2 | Confronting the Cow

Soybean Milk and the Fashioning of a Chinese Dairy Alternative

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In the early twentieth century, milk became important to how Chinese intellectuals and scientists thought about China and its place within a wider world. Although dairy products and processes were continually introduced and reintroduced during earlier historical periods, for much of Chinese imperial history, milk represented alterity, especially in connection to nomadic and seminomadic peoples living in Central Asia and along the northern borders of the empire.[1] Milk was considered a medicine or tonic for the elderly, and sometimes the young, and when discussed in culinary treatises, milk was typically integrated in the cooking process: fermented, curdled, or cooked, as opposed to consumed raw or fresh. But as Françoise Sabban has emphasized, these culinary references to milk were "few and rather uncommon in the vast Chinese culinary repertoire."[2] Even after the birth of a nascent dairy industry in several Chinese treaty-port cities such as Shanghai, Harbin, and Beijing from the mid-nineteenth century onward, milk remained largely peripheral to the Chinese worldview. But as European and American conceptions of milk shifted over the course of the nineteenth century, and more and more Westerners came to drink and consider milk an indispensable food, so too were the Chinese increasingly confronted with ideas of milk's essential goodness, its place within a scientific world order of modern nutrition, and its role in making healthy, strong bodies. Earlier notions of alterity were not so much eclipsed as reoriented as milk became a symbol of Western wealth and power.

This chapter explores how the idea of milk's importance to the modern Chinese pursuit of wealth and power generated its own discursive and material experimentations with milk alternatives. Almost as soon as the Chinese found themselves faced with presentations that identified milk as the foundation of a modern diet that fueled the success of modern nations, they began exploring other possibilities that better suited China and the Chinese people. Soybean milk (*doujiang*), which had traditionally been a by-product of the process of making tofu, represented an especially conducive alternative. Spurred by the propagation of a nutritional paradigm that identified dairy as an essential food category in the human diet, and milk, in particular, as a critical protective food whose consumption ensured both individual and national fitness, Chinese entrepreneurs and scientists in the 1910s and 1920s began experimenting with ways in which to refashion a common food, *doujiang,* into a modern good food that we know of as soybean milk. As milk drinking became increasingly construed as integral to a normative diet, not drinking milk became a problem whose tidy resolution marked a first step toward creating and nourishing a modern China. By the 1930s, Chinese entrepreneurs' and scientists' efforts assumed heightened urgency as milk drinking became linked to concerns about child growth and development. Milk was not simply an ingredient for the national pursuit of wealth and power; it was an essential food for growing boys and girls. Here, too, soybean milk could serve as a viable, if not superior, alternative to cow's milk.

Chinese intellectuals such as Li Shizeng and Ernest Tso linked biomedical nutrition to the nation and in doing so contributed to the cultural and scientific refashioning of soybean milk as the modern antidote to China's status as the "sick man of Asia." Much of their advocacy was premised on the idea that soybean milk was a distinctly Chinese food whose functional role within the Chinese diet was akin to that of dairy. Whether or not this was in fact true mattered less than the implicit challenge to the bioculturalist assumptions of universality embedded in the Western celebration of milk.

The Milky Way

Scientific interest in milk and its chemical properties arose in the nineteenth century when scientists in Germany, France, and England, using newly developed techniques of analytical chemistry in the laboratory, began investigating the chemical compositions of foods, and of bodily fluids

and tissues. In 1827 the English physician William Prout (1785–1850) identified three elemental units of human sustenance—"the *saccharine,* the *oily,* and the *albuminous*"—that constituted the building blocks of flesh, bones, and human energy. Later chemists modified the terminology of this classification of ultimate foodstuffs: *carbohydrates,* coined in 1844 by Carl Schmidt and covering sugars and starches; *fats;* and *protein,* that is, substances that, like the white of an egg, coagulate on heating.[3] Milk, both human and bovine, was one of the foods that contained all three elements. Prout, in particular, extolled milk as both a universal and providential form of nourishment. "Of all the evidences of design in the whole order of nature," he argued, "milk affords one of the most unequivocal." "It is the only aliment designed and prepared by nature expressly as food; and it is the *only material* throughout the range of organization that is so prepared. In milk, therefore, we should expect to find a model of what an alimentary substance ought to be—a kind of prototype, as it were, of nutritious materials in general."[4] His celebration of the powers of milk traveled across the Atlantic and deeply impressed Robert Milham Hartley (1796–1881), a religiously inspired reformer in New York City and first director of the New York Association for Improving the Condition of the Poor. Hartley was keen on improving the supply of milk for infants of the poor. The growth of American cities had led to a decline in breastfeeding, and many, especially among the well-to-do, turned to fresh milk as an alternative to wet-nursing. But the most common form of milk available was "swill milk," which came from cows fed by the byproducts of urban breweries. Hartley lambasted cheap "swill milk" as morally and physically dangerous, and launched a campaign to rid New York City of its swill milk system and replace it with "pure" country milk brought into the city by rail. Using extensive scaffolding provided by the latest science, animal chemistry, he argued that milk was a perfect, God-given food for humanity—"the most perfect of all alimentary aliments."[5]

By the turn of the twentieth century, a general consensus had been established about the relations obtained between diet and physical vigor. It was widely accepted that health depended above all on sufficient energy intake (i.e., the calorie content of a diet) and the three major dietary elements: carbohydrates, fats, and proteins. Suspicions that this consensus was incomplete had been expressed by the French chemist J. A. B. Dumas after the Franco-Prussian War of 1871, but it was not until the first decade of the twentieth century that more fine-grained animal feeding experiments revealed the vital nutritional role played by hitherto unsuspected

dietary components.[6] The discovery of essential amino acids and vitamins dramatically shifted scientific interest away from the energy content of the diet as well as shifted scientific authority from chemical physiology to the newly established field of biochemistry.[7]

