always sickly and had been on formulae since birth. These formulae included powdered milk, pasteurized milk, boiled milk, boiled certified milk and canned milk. She had suffered from severe gastric distress during her entire infancy and when eight months old she developed asthma. She is very small though her parents are of larger build than the parents of the other two children.

"The strictest bacteriologic standards for milk must always be maintained. The feeding of cattle should receive greater attention. It should be determined experimentally, if possible, whether health and resistance are undermined by pasteurization. If so, in our attempt to protect the child from milk-borne infections, we may be denying his heritage of good health by removing from his milk vitamins, hormones, and enzymes that control mineral assimilation and promote body development and general resistance to disease. Is it also possible that these same elements are as important to the adult invalid who needs milk as to the infant?

"Let us have closer cooperation between raw-milk producers and public-health officials so that the growth-producing factors of raw milk can be studied. We cannot afford to pasteurize milk if it is found that pasteurization diminishes the potency of the growth-promoting factors that determine the skeletal development of our children. We cannot afford to lessen the resistance of our children to respiratory infection, asthma,

bronchitis and the common cold when factors preventing them are present in greater amounts in properly produced clean raw milk than in pasteurized milk."

Pottenger, F. M., Jr., Clinical and Experimental Evidence of Growth Factors in Raw Milk, Certified Milk, January, 1937.

"Some have questioned whether pasteurized milk is really involved in the production of scurvy. The fact, however, that when one gives a group of infants this food for a period of about six months, instances of scurvy occur, and that a cure is brought about when raw milk is substituted, taken in conjunction with the fact that if we feed the same number of infants on raw milk, cases of scurvy will not develop — these results seem sufficient to warrant the deduction that pasteurized milk is a causative factor. The experience in Berlin, noted by Neumann (Neumann, H., Deutsch. Klin., 7:341, 1904) and others, is most illuminating and convincing in this connection. In 1901 a large dairy in that city established a pasteurizing plant in which all milk was raised to a temperature of about 60 degrees C. After an interval of some months infantile scurvy, was reported from various sources throughout the city. Neumann writes about the situation as follows:

"Whereas Heubner, Cassel and myself had seen only thirty-two cases of scurvy from 1896 to 1900, the number of cases suddenly rose from the year 1901, so that the same observers — not to mention a great many others — treated eighty-three cases in 1901 and 1902."

An investigation was made as to the cause, and the pasteurization was discontinued. The result was that the number of cases decreased just as suddenly as they had increased..."

Hess, A. F., Infantile Scurvy, V. A Study of Its Pathogenesis, Am. J. Dis. Child., November, 1917.

"Although pasteurized milk is to be recommended on account of the security which it affords against infection, we should realize that it is an incomplete food. Unless an antiscorbutic, such as orange juice, or potato water is added, infants will develop scurvy on this diet. This form of scurvy takes some months to develop and may be termed subacute. It must be considered not only the most common form of this disorder, but the one which passes most often unrecognized. In order to guard against it, infants fed exclusively on a diet of pasteurized milk should be given antiscorbutics far earlier than is at present the custom, even as early as at the end of the first month of life."

Hess, A. F., Infantile Scurvy, III. Its Influence on Growth (Length and Weight), Am. J. Dis. Child., August 1916.

"One of the most striking clinical phenomenon of infantile scurvy is the marked susceptibility to infection which it entails — the frequent attacks of 'grippe', the widespread occurrence of nasal diphtheria, the furunculosis of the skin, the danger of pneumonia in advanced cases..."

Hess, A. F., Infantile Scurvy, V. A Study of Its Pathogenesis, Am. J. Dis. Child., November, 1917.

"... Recently, Minot and his colleagues came to the conclusion that adult scurvy can be precipitated by infectious processes; in other words, that latent scurvy can by this means be changed to manifest scurvy. In general, therefore, investigations in the laboratory as well as clinical observations are in agreement in stressing the interrelationship of scurvy and bacterial infection."

Hess, A. F., Recent Advances in Knowledge of Scurvy and the Antiscorbutic Vitamin, J. A. M. A., April 23, 1932.

