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Pipeline Statistics

January – June 2017

Nutrition

Papers:	3
Abstracts:	15

Product

Papers:	6
Abstracts:	5

Sustainability

Papers:	2
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Total Published: 29

NR

Nutrition Research

High Impact Papers * - Published

- **Multiple Vitamin K Forms Exist in Dairy Foods.** Xueyan Fu, Stephanie G. Harshman, Xiaohua Shen, David B. Haytowitz, J. Phillip Karl, Benjamin E. Wolfe and Sarah L Booth **Current Developments in Nutrition** 2017, 1 (6) e000638.

High Impact Papers * - Submitted for publication

- **Children Consuming Flavored Milk Consumed More Milk and There Was a Higher Prevalence That Met Dietary Recommendations for Calcium Than Non-consumers: NHANES 2001-2012.** Nicklas, T. **Journal of School Health** 2017

PR

Product Research

High Impact Papers * - In Press

- **Drivers of choice for fluid milk versus plant-based alternatives: What are consumer perceptions of fluid milk?** McCarthy KS, Parker M, Ameerally A, Drake SL and Drake MA. 2017. *Journal of Dairy Science* 2017 doi.org/10.3168/jds.2016-12519

S

Sustainability

- **Review Article Commissioned by the Innovation Center for U.S. Dairy Receives JDS Most-Cited Award in Nutrition, Feeding and Calves**

** The High Impact Papers in this Research Pipeline Quarterly were selected to present new or novel findings that enhance what we know about a particular area of dairy related research, or reflect new large scale studies that support previous evidence that was once only considered emerging.*

Xueyan Fu, Stephanie G. Harshman, Xiaohua Shen, David B. Haytowitz, J. Phillip Karl, Benjamin E. Wolfe and Sarah L Booth *Current Developments in Nutrition* 2017, 1 (6) e000638; DOI: <https://doi.org/10.3945/cdn.117.000638>

Status: **Published**

Communication Ready: **YES**

DGA Relevant: **YES**

Key Words: *vitamin K, menaquinones, dairy products, fermented, reduced fat, phyloquinone, Booth*

Type of Research: Clinical trial

Funding Source: **National Dairy Council** and USDA-ARS.

References:

- [Gast GC et al. *Nutr Metab Cardiovasc Dis.* 2009; 19\(7\):504-10](#)

Headline: **US dairy products are a significant dietary source of vitamin K.**

Abstract

The plant-based form of vitamin K (phyloquinone, PK, vitamin K1) has been well-quantified in the U.S. diet. Menaquinones (MK, vitamin K2) are another class of vitamin K compounds that differ from PK in the length and saturation of their side chain but have not been well characterized in foods. The objectives of this study were to: 1) quantify, using mass spectrometry technology, PK and the different forms of MK (MK4 through MK13) in milk, yogurt, Greek yogurt, creams and cheeses; and 2) compare the MK contents of full-fat, reduced fat and non-fat dairy products. All dairy samples were either obtained from USDA National Food and Nutrient Analysis Program or purchased from retail outlets. Full fat dairy products contained appreciable amounts of MK, primarily in the forms of MK9, MK10 and MK11. We also measured modest amounts of PK, MK4, MK8 and MK12. In contrast, there was little MK5-7 or MK13 detected in the majority of dairy products. The total vitamin K contents of soft cheese, blue cheese, semi-soft cheese and hard cheese were 506 ± 63 , 440 ± 41 , 289 ± 38 and 282 ± 5.0 $\mu\text{g}/100$ g, respectively. Non-fermented cheeses, like processed cheese, contained lower amounts of vitamin K (98 ± 11 $\mu\text{g}/100$ g). Reduced fat or fat free dairy products contained ~5-22% of the vitamin K found in full fat equivalents. For example, total vitamin K contents of full fat milk, 2% milk, 1% milk and non-fat milk were 38.1 ± 8.6 , 19.4 ± 7.7 , 12.9 ± 2.0 and 7.7 ± 2.9 $\mu\text{g}/100$ g, respectively. To the best of our knowledge, this is the first report of MK contents of U.S. dairy products. Findings indicate that the amount of vitamin K contents in dairy products is high and proportional to the fat content of the product. If biological activity of MK from foods is established, dairy products could have an important dietary role in vitamin K nutrition.

Contribution to the State of Science

Vitamin K is an essential fat-soluble vitamin that is crucial for blood clotting, bone metabolism, cell cycle regulation, and cardiovascular health. Vitamin K is found in 2 natural forms; 1) phyloquinones (PK) and 2) menaquinones (MK). While the PK form is widely distributed in the food supply, MK forms appear to be limited to animal products and fermented foods. The current US recommendation for vitamin K intake is based on usual PK intakes and does not consider the potential dietary contribution of other forms of Vitamin K, due in part to the fact that MK has not been systematically analyzed in the US foods. While observational data suggests that intakes of MK found in dairy products has stronger associations with heart health benefits compared to [PK intakes](#), quantifying MK content of commonly consumed foods is needed to determine if these observations are generalizable. To that end, the purpose of this study was to quantify the content of multiple forms of vitamin K in various dairy products, including dairy foods with different fat-levels. Results from this study showed that even though historically dairy foods have not been considered a rich dietary source of vitamin K because of low PK levels, results from this study showed that US dairy products are a significant dietary source of MK.