With respect to milk, perception of its value improved further as nutrition science recategorized it as a "protective food," that is, a food rich in minerals and vitamins. Milk was increasingly touted by nutrition scientists as nature's perfect food and was even designated the most important alimentary factor in the rise of modern civilization.[8] Elmer V. McCollum (1879–1967), who has been credited with the discovery of vitamin A—a key agent in enabling growth in animals and humans that he isolated from the fat of whole milk—insisted that "the consumption of milk and its products forms the greatest factor for the protection of mankind."[9] A hierarchy of foods emerged, and milk and milk products (including butter) consistently outranked other protective foods such as green-leafed vegetables and fruits.[10]

McCollum's scientific celebration of milk led him to see the world through the lens of milk.[11] Writing in 1918, McCollum suggested that the world's people could be divided into those whose diets included milk, and those whose did not. On the one side, "represented by the Chinese, Japanese, and the people of the Tropics, generally," were people who "employed the leaves of plants as almost their sole protective food. They likewise eat eggs and these serve to correct their diet." On the other side were the peoples of North America and Europe who have "likewise made use of the leaves of plants, but in lesser degree, and have, in addition, derived a considerable part of their food supply from milk and its products." The social and cultural consequences of these dietary differences were stark:

> Those people who have employed the leaf of the plant as their sole protective food are characterized by small stature, relatively short span of life, high infant mortality, and by contended adherence to the employment of the simple mechanical inventions of their forefathers. The peoples who have made liberal use of milk as a food, have, in contrast, attained greater size, greater longevity, and have been much more successful in the rearing of their young. They have been more aggressive than the non-milk using people, and have achieved much greater advancement in literature, science, and art.[12]

McCollum's celebration of milk as a vitamin- and mineral-rich protective food might have been dismissed as one man's fancy were it not for its

general acceptance within the scientific community. His book, *The Newer Knowledge of Nutrition,* based on the lectures McCollum gave at the Harvard School of Public Health in 1918, celebrated the "gospel of milk" and sold fourteen thousand copies in its first three years, and went into five editions by 1939.[13] Its influence can also be discerned in the League of Nations' 1936 *Final Report,* which McCollum helped author and which defined "correct nutrition" on the basis of "good" proteins (i.e., animal origin) and protective foods. Milk was ranked a "highly protective food" for its share of "good" proteins, minerals, and vitamins A, B, C, and D.[14]

Milk as Wealth and Power

The idea that a Western diet composed primarily of meat, wheat, and milk had distinct social and political advantages over a Chinese one had already entered the country by the end of the Qing dynasty. The *Qing bai lei chao* (Categorized anthology of petty matters from the Qing period) included an extended rumination on the differences between Eastern and Western diets and described the consequent bodily effects in the following manner:

> Food is essential for man. Orientals typically eat the five grains, while Occidentals typically eat meat. Those whose diets are based on the five grains have weaker bodies than those who eat meat diets. People who eat meat and fish are necessarily stronger than those who eat vegetarian.[15]

Dietary differences translated into different national vitalities, with those nations with richer, more bountiful foods dominating the world. For evidence, the author invited the reader to compare the foods eaten by an Indian as opposed to his British overlord and then concluded that if the Chinese were to eat the same diet as Americans and Europeans, one need not doubt that one day China too would become a powerful and prosperous nation.[16]

By this estimation, milk represented Western strength and prosperity, but the implication that the Chinese needed to change their traditional dietary practices in order to compete in the modern world was not accepted by all. As Angela Leung demonstrates in this volume, an early generation of late Qing and Republican political figures such as Wu Tingfang, Li Shizeng, and Sun Yat-sen saw in vegetarianism, if properly

understood and practiced according to scientific principles, "a moral food choice for a modernizing Asian nation" that acknowledged and advanced the natural strengths of China's agricultural and dietetic traditions.[17] Modern vegetarianism, these men argued, was healthy and hygienic. It represented the advancement of the forces of progress and science. To demonstrate its superior social and political value for Chinese society, they used the language of chemistry to validate their claims of nutritional potency and hygienic superiority.

With respect to milk, scientific vegetarianism's point of contestation lay not with the claim that drinking milk could marshal the Chinese along a path toward strength and prosperity, but rather with which kind of milk would better serve this purpose. We see this in the early writings of the anarchist turned elder Guomindang statesman Li Shizeng (Li Yuying, 1881–1973), who set up a "tofu factory" on the outskirts of Paris in 1909. In downplaying the essentialness of cow's milk to a modern diet, Li presented a Chinese alternative in the form of soybean milk, the chemical properties of which ensured a comparable, if not superior, alternative. Soybeans had not been a self-stated interest when Li left China in 1902 as a twenty-two-year-old and one of two hand-selected students designated to accompany Sun Baoqi (1867–1931), the newly appointed Minister to France. But once in France, Li's interest in soybeans blossomed through his embrace of vegetarianism and his studies at a French agricultural college (École Pratique d'Agriculture du Chesnoy) in Montargis, sixty miles south of Paris, and at the Institut Pasteur in Paris. At the Institut Pasteur, Li began research on "China's soybean problem" (*Zhongguo de dadou wenti*) and discovered for himself how the soybean plant exhibited some of the more curious characteristics of vegetable physiology.[18] In his own words, "From the perspective of agriculture, the soybean plant is a bit unusual and very productive. Its nitrogen-fixing properties surpass other more commonly used pulses. Finally, it must not be forgotten the number of industrial applications one can achieve with the oil and vegetable protein (*caseine de soja*) from soybeans."[19] Li's scientific investigations with the soybean focused especially on soybean milk, which he called *caséosojaïne,* and its potential to serve as a dairy substitute. Li thought it may be possible through innovations in handling and fermentation techniques to produce soybean milk amenable to the Western palate.[20] His application for a British patent, dated December 30, 1910, indicated that his invention produced a "vegetable milk and its derivatives by means of soja grains (Chinese peas)." The resulting milk

would have "the appearance, the color, and the taste of ordinary milk, its chemical composition greatly resembling the same. It has moreover approximately the same nutritive and alimentary properties."[21]