This illustrates the futility of pasteurization of milk to prevent infection from diseases the cows may sometimes have such as undulant fever. The infant is then made subject to the common infectious diseases, and deaths from these common diseases are not attributed, as they should be, to the defective nature of the milk.

EFFECTS OF PASTEURIZATION OF MILK ON TOOTH HEALTH

Lancet, page 1142, May 8, 1937 says that in children the teeth are less likely to decay on diet supplemented with raw milk than with pasteurized milk.

"Dr. Evelyn Sprawson, of the London Hospital has recently stated that in certain institutions children who were brought up on raw milk (as opposed to pasteurized milk) had perfect teeth and no decay. Whether this was due actually to

the milk being unheated, or possibly to some other quite different and so far unrecognized cause, we cannot yet say; but we may be sure of one thing, that the result is so striking and unusual that it will undoubtedly be made the subject of further inquiry."

Harris, L. J., *Vitamins in Theory and Practice*, page 224, Cambridge, University Press, 1935.

EFFECT OF PASTEURIZATION OF MILK ON GROWTH

... Fisher and Bartlett "point out by statistical treatment that the response in height to raw milk was significantly greater than that to pasteurized milk. Their interpretation of the data led to the assertion that the pasteurized milk was only 66.0 per cent as effective as the raw milk in the case of boys and 91.1 per cent as effective in the case of girls in inducing increases in weight, and 50.0 per cent as effective in boys and 70.0 per cent in girls in bringing about height increases."

Krauss, W. E., Erb, J. H. and Washburn, R. G., *Studies on the Nutritive Value of Milk. II. The Effect of Pasteurization on Some of the Nutritive Properties of Milk*, Ohio Agricultural Experiment Station Bulletin 518, page 7, January, 1933.

... Daniels and Loughlin observed that young rats fed long heat-treated milks, evaporated, condensed, and pasteurized by the 'hold' method failed to grow normally, but if the precipitated calcium salts were incorporated into the various milk, growth was normal. . . ."

Daniels, A. L., and Loughlin, R., *Journal of Biological Chemistry*, 44:381, 1920, as abstracted by Holmes and Pigott, *Factors That Influence the Antirachitic Value of Milk in Infant Feeding*, *Oil & Soap*, 12:9:202-207, Sept., 1935.

CALCIUM AVAILABILITY IN PASTEURIZED MILK

"Kramer, Latzke and Shaw (Kramer, Martha M., Latzke, E. and Shaw, M. M., *A Comparison of Raw, Pasteurized, Evaporated and Dried Milks as Sources of Calcium and Phosphorus for the Human Subject*, *Journal of Biological Chemistry*, 79:283-295, 1928) obtained less favorable calcium balances in adults with pasteurized milk than with 'fresh milk' and made the further observation that milk from cows kept in the barn for five months gave less favorable calcium balances than did 'fresh milk' (herd milk from a college dairy)."

Krauss, W. E., Erb, J. H., and Washburn, R. G., *Studies on the Nutritive Value of Milk. II. The Effect of Pasteurization on Some of the Nutritive Properties of Milk*, Ohio Agricultural Experiment Station, Bulletin 518, page 8, January, 1933.

In the *Lancet*, page 1142, May 8, 1937 it is shown that chills are practically eliminated (result of higher calcium values of raw milk or improved assimilation of calcium) when raw milk rather than pasteurized milk is used in the diet of children.

PASTEURIZATION DESTROYS VITAMIN A

... According to S. Schmidt-Nielsen and Schmidt-Nielsen (*Kgl. Norske Videnskab. Selsk. Forhandl.*, 1:126-128, abstracted in *Biological Abstracts*, 4:94, 1930), when milk pasteurized at 63 degrees C. (145 degrees F.) was fed to mature rats, early death or diminished vitality resulted in the offspring. This was attributed to the destruction of Vitamin A."

Krauss, W. E., Erb, J. H. and Washburn, R. G., *Studies on the Nutritive Value of Milk. II. The Effect of Pasteurization on Some of the Nutritive Properties of Milk*, Ohio Agricultural Experiment Station Bulletin 518, page 9, January, 1933.

PASTEURIZATION DESTROYS VITAMIN B COMPLEX

"Pasteurization of milk destroys about 38% of the B complex according to Dutcher and his associates. . . ."

