Introduction to the Yogurt in Nutrition Initiative and the First Global Summit on the Health Effects of Yogurt[1–3]

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ABSTRACT

Yogurt has been part of the human diet for thousands of years, and during that time a number of health benefits have been associated with its consumption. The goal of the First Global Summit on the Health Effects of Yogurt was to review and evaluate the strength of current scientific knowledge with regard to the health benefits of yogurt and to identify areas where further research is needed. The evidence base for the benefits of yogurt in promoting bone health, maintaining health throughout the life cycle, improving diet quality, and reducing the incidence of chronic diseases, such as obesity, metabolic syndrome, and cardiovascular disease, was presented. When assessing a complex food matrix, rather than specific nutrients, scientists and consumers are faced with new challenges as to how a food item's quality or necessity would be judged as part of an individual's whole diet. To tackle this challenge, speakers described methods for assessing the nutrient density of foods and its application to yogurt, use of yogurt for lactose intolerance, and the cost-effectiveness of yogurt and dairy products in reducing health care expenses. Last, speakers described the role of dairy products in global public health and nutrition, the scientific basis for current dairy recommendations, and future scientific and policy needs related to dairy and yogurt recommendations. *Am J Clin Nutr* 2014;99(suppl):1209S–11S.

On 24 April 2013, the First Global Summit on the Health Effects of Yogurt was held as a satellite symposium to the 2013 Experimental Biology meeting. The symposium was supported by the ASN (Washington, DC), The Nutrition Society (London, United Kingdom), the Dairy Research Institute (Rosemont, IL), and Danone Institute International (Palaiseau, France). The symposium was organized on behalf of the Yogurt in Nutrition Initiative (YINI), which was established in 2012. The overall mission of the YINI is to advance scientific knowledge on the health benefits of yogurt and to broadly disseminate that information. To achieve this mission, YINI has established 3 overall goals: first, to identify and review existing science on the health benefits of yogurt; second, to promote scientific research on the health benefits of yogurt; and last, to broadly disseminate knowledge on the health benefits of yogurt. The First Global Summit on the Health Effects of Yogurt was the initial step in meeting the objectives of the first goal.

Yogurt is prepared from milk fermented by added bacteria, which produce lactic acid that acts on milk protein to give yogurt its texture and its characteristic acidity. Bovine milk is most commonly used to make yogurt, but milk from water buffalo, goats, ewes, mares, camels, and yaks is also used in various parts of the world. In the United States, yogurt is produced by using a culture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* bacteria to meet the standard of identity for yogurt. In addition, other lactobacilli and bifidobacteria are also sometimes added during or after culturing yogurt (1, 2).

Yogurt has been consumed for several thousands of years. It is one of the earliest examples of food processing to improve "shelf life." Most historical accounts attribute the creation of yogurt to the Neolithic peoples of central Asia around 6000 BCE, but little remains as direct proof of this (3). It is thought that herdsmen stored milk from their sheep in containers made from the stomachs of animals and the natural enzymes in the stomach lining curdled the milk, essentially making yogurt. Curdling the milk extended the time that it could be consumed safely and likely improved its digestibility by reducing the lactose content (4). Since their discovery, yogurts and other soured-milk products were a component of the diet of some of the earliest civilizations in the Middle East (3). The Roman Pliny the Elder later mentioned production of yogurt by "barbarian tribes" (3).

The first unequivocal description of yogurt is found in a dictionary called *Divanu luga-i turk*, compiled by Kasgarli Mahmut in 1072–1073 in the Middle East. The consumption of yogurt spread rapidly throughout the geographic and cultural region known as the Levant, which encompassed the westernmost protrusion of Asia, comprising most of the Republic of Turkey (5). Recorded history states that in the 13th century, Genghis Khan and his armies lived on yogurt made from horse milk, likely resulting in the exposure of people in the conquered Mongol Empire to this new food (5).