Li's growing passion for the soybean led him to propagate its virtues among France's scientific community. He spoke before the Société d'Agriculture de France, and, perhaps to everyone's surprise, attended the International Dairy Congress in October of that year, where his presentation to the attendees attracted media attention.[22] Speaking before an audience composed of prominent men "in the dairy and general agricultural circles of Europe," Li spoke earnestly of the Chinese practice of producing "milk" from a plant.[23] The entire world, Li remarked, recognized the many advantages associated with animal milk. And yet, the Chinese drank little of it. To explain this curious situation, Li postulated for ten minutes about the soybean and Chinese methods for producing soyfoods, which were not only similar in appearance to dairy products, but were comparable in chemical composition. China, with its vast and varied regions, and its humid soil and climate, was largely ill suited to the raising of cattle and livestock, Li explained. Excluding areas to the far north and east, which Li identified as "dairy regions" (*régions laitières*), most parts of China depended on soybeans, which could be made into a "vegetal milk, rich in proteins and fats," for its dairy needs.[24] Li's reference to there being "dairy regions" in China is curious precisely for its ellipsis of the people who traditionally lived in those areas. As Françoise Sabban and Susie Wang have shown, dairy products were not completely foreign to the Chinese diet, but their presence in past diets was often linked to the ruling dynasty.[25] A dual sensibility that perceived milk as a luxury as well as a foreign food more typical of the seminomadic non-Han tribes to the north and northwest was evident as early as the Three Kingdoms period (220–280 CE). Wang suggests that Chinese interest in cow's milk in the late nineteenth and early twentieth centuries was notable precisely because it ignored these earlier associations of milk with foreign dynasties, including the Manchu Qing, and instead reframed milk as a dietary ingredient in the rise of Western wealth and power.[26]

Li's passion for soybeans stemmed from his dedication to a vision of Chinese modernity that did not divorce itself from traditional crops but instead reinvented them with the help of modern science.[27] He believed that while foods differed from region to region, the essential qualities and nutrients making up such foods were universal. "Speaking of our country, Buddhist monks eat more tofu and *mianjin* (gluten) than ordinary people,

which is to say, they eat more meat than ordinary people, because [tofu and *mianjin*] are qualitatively the same as meat. Thus, these foods can substitute for meat."[28] Following the same reasoning, soybean milk could replace cow's milk in a modern diet.

Other Chinese homed directly in on the competitive dimensions of the soybean for navigating the brave new social Darwinian world. In an unattributed 1910 piece, "A Comparison of Soybean milk and Cow's milk," which appeared in *Zhongxi yixuebao* (Journal of Chinese and Western medicines), a journal established by the famous vegetarian and popular writer of new medical knowledge, Ding Fubao (1874–1952), the author, like Li Shizeng, highlighted soybean milk's more advantageous nutritional profile, which had been demonstrated not only by chemical analysis but also in connection with the medical treatment of patients. The author also praised Li Shizeng's success in "winning" over the French palate to soybean-made foods and went so far as to suggest that the shifting winds of progress were now moving from East to West. "It is unavoidable that soybean milk will become one of cow's milk's most formidable adversaries."[29]

Milk for Growth

In the 1920s, Chinese nutrition scientists and physicians expanded the discussion about what made soybean milk good by recasting its functions in terms of infant and child health. The earlier estimation of milk's importance to national wealth and power was upheld, but transmuted more directly into medical concern for feeding and caring for China's young. Milk was identified as critical for normal child growth and development. But within a setting with neither a longstanding dairy industry nor economical ways to obtain imported milk products, medical physicians focused on soybean milk as a locally available and affordable alternative to cow's milk that could nonetheless achieve comparable physiological results.

A handful of Western physicians and researchers had begun experimenting with the development of an infant formula based on soybean powder. As Hilary Smith shows in this volume, medical interest in milk intolerance was first described in 1901, but was understood primarily as a problem only in infants.[30] Because cow's milk was the primary substitute recommended for breast milk, an infant's milk intolerance could have mortal consequences. John Ruhräh's 1909 study on soybean milk for

children with cow's milk idiosyncrasy or allergy marked an important step toward solving this problem. Combining finely ground soybean flour with water and a bit of sodium chloride to taste, Ruhräh then boiled the thin gruel for fifteen minutes before feeding it to infants with diarrhea and digestive disturbances. His work with soybean flour led him to develop the first line of soy-based infant formula, which appeared commercially in 1929.[31] Most American and European medical researchers framed their investigations of soybean milk as a potential alternative or substitute for cow's milk in infant feeding.[32] Valuations of taste, consistency, nutritional content, and so on, were all measured against cow's milk, and as long as the soybean ensured normal and healthy growth for the child recipient, medical researchers praised the bean for its high concentration of essential amino acids, adequate amount of vitamin B complex, and rich amounts of phosphorus, potassium, and iron.[33]

Within China, the Western-style medical community adopted this framework of evaluating soybean milk in terms of its ability to compete with cow's milk, be it in terms of taste, consistency, or nutritional values. Their interest in soybean milk as a cow's milk alternative reflected the biomedical consensus that the absence of milk compromised the proper nutrition of young children, but it also flagged scientific interest in the economic constraints facing Chinese mothers. The Peking Union Medical College (PUMC) physician Ernest Tso (Zhu Shenzhi) was the first researcher in China to study the application of soybean milk for the purposes of infant feeding. Born in Wuchang in 1894, Tso began his medical education at Harvard Medical School of China in Shanghai, and in 1919 graduated with a medical degree from Harvard Medical School in Cambridge, Massachusetts. He stayed on in Boston for the next decade and worked at the Boston Children's Hospital and the Boston Floating Hospital for Sick Infants, before returning to China in 1931 to join the pediatric faculty of PUMC.[34] In his research on soybean milk, Tso invoked the authority of Elmer V. McCollum and repeated McCollum's assessment that "the diet of China, Japan, and other countries in which the same general habits prevail [i.e., lack of cow's milk], is not suited for the proper nutrition of young children."[35] In McCollum's words,

> The final goal is to strive to discover whether any dietary regimen in use by man best promotes his vitality to the maximum. There is good reason to believe that the Oriental diet of the type under discussion, is at best, but a

> second rate one, and that it is not capable of meeting the needs of a growing child except in special cases where the most fortunate selection of articles is made. It does not, in general, support vigorous health and stimulate effort to an advanced age.[36]

By citing McCollum, Tso seemed to suggest that the absence of cow's milk in the Chinese diet posed serious problems to child growth and development. Moreover, the not uncommon situations in which "a mother's milk fails" or "the family cannot afford either the employment of a wet-nurse or artificial feeding with cow's milk" raised serious concerns about what kind of nutrition Chinese infants were getting, if any.[37] With neither breast milk nor cow's milk, Chinese infants faced severe and potentially life-altering challenges that delimited the extent to which they could mature into robust, vigorous adults.

Thus, from both an economic and a physiological standpoint, Tso argued, investigating the growth effects of a soybean milk diet on a young infant warranted attention, because an alternative had to be found. Tso carried out his examination and observation for eight months on Baby Yao, who had been born in the PUMC Hospital on August 27, 1926. Because the growth record of the child during the testing period compared favorably with "the average development of breast-fed infants," Tso concluded that a diet mainly of soybean milk, "properly supplemented, . . . can be more or less comparable to cow's milk in nutritive properties."[38]

Scientific interest in soybean milk as infant food did not arise out of an attempt by the Chinese scientific community to demonstrate the inadequacy of breast milk.[39] The extent to which Chinese mothers during the 1920s shifted away from breastfeeding to artificial feeding methods is difficult to determine. Certainly, from roughly 1910 through 1915 onward, milk advertisements became regular features in several popular magazines, such as *Funü zazhi* (The ladies' journal) and the newspaper *Shenbao,* which suggests a degree of popularization of at least the idea of milk consumption for children and family.[40] Greater female participation in the burgeoning urban and industrial workforce may have also decreased breastfeeding rates, although further research remains to be done to substantiate this point. At the very least, Chinese medical emphasis on the importance of breastfeeding may have functioned as a defensive mechanism to stem the actual or perceived tide of women forgoing breastfeeding for alternative methods.[41] It may also have reflected the medical

community's concern for the impracticality of cow's milk as an infant food in China, given the limited extent of dairying and the prohibitive costs associated with buying fresh and canned milk.[42]

Throughout the 1920s and 1930s, popular and specialist journals printed column after column urging mothers to breastfeed their babies.[43] Many physicians argued that breast milk was the best prophylactic against diarrheal diseases and the best nourishment for superior growth and development—mentally and physically—of an infant child, and for building resistance to infection.[44] As one "Venerable Youth" explained, "Mother's milk is suitable for infant digestion. It is neither too thick nor does it cause diarrhea. There's no other food as exquisite and healthy in the world that can beat mother's milk."[45] Medical consensus during this period tended to emphasize the nutritional importance of breast milk to infant growth and development. Western physicians practicing in China and their Chinese colleagues were largely in agreement on this point. Popular press pieces in support of breast milk emphasized the economic extravagance, as well as the questionable cleanliness, of tinned cow's milk. Breast milk—something all women could produce if provided a happy environment and simple yet sufficient nourishment—represented the quintessential food for infants such that feeding infants breast milk was advantageous not only for the infant but for the mother as well.[46] The idea of breastfeeding, intentionally or not, was also conscripted into nationalistic campaigns to promote the consumption of Chinese-produced goods.[47]

For situations in which a woman has been chronically ill or unable to produce breast milk, the Chinese medical community provided instructions on how to introduce and provide artificial milk.[48] In a similar fashion to Japan, popular prescriptions tended to organize one's options into a hierarchy of milks, with cow's milk (i.e., tinned milk) being touted as the best alternative in cases where the mother could not breastfeed her infant.[49] Tso's research on soybean milk should be seen as an example of economic pragmatism through the language of nutrition science.[50] By arguing that soybean milk was nutritionally comparable to cow's milk, Tso presented a scientifically backed rationale for recasting a local foodstuff as a modern "good" food that supported child growth and development. In other words, soybean milk, precisely because it could be construed as chemically comparable to cow's milk, could thereby be used to achieve the same results.

Soybean milk's affordability and integration into local diets and agricultural practices were cited as distinguishing features that demarcated

it from the foreignness of cow's milk in the popular consciousness. As Tso explained in his 1928 study, "Soybean 'milk' is a native food used in certain parts of the country as a morning beverage. . . . [It] is five to ten times cheaper than cow's milk. [My] experiment tends to show that, properly supplemented, it can be made more or less comparable to cow's milk in nutritive properties."[51] An indigenous foodstuff with a presumed pattern of local consumption, the soybean represented to many Chinese researchers a uniquely Chinese contribution to nutritional science. For this reason, clinical researchers associated with PUMC, Yenching University, and later the Henry Lester Institute for Medical Research in Shanghai examined not only the chemical composition of soybean milk, as well as that of other soy-derived products, but also its place within local diets and its effects on growth and development.[52]

Tso's research on the positive growth effects of a soybean milk diet for infants quickly reached urban audiences. Within a year, Chinese reprints and summaries of his work had appeared in public health and medical journals.[53] In 1933, the bimonthly medical journal *Guangji yikan* (Kwang Chi medical journal), edited by Ruan Qiyu (1891–1946), reported that the city government of Nanjing had implemented a trial program to distribute soybean milk to infants to combat malnutrition. Initiated on National Day (October 10, 1933), the program was designed to provide poor families with a nutritious and affordable infant food that had been properly and scientifically produced. "Many of the city's infants suffer from poor nutrition. Infant nutriments like cow's milk and milk powder are too expensive." In 1935, the pediatrician Su Zufei cited Tso's research in her recommendation that soybean milk could solve the pervasive threat of undernutrition that haunted Chinese children. "Our standard of living is so low that [if faced with situations, such as] low supplies of cow's milk, insufficient breast milk, or recently weaned children, there's always a fear of undernutrition." Legumes, Su continued, were full of nutrients, and this fact was well understood by the general public. So long as soybean milk was scientifically produced to yield "4.4% of protein, 1.8% of fat, and 9.5% of water-carbon," its benefits for infant nutrition were proven.[54] At a price point significantly cheaper than cow's milk (ten times less!), soybean milk was affordable for middle-class and poor households. As further support for the value of soybean milk to infant nutrition, Su highlighted the decision by the Beiping Health Demonstration Station to use soybean milk in their infant feeding programs.[55]

Chinese medical research emphasized the nutritional equivalency of soybean milk and cow's milk. That such nutritional benefits could be derived at lower expenditures was touted as one of soybean milk's advantages as an alternative to cow's milk. But its advantages were not limited to cost. A young female dietician writing for *Beiping chenbao* (Beiping morning newspaper) in 1934 also highlighted the fact that soybean milk would not curdle or congeal in the stomach as cow's milk would. In other words, soybean milk was more easily digestible—an argument that had also been advanced by an earlier generation of Chinese proponents for modern vegetarianism.[56] In this case, soybean milk's greater digestibility was especially important, as an infant's stomach was vulnerable during its first year of life—the easier to digest, the greater the influence upon proper growth and development.[57] Not only was soybean milk more digestible, it was, some argued, more hygienic because it was specially bottled and delivered to one's home.[58] Although an observant commentator could minimize this apparent advantage by pointing out that cow's milk was also bottled and delivered, medical proponents of soybean milk for infants highlighted two additional distinguishing features: first, because soybean milk came from a plant, one need not fear contamination or illness resulting from a sick cow's milk production, and second, one could easily produce soybean milk at home, thereby circumventing concerns about poor packaging or mishandling.[59] By providing an affordable but also accessible alternative for cow's milk in infant feeding, soybean milk promised the nutritional advantages of cow's milk in a more digestible form. Its goodness derived as much from its nutritional profile as from its low cost and sanitary properties—all of which is to say that soybean milk was deemed a modern good food for growing the Chinese body. In the words of one Wen Zhongjie writing for *Kexue congkan* (Science collectanea), "One can hardly believe that soybean milk has all that we need nutritionally and is so affordable. If we Chinese can use it regularly, then the less well-off can still obtain good foods; infants without mother's milk can still obtain proper nutrients; they need not worry about [not] building a strong body or a robust race."[60]

Soy as the Other Milk

By the early twentieth century, the Western scientific community had come to extol the virtues of dairy milk as an integral component of human nutrition, nature's perfect food, and later an essential protective food

whose presence in local dietaries could serve as the alimentary benchmark for determining the rise of modern civilization. Nations could be ranked according to what they ate, and without milk, the likelihood of a nation rising to the ranks of the progressive few was small. Without milk, as chemists such as Elmer V. McCollum explained, nations suffered from poor physiques, shortened lives, high infant mortality, and stunted literature, science, and art. To be without milk was to be excluded from the progress of man and modern civilization.

This message of dietary destiny and the importance of the "power cuisines" of nineteenth-century imperialist nations informed the mindset and activities of men such as Li Shizeng and Ernest Tso, who internalized the modernist demand for milk but attempted to subvert its universalizing reach by querying which milk.[61] That cows should be the primary or sole benefactor of such nutritional and civilizational goodness seemed to contravene the wealth and diversity of China's own experiences. For Li, soybean milk represented a vision of Chinese modernity achieved through the reinvention of existing agricultural practices with the aid of modern science and technology. That the rest of the world might esteem cow's milk and its products did not, in and of itself, necessitate that the Chinese too should do the same. If anything, modern science and the language of biochemistry testified to the power of alternatives such as soybean milk to achieve the same ends. The goodness of cow's milk could also be found in soybean milk.

By the late 1920s, the importance of soybean milk as a Chinese alternative to cow's milk arose in connection to growing concern for Chinese infant and child health. Ernest Tso framed the quest to improve infant and child health as an economic and social problem for which soybean milk was uniquely positioned to solve. As a local customary food and byproduct of the tofu-making process, soybean milk was both more available and more affordable than cow's milk. With medical research undertaken to confirm its nutritive properties and positive influence on child growth and development, medical proponents of soybean milk also characterized the drink as more digestible for infantile stomachs and as more hygienic for its association with modern bottling and distribution. That soybean milk could also be made at home suggested a degree of control and security not otherwise available with fresh or tinned cow's milk. The importance of milk and its alternatives for Chinese intellectuals and scientists from the 1910s through the 1930s

delineated a broader concern for how China ought to develop and its place within a global community of modern nations. For China, "got milk" may have been the prerequisite for modern progress, but "which milk" represented the more pivotal concern.

Notes

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1. During the Tang period, milk products formed a significant part of the diet of the upper classes, but the long-term effects of this dietary practice remained tied to the dynasty itself. For a general introduction, see K. C. Chang, ed., *Food in Chinese Culture: Anthropological and Historical Perspectives* (New Haven, CT: Yale University Press, 1977), especially Edward H. Schafer's chapter on the Tang.
2. Françoise Sabban, "Session 4: To Each His Own Milk, Questions and Responses with Françoise Sabban," "Cultures des laits du monde," Ocha International Symposium, May 6–7, 2010, Musée national d'histoire naturelle, Paris.
3. Gerrit Jan Mulder, physician and professor of chemistry at Utrecht, coined the term "protein" in 1838.
4. Quoted in Deborah M. Valenze, *Milk: A Local and Global History* (New Haven, CT: Yale University Press, 2011), 164.
5. E. Melanie DuPuis, *Nature's Perfect Food: How Milk Became America's Drink* (New York: New York University Press, 2002), 21–25, 35.
6. E. V. McCollum was the first to highlight Dumas' observations in "Who Discovered Vitamins?" *Science* 118 (November 1953): 632.
7. Harmke Kamminga and Andrew Cunningham, eds., *The Science and Culture of Nutrition, 1840–1940* (Amsterdam: Rodopi, 1995), 10.
8. DuPuis, *Nature's Perfect Food;* and Valenze, *Milk,* chap. 9.
9. Elmer V. McCollum, *The Newer Knowledge of Nutrition: The Use of Food for the Preservation of Vitality and Health* (New York: Macmillan, 1918), 67; and Valenze, *Milk,* 239.
10. League of Nations, *The Problem of Nutrition,* vol. 2, *, Report on the Physiological Bases of Nutrition* (Geneva: League of Nations, 1936), 15.
11. Valenze, *Milk,* 251.
12. McCollum, *Newer Knowledge of Nutrition,* 150–151.
13. Valenze, 2 *Milk,* 49.
14. For a detailed discussion of how Chinese dairymen and supporters of cow's milk in the 1930s and 1940s presented milk as a scientific habit fit for a modern nation and a key ingredient to China's success in the evolutionary struggle to survive,

see Susan Glosser, "Milk for Health, Milk for Profit: Shanghai's Chinese Dairy Industry under Japanese Occupation," in *Inventing Nanjing Road: Commercial Culture in Shanghai, 1900–1945,* ed. Sherman Cochran (Ithaca, NY: Cornell University Press, 1999), 207–233. League of Nations, *Nutrition: Final Report of the Mixed Committee of the League of Nations on the Relation of Nutrition of Health, Agriculture, and Economic Policy* (Geneva: League of Nations, [1937]), 60–64.

15. Quoted in Susie Wang, "Buyu Zhongguo: Jindai Zhongguo de niuru xiaofei—20shiji er, sanling niandai Shanghai wei zhongxin de kaocha" (Bolstering China: Modern Chinese milk consumption in Shanghai during the 1920s and 1930s), *Journal of Chinese Dietary Culture* 7, no. 1 (2011): 215.

16. Ibid.

17. See the chapter by Leung in this volume.

18. Li Shizeng, "Ershier sui chuyou sihai" (See the world at the age of twenty-two), in *Li Shizeng xiansheng wenji xiace* (Taipei: Zhongguo guomindang zhongyang weiyuanhui dangshi weiyuanhui, Zhongyang wenwu gongyingshe, 1980), 74; Li Yuying, *Da Dou: Le Soja* (The soybean) (Paris: Société biologique de l'Extrême Orient, 1910); and Li Shuhua, "Xinhai geming qianhou de Li Shizeng xiansheng" (Li Shizeng before the Xinhai Revolution), *Zhuanji wenxue* 24, no. 2 (1974): 42–46; reprinted in *Li Shizeng zhuanji ziliao,* vol. 1 (Taipei: Tianyi chubanshe, 1979), 47–49.

19. Li Yuying, "Le Soja," *L'Agriculture pratique des pays chauds* 11, no. 2 (September 1911): 178.

20. Charles Lemarié, "Les sojas du Japan," *Bulletin économique de l'Indochine* (Hanoi) 13, no. 85 (1910): 493–498.

21. Li Yuying, "Vegetable Milk and Its Derivatives," British Patent 30275, filed December 30, 1910, and accepted February 29, 1912, cited in Shurtleff and Aoyagi, *Li Yu-ying (Li Shizeng),* 26. Li was incredibly active in patenting his various soybean-related products and techniques. Alongside this application for "vegetable milk," Li also applied and received British patents for "sauce consisting chiefly of soja grains" and "soja flour and its derivatives," as well as French patents for soybean-made meats and cold cuts and chocolate. He also received an American patent in 1913 for his "method of manufacturing products from soja."

22. For references to his presentation to the French Society of Agriculture, see H. Hitier, "Société Nationale d'Agriculture de France: Le soja," *Journal d'agriculture pratique* 74, no. 1 (1910): 24–25; and Henri Blin, "Le soja ou fève de Mandchourie: Productions et utilisations" (The soybean or bean of Manchuria: Production and utilization), *La Nature* (Paris) 38, no. 1 (1910): 141–142, both cited in William Shurtleff and Akiko Aoyagi, comp., *Li Yu-ying (Li Shizeng)—History of His Work with Soyfoods and Soybeans in France, and His Political Career in China and Taiwan (1881–1973): Extensively Annotated Bibliography and Sourcebook* (Lafeyette, CA: Soyinfo Center, 2011), 17, 21.

23. United States Department of Agriculture, *The International Dairy Federation and International Dairy Congresses* (Washington, DC: US Department of Agriculture, Bureau of Animal Industry, 1904), 9–10.