Subject Matter Expert Comment – Elieke Demmer, Ph.D.

This is an important study with exciting results; commonly consumed dairy products in the US diet contain appreciable amounts of multiple vitamin K forms which are directly related to fat content. However, it's important to highlight that current understanding of MK absorption, transportation, and bioactivity is limited. Now that we know MK forms are more abundant in commonly-consumed US dairy foods than previously recognized, additional research is needed to determine the bioavailability of MK.

Status: Submitted - Under Review

DGA Relevant: YES

Key Words: Children, flavored milk, school, NHANES, dairy, calcium

Type of Research: Cross-sectional, observational study

Funding Source: National Dairy Council and USDA/Agricultural Research Service

NOT READY FOR COMMUNICATION
Publication Pending

References:

1. [U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015.](#)
2. [Hanks, AS et al. PLOS One. 2014 Apr; 9\(4\):e91022.](#)
3. [Quann, EE et al. Nutr Today. 2013 May/June; 48\(3\):127-34](#)
4. [Fayet-Moore, F. Nutr Rev. 2016 Jan; 74\(1\): 1-17.](#)
5. [Nicklas, TA et al. J Sch Health. 2013 Oct; 83\(10\): 728-733.](#)

Children Consuming Flavored Milk Consumed More Milk and There Was a Higher Prevalence That Met Dietary Recommendations for Calcium Than Non-consumers: NHANES 2001-2012

Nicklas T., Journal of School Health

Headline: Consumption of flavored milk may improve diet quality for children

Abstract

Background: Flavored milk is being removed from some schools because of the perception that it negatively impacts the overall diet. This study assessed the contribution of flavored milk to the diets of children. **Methods:** Individual usual intakes (IUI) were calculated from 24-hour dietary recalls in the NHANES 2001-2012 for children 2-18 years (n=20,329). IUI of >0.25 cup equivalent of flavored dairy milk defined consumers (n=3,564; 56% male). Regression analysis used appropriate sample weights and adjusted for age, gender, ethnicity, poverty index ratio, and physical activity. Estimated Average Requirements (EAR) and Adequate Intakes (AI) determined the relation to dietary recommendations. Significance was set at a p value ≤ 0.001 for all analyses. **Results:** Flavored milk consumers consumed more milk than non-consumers. In children 2-3 years mean added sugars intakes were higher than in non-consumers. Consumers 2-3 years and 9-13 years consumed more mean saturated fat (SFA) than non-consumers. Consumers 14-18 years had higher percent energy from SFA than non-consumers. Consumers had a lower mean percentage of children meeting AI for fiber and a higher percentage meeting the EAR for calcium. Only consumers 4-8 years and 9-13 years had a higher mean percentage of children meeting the EAR for magnesium. **Conclusion:** Consumption of flavored milk has the potential of increasing milk consumption and reducing the percentage of children below the EAR for calcium; however the percentage meeting AI for fiber was lower.

Contribution to the State of Science

The Dietary Guidelines for Americans (DGA) recommends children aged 2-18 years consume between 2 and 3 servings of dairy per day, based on age group, and keep added sugars to $\leq 10\%$ of calories milk provides calcium, vitamin D, potassium and magnesium. However, flavored milk can have up to twice as much added sugar as non-flavored milk. As a result, some schools have considered limiting, or completely removing, flavored milk from cafeterias to adhere to the DGA's recommendations. Prior research has shown that removing flavored milk from schools [increase waste and decrease the number of students eating school lunches, increase costs by requiring additional foods to replace flavored milk and lead children to drink less milk overall](#). Additionally, flavored milk contributes only [4% of total added sugars in children's diets](#) while providing essential nutrients. This study utilized NHANES data from 2001-2012 to determine the nutrient contribution of flavored milk to the children's diets. Results showed that children 2-18 years of age are not meeting the recommendations for calcium, vitamin D, magnesium, fiber or potassium but children who consumed flavored milk had significantly higher calcium, vitamin D, potassium (except those 14-18 years old) and magnesium (only in those 2-3 years old) intakes. Some age groups who consumed flavored milk had a higher mean saturated fatty acid intake compared to non-consumers.



Subject Matter Expert Comment – Leila Shinn, MS, RD

This study found that flavored milk may contribute to increased calcium intakes in children, which is important because on average children are not meeting current calcium recommendations. While flavored milk contains saturated fat, added sugars and sodium, it also contains 3 of the 4 nutrients of public health concern; calcium, vitamin D and potassium. As noted by authoritative sources such as the American Academy of Pediatrics, some added sugars can be included as part of a healthy diet to help increase consumption of nutrient rich foods. Consumption of flavored milk has the potential of increasing milk consumption and decreasing the percentage of children below the EAR for calcium.

Leila Shinn, MS, RD is an intern in the Nutrition Research department. She is a recent graduate of Rush University with her Masters in Nutrition. While at NDC Leila is responsible for assisting with the translation of scientific information related to dairy consumption and health