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[2] Presented at the satellite symposium "First Global Summit on the Health Effects of Yogurt," held in Boston, MA, at ASN's Scientific Sessions at Experimental Biology 2013, 24 April 2013. The conference was organized by the ASN, the Nutrition Society, Danone Institute International, and the Dairy Research Institute. The supplement scientific guest editors were Sharon M Donovan, University of Illinois, Urbana, IL, and Raanan Shamir, Schneider Children's Medical Center and Tel Aviv University, Israel.

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Why study the health benefits of yogurt? Yogurt first gained international prominence in the early 1900s when Ilya (Elie) Metchnikov, a Nobel Prize–winning Russian immunologist and bacteriologist, observed that Bulgarians whose diet included the consumption of large quantities of soured milk lived longer than those who did not (6, 7). Although this observation was purely associative, Metchnikov subsequently began research on the causes of human aging while working at the Pasteur Institute in Paris. He found that dietary proteins were degraded by the action of putrefactive intestinal bacteria that he hypothesized caused poisoning of the body and early death. He went on to show that the only food that could restrict the development of putrefactive bacteria in the intestine was Bulgarian yogurt (8).

Over the past century, there has been continued research into the potential health benefits of yogurt. A PubMed (http://www.ncbi.nlm.nih.gov/pubmed) search of the terms "yogurt and health" identified >420 citations, including applications for improving nutritional status (9), maintaining health (10), the prevention and treatment of acute diarrheal disease (11), and the prevention or treatment of chronic diseases such as elevated blood pressure, weight gain, and metabolic diseases (12–15). A recent study that caught the attention of consumers worldwide attributed commercially available yogurt to a "glow of health" in rodents (16). Feeding probiotic bacteria to aged mice induced integumentary changes mimicking peak health and reproductive fitness characteristic of much younger animals (16). Mechanistically, the probiotic yogurt triggered epithelial sebocytogenesis, resulting in thick lustrous fur, which was associated with an IL-10–dependent process (16). The authors postulated that the probiotic-triggered changes in skin and hair arose from microbe-induced effects on tissue inflammation (16).

As presented in this symposium, accumulating preclinical, clinical, and epidemiologic findings provide suggestive evidence for health benefits associated with yogurt consumption, although the strength of the evidence varies depending on the health outcome. Many studies were underpowered, and few randomized controlled clinical trials with yogurt have been conducted.

What research is required to establish the health benefits of yogurt?

- Investigations need to be conducted across the life span from "pediatrics" to "geriatrics," including pregnancy.
- Randomized, placebo-controlled studies are required in healthy and diseased populations.
- Evaluations are required of the individual and combined influences of the nutrients and bacteria contained in yogurt.
- In terms of the bacteria in yogurt, studies must include a complete description of the product being tested. In some cases, the efficacy of yogurt is compared with isolated probiotic bacteria within the same study. For example, Levkovich et al (16) compared isolated *Lactobacillus reuteri* to a commercially available yogurt. Without detailed information on the types and doses of bacteria present in the treatments, it is impossible to compare findings across studies in systematic reviews or meta-analyses.
- Evaluation is required of the impact of delivery matrix on the efficacy of probiotic bacteria (9). As summarized by Sanders (10), the delivery matrix of yogurt may influence probiotic functionality in several ways: by increasing probiotic survival in the product, by increasing probiotic survival and efficacy at the site of action in the host, or by delivering complementary functionality through components of the delivery system or from fermentation-derived bioactive compounds.
- The relative efficacies of live compared with killed bacteria in yogurt need to be compared, as well as the value of adding bacteria to yogurt.
- Mechanistic studies of yogurt and/or the probiotic action on gut health and the microbiome are required (17). For example, McNulty et al (18) conducted a parallel series of studies in animals and monozygotic twins to study the effects of probiotic yogurt containing 5 bacterial species on the gut microbiota. No change in the gut microbiota composition was observed in response to yogurt consumption, but transcriptional and metabolic changes in the host commensal microbiota in response to the probiotic species was noted.

Although much has yet to be learned about the relation between yogurt and its components and health outcomes, the presentations at this symposium indicate that we are effectively advancing our understanding of the efficacy of yogurt. We hope that the presentations provided in this supplement will stimulate scientific discussion and promote targeted research to identify mechanisms and benefits of yogurt on health.

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