24. "Bulletin agricole et horticole: Le Congrès international de laiterie," *La Gazette du Village* 42, no. 2 (January 8, 1905): 719; and Fédération internationale de laiterie—Comié français, *2^e^ Congrès International de Laiterie Paris, 16–19 Octobre 1905: Compt-rendu des séances, excursions, liste des congressistes* (Paris: Condé-sur-l'Escaut, Impr. F. Descamps, 1905), 387–389.

25. Sabban, "Session 4," 211.

26. Wang, "Buyu Zhongguo," 214–215.

27. Jia-Chen Fu, *The Other Milk: Reinventing Soy in Republican China* (Seattle: University of Washington Press, 2018).

28. Li Yuying, "Dadou shipin zhi gongyong" (Uses of soybean-derived foods), *Tongwen bao: Yesujiao jiating xinwen* 417 (1910): 7.

29. The author overstates Li's success. As Angela Leung notes, his factory was unprofitable and quickly became reliant on French government subsidies for making soya products for Chinese soldiers fighting for the French government. "Douru yu niuru zhi bijiao" (A comparison of soybean milk and cow's milk), *Zhongxi yixue bao* 8 (1910): 8; see also note 32 in the chapter by Leung in this volume.

30. See the chapter by Smith in this volume.

31. Frank T. Faulkner, *Infant and Child Nutrition Worldwide: Issues and Perspectives* (Boca Raton, FL: CRC Press, 1991), 232; and William Shurtleff and Akiko Aoyagi, "History of Soymilk and Dairy-like Soymilk Products," Soy Info Center, accessed August 3, 2011, http://www.soyinfocenter.

32. On the rise of artificial infant feeding in the United States and Britain, see Rima D. Apple, *Mothers and Medicine: A Social History of Infant Feeding, 1890–1950* (Madison: University of Wisconsin, 1987); Valerie A. Fildes, *Breasts, Bottles, and Babies: A History of Infant Feeding* (Edinburgh: Edinburgh University Press, 1986); and Samuel J. Fomon, "Infant Feeding in the 20th Century: Formula and Beikost," *Journal of Nutrition* 131 (2001): 409S–420S.

33. An emphatically positive assessment of soy milk's nutritive properties appeared in the *Chinese Medical Journal*'s special issue on pediatrics in April 1936. The authors, H. W. Miller and C. Jean Wen, physicians at the Shanghai Sanitarium and Pediatric Department of the Shanghai Clinic. Miller, a Seventh-day Adventist medical missionary, arrived in China in 1903 and began investigating the potential benefits of soy milk for human nutrition around 1925. He developed a "nutritious milk" from soybeans to give patients at his Shanghai Sanitorium. Raymond S. Moore, *China Doctor: The Life Story of Harry Willis Miller* (New York: Harper and Brothers, 1961), 126. See also the chapter by Leung in this volume.

34. "Who's Who in China: Dr. Ernest Tso," *China Weekly Review,* September 24, 1932, 167.

35. Quoted in Ernest Tso (Zhu Shenzhi), "The Development of an Infant Fed Eighth Months on a Soybean Milk Diet," *Chinese Journal of Physiology* 2, no. 1 (1928): 33–40. The original quote comes from McCollum's discussion of the "Oriental Diet" in *Newer Knowledge of Nutrition*, 399.

36. Elmer V. McCollum, *The New Knowledge of Nutrition: The Use of Food for the Preservation of Vitality and Health*, 2nd ed. (New York: Macmillan, 1922), 399.

37. Ernest Tso , "Development of an Infant," 33.

38. Ibid. Tso does not explain why Baby Yao was transferred to the Pediatric Service almost a month after his birth, nor does he elaborate on the circumstances that led him to use Baby Yao for the experiment.

39. For an exploration of how breastmilk was increasingly seen as the material manifestation of proper motherhood in Japan, see the chapter by Nakayama in this volume.

40. Sabban, "The Taste for Milk in Modern China (1865–1937)," in *Food Consumption in Global Perspective: Essays in the Anthropology of Food in Honor of Jack*

Goody, ed. Jakob A. Klein and Anne Murcott (Basingstoke, UK: Palgrave Macmillan, 2014), 194.

41. It may also have reflected revaluations of women and motherhood in a period of intensive cultural and social upheaval. Further research on this topic to come.

42. According to B. S. Platt, an associate researcher in the Division of Clinical Research of the Henry Lester Institute of Medical Research (Shanghai), "The facilities afforded in China at the present time for introducing such substitutes for human milk are so limited that no useful purpose can be served by extended discussion." B. S. Platt, "An Approach to the Problems of Infant Nutrition in China," *Chinese Medical Journal* 50 (April 1936): 417.

43. See, for example, "Xiao'er tianran de buru zhi jiazhi" (The value of natural breastfeeding for infants), *Shenbao* (May 17, 1923); Aibo, "Ying'er yinshi de wenti" (The infant food problem), *Weishengbao* 2, no. 16 (1930): 15; and Shao Wenshan, "Tantan ying'er weisheng de jijian zhongyao wenti" (A discussion of a few infant hygiene issues), *Yiyao pinglun* 55 (1933): 54–55.

44. Platt, "Approach," 415–416.

45. Laoshao nian, "Ying'er buru wenti" (Infant feeding problem), *Zhongguo kangjian yuebao* 1, no. 4 (1933): 55.

46. Aibo, "Ying'er yinshi de wenti," 15.

47. See Sabban, "Taste for Milk in China," 195. Incidentally, Chinese dairymen also attempted to present their commercial forays into dairying as nationalistic enterprises, such that buying fresh milk could also be construed as supporting China against foreign aggression and imperialism. See Wang, "Buyu Zhongguo," 218.

48. The more common practice prior to the twentieth century was to employ a wet nurse. To this end, classical medical authors went into considerable detail delineating the importance of obtaining a wet nurse with the right sorts of physical qualities and character attributes. The emphasis on artificial milk, be it from an animal or a plant, seems to be part of the larger project of modern motherhood that rendered "natural" acts as transparent acts (i.e., descriptions and images of how gestation and birth actually occur), guarded the nuclear family against interlopers (e.g., wet nurses), and overlaid female reproduction with responsibilities to the nation-state. More work remains to be done about the politics of wet nurses and changes in conceptions of the human and human fluids in twentieth-century China. See Hsiung Ping-chen, "The Nurse the Young: Breastfeeding and Infant Feeding in Late Imperial China," *Journal of Family History* 20 (September 1995): 217–238; Hsiung Ping-chen, *A Tender Voyage: Children and Childhood in Late Imperial China* (Stanford, CA: Stanford University Press, 2005), 83–90; and Tina Phillips Johnson, *Childbirth in Republican China: Delivery Modernity* (Lanham, MD: Lexington Books), 2011, 35–72.

49. See, for example, "Yu er fa" (Caring for infants), *Shenbao,* December 23, 1917; "Yu er fa zai xu" (Caring for infants continued), *Shenbao,* December 25, 1917; "Ying'er tiaoyang fa" (How to take care of infants), *Shenbao,* March 17, 1921; and "Lun jiating jiaoyu" (On family education), *Shenbao,* January 8, 1922.

50. For other medical studies encouraging the use of soybean milk as infant food, see, for example, A. C. Siddal and Y. T. Chiu, "A Feeding Experiment with Soybean Milk," *Lingnan Science Journal* 10, no. 4 (1931): 387–391; and Wen Zhongjie, "Huang douru zhi yanjiu" (Research on soybean milk), *Kexue congkan* 3 (1930): 1–19; "Douru, huashengru, yumi mian yu niurufen yingyang jiazhi zhi bijiao" (A comparison of the nutritional values of soybean milk, peanut milk, corn flour noodles, and cow's milk), *Nankai daxue yingyong huaxue yanjiusuo baogaoshu* 3, no. 0 (1935): 71–76.

51. Tso, "Development of an Infant," 33.

52. See, for example, William H. Adolph, "How China Uses the Soybean as Food," *Journal of Home Economics* 43 (1922): 63; Wu Guangli, "Douru jiaoti huaxue zhi yanjiu" (Research on soybean milk colloid chemistry), *Ziran kexue* 2, no. 4 (1930): 41–54; Wen Zhongjie, "Huangdouru zhi yanjiu" (Research on soybean milk), *Kexue congkan* 3 (1930): 1–19; K. J. Chang and Ernest Tso, "Soybean Milk," *Chinese Journal of Physiology* 5 (1931): 199; and A. A. Horvath, "Nutritional Value of Soybeans," *American Journal of Digestive Diseases* 5 (1938): 177–183.

53. Tso's study was printed in Chinese as "Yong douru bu ying'er zhi chengji," *Weisheng yuekan* 4 (1928): 5–11. Summaries, discussions, and reprints of his work can be seen in "Yong douru bu yinghai zhi chengji," *Weisheng gongbao* 2 (1929): 1–6; Zhang Zeyao, "Zazu: Yong douru bu ying'er de chengji," *Kexue* 14, no. 5 (1930): 731–736; and Zhu Shenzhi, "Yong douru bu yinghai zhi chengji," *Yixue zhoukanji* 4 (1931): 52–55.

54. Su Zufei, *Ertong yingyang* (Child nutrition) (Shanghai: Yamei gufen youxian gongsi, 1935), 16.

55. See "Yijie xiaoxi: Jingshi weisheng shiwusuo faming doujiang buying" (Medical world news: Nanjing health office invents doujiang for feeding infants), *Guangji yikan* 10, no. 10 (1935): 6.

56. Su Fei, "Dou ji douru" (Soybeans and soybean milk), *Beiping chenbao*, March 3, 1934; see also the chapter by Leung in this volume.

57. "Doujiang ke dai rennai" (Soybean milk can substitute for breastmilk), *Xing Hua* 32 (1935): 18–19. See also "Yong douru bu yinghai zhi chengji" (Results of using soybean milk to feed children), *Weisheng gongbao* 2 (1929): 5.

58. See, for example, "Jishi: Sanduo douruchang faxing doufujiang" (News about town: Sanduo soybean milk company has begun selling soybean milk), *Wujiang* 30 (1922): 1; "Zawen: doujiang shangshi" (Miscellaneous news: Soybean milk has reached the market), *Qinghua zhoukan* 322 (1924): 24; "Doujiang zhi fenxi" (*Doujiang* analysis), *Nankai daxue yingyong huaxue yanjiusuo baogaoshu* 1, no. 0 (1933): 21–22.

59. "Zuo douru de fazi" (Method for making soybean milk), *Guanhua zhuyin zimu bao* 100 (1920): 20–22; "Shi Weisheng shiwusuo faming doujiang buying" (City Health Bureau discovers the *doujiang* for infants), *Guangji yikan* 10, no. 10 (1933): 92–93; and Ming, "Xinfa zhi doujiang" (New method for making *doujiang*), *Jiaoyu duanbo* 1 (1934): 51.

60. Wen Zhongjie, "Huangdouru zhi yanjiu" (Research on soybean milk), *Kexue congkan* 3 (1930): 2.

61. Rachel Laudan, "Power Cuisines, Dietary Determinism, and Nutritional Crisis: The Origins of the Globalization of the Western Diet," paper presented at the conference "Interactions: Regional Studies, Global Processes, and Historical Analysis," Washington DC, February 28–March 3, 2001, accessed December 20, 2015, http://webdoc.sub.gwdg.de.