



A 100-Year Review: The production of fluid (market) milk^{1,2}

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ABSTRACT

During the first 100 years of the *Journal of Dairy Science*, dairy foods and dairy production dairy scientists have partnered to publish new data and research results that have fostered the development of new knowledge. This knowledge has been the underpinning of both the commercial development of the fluid milk processing industry and regulations and marketing policies for the benefit of dairy farmers, processors, and consumers. During the first 50 years, most of the focus was on producing and delivering high-quality raw milk to factories and improving the shelf life of pasteurized fluid milk. During the second 50 years, raw milk quality was further improved through the use of milk quality payment incentives. Due to changing demographics and lifestyle, whole fluid milk consumption declined and processing technologies were developed to increase the range of fluid milk products (skim and low-fat milks, flavored milks, lactose-reduced milk, long-shelf-life milks, and milks with higher protein and calcium contents) offered to the consumer. In addition, technology to produce specialty high-protein sports beverages was developed, which expanded the milk-based beverage offerings to the consumer.

Key words: fluid milk, pasteurization, flavor, shelf life

INTRODUCTION

In the 50 years before the initiation of the *Journal of Dairy Science (JDS)*, milk processing in the United States had evolved from production of milk, butter, and cheese on farms to a system of local milk assembly in small country factories and creameries for production of market milk, cheese, butter, condensed milk,

and milk powder. Transportation of milk to local dairy factories was typically done by horse and wagon. As larger cities developed, the demand for market (i.e., fluid) milk by city markets created more of a challenge because of slow transportation and lack of refrigeration. Farms near large cities were able to supply milk for the fluid market and those farms enjoyed a higher price for their milk, whereas farms located far from cities provided milk to produce cheese and butter and received a lower price for their milk. Farms in rural areas had little bargaining power for milk price because of the perishable nature of raw milk. As populations grew in urban areas, the demand for market milk increased and raw milk had to be transported longer distances. The most viable option for rapid transportation of raw milk from rural areas to cities was in large milk cans carried by train in ice-cooled railroad cars. The trains ran daily from country to city. Milk was received at privately owned central market milk processing facilities, where it was heat treated and packaged in returnable glass bottles for home delivery (Figure 1).

At the time of the initiation of JDS in 1917, most cities had market milk processing factories. A network of rural creameries produced cheese, butter, condensed milk, and some milk powder to utilize milk that was not needed to meet demand for fresh market milk. Before JDS and even for the 50 years after its launch, a large amount of information and knowledge from applied dairy science research was published in cooperative extension bulletins published by land-grant universities. A classic land-grant university extension bulletin describing a practical method to measure the fat content of milk was written by S. M. Babcock (1890). At the same time, books on milk and dairy products were published by faculty at land-grant universities. Examples of books that summarized the state of knowledge in milk chemistry, milk quality, and dairy product manufacturing immediately before and in the earlier years of JDS are *American Dairying: A Manual for Butter and Cheese Makers* by Arnold (1876), *Testing of Milk and Its Products* by Farrington and Woll (1897), *Milk and Its Products* by Wing (1904), *Modern Methods of Testing Milk and Milk Products* by VanSlyke (1906), *The Science and Practice of Cheese* by VanSlyke and

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²Use of names, names of ingredients, and identification of specific models of equipment is for scientific clarity and does not constitute any endorsement of product by authors, Cornell University, or the Northeast Dairy Foods Research Center.

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Figure 1. Home delivery of market milk from the Brooklyn Creamery, L. Blodgett, Cazenovia, NY: “Fine dairy products, regulated milk, and ice cream.” Color version available online.

Publow (1909), *Condensed Milk and Milk Powder* by Hunziker (1914), *Manual of Milk Products* by Stocking (1917), *The Book of Cheese* by Thom and Fisk (1918) and *The Book of Butter* by Guthrie (1918), *The Technical Control of Dairy Products* by Mojonier and Troy (1922), *The Care and Handling of Milk* by Ross (1927), and *Fundamentals of Dairy Science* by Rogers (1928). The scope and function of JDS with respect to market milk and dairy products had to be integrated into the landscape of published literature within the context of other venues of communication of the science of milk and milk products at that time. Before 1917, new knowledge about milk pasteurization (Stocking, 1917), centrifugal cream separation (Wing, 1904), evaporators and dryers (Hunziker, 1914), the Babcock milk fat test for milk payment (Babcock, 1890), and research that determined the relationship between milk composition and cheese yield and cheese quality (VanSlyke and Publow, 1909) were published. It is interesting to note that today, as consumers have more interest in local

and minimally processed foods, the basic information and knowledge contained in these early publications is still of use by today’s artisan dairy product producers. The challenge for dairy science research requires a balance between (1) developing science-based best practice guidance, as market conditions change and new experience develops in the field, and (2) developing new knowledge and technology that moves the industry forward to find new ways to deliver affordable, safe, and wholesome market milk, dairy foods, and dairy ingredients. Today, more than ever, milk production technologies used at the farm and post-farm milk processing technologies need to be consistent with the desires of consumers and the public in general. Over the years, we have learned that the science may be correct, but ultimately consumer and public opinion balanced against the landscape of differing needs in different areas of the world and societies will allow new technologies and knowledge to be implemented at the appropriate times and places (Appendix Table A1).

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