Lewis, L. R., *The Relation of the Vitamins to Obstetrics*, *American Journal of Obstetrics and Gynecology*, 29,5:759, May, 1935.

"Mattick and Golding (Relative Value of Raw and Heated Milk in Nutrition, *Lancet* 220:662-667) reported some preliminary experiments which indicated that pasteurization

destroys some of the dietetic value of milk, including partial destruction of Vitamin B1. These same workers found the raw milk to be considerably superior to sterilized milk in nutritive value."

Krauss, W. E., Erb, J. H. and Washburn, R. G., *Studies on the Nutritive Value of Milk. II. The Effect of Pasteurization on Some of the Nutritive Properties of Milk*, Ohio Agricultural Experiment Station, Bulletin 518, page 9, January, 1933.

"... On the 7.5 cc. level two rats on raw milk developed mild polyneuritis toward the end of the trial; whereas three rats on pasteurized milk developed polyneuritis early, which became severe as the trial drew to a close. On the 10.0 cc. level none of the rats on raw milk developed polyneuritis, but three on pasteurized milk were severely afflicted."

Ibid, page 23.

"Using standard methods for determining vitamins A, B, G and D, it was found that pasteurization destroyed at least 25% of the vitamin B in the original raw milk."

Ibid, page 30.

PASTEURIZATION DESTROYS VITAMIN C

"... The pasteurization of milk has been found to destroy 20 to 50 per cent (of the Vitamin C), the fraction that has undergone reversible oxidation. . . ."

Bastedo, W. A., *Materia Medica, Pharmacology, Therapeutics and Prescription Writing*, Fourth Edition, Re-set, page 78, W. B. Saunders Co., Philadelphia, 1938.

"Current objection to pasteurization is mainly on the ground of vitamin destruction. Vitamins A (fat-soluble) and B (water-soluble), both abundant in milk, are quite resistant to heat, but the antiscorbutic vitamin C is weakened or destroyed by pasteurizing temperatures. Infants fed exclusively on a diet of pasteurized milk will develop scurvy. Fortunately the addition to the diet of readily accessible antiscorbutics such as orange juice or tomato juice is tolerated by infants much earlier than used to be supposed, even in the first month of life. The reasonable procedure, therefore, appears to be to use pasteurized milk to insure protection against disease germs of various kinds and to supply the vitamin deficiency through other foods. The success in infant feeding based on this principle is evinced especially in the amazing reduction in infant mortality in the summer months."

Jordan, E. O., *A Textbook of General Bacteriology*, Twelfth Edition, Revised, page 691, W. B. Saunders Co., 1938.

"Within the past few years an increasing number of patients affected with scurvy have been brought to the Oregon Children's Hospital. As the prophylactic amount of Vitamin C (15 mg. daily) is contained in 300 cc. of breast milk, scurvy is rarely found in breast-fed babies.

"The vitamin C of cow's milk is largely destroyed by pasteurization or evaporation."

Overstreet, R. M., *Northwest Medicine*, June, 1938, as abstracted by *Clinical Medicine and Surgery*, *The Increase of Scurvy*, 42, 12:598, December, 1938.

"Samples of raw, certified, certified Guernsey and certified vitamin D milks were collected at the different dairies throughout the city of Madison. These milks on the average are only a little below the fresh milks as recorded in Table I, indicating that commercial raw and certified milks as delivered to the consumer lose only a small amount of their antiscorbutic potency. Likewise, samples of commercial pasteurized milks were collected and analyzed. On an average they contained only about one-half as much ascorbic acid as fresh raw milks and significantly less ascorbic acid than the commercial un-pasteurized milks.

"It was found that commercial raw milks contained an antiscorbutic potency which was only slightly less than fresh raw milks and that pasteurized milks on the average contained only one-half the latter potency. Mineral modification and homogenization apparently have a destructive effect on ascorbic acid."

Woessner, Warren W., Elvehjem, C. A., and Schuettle, Henry A., *The Determination of Ascorbic Acid in Commercial Milks*, *Journal of Nutrition*, 18,6:619-626, December, 1939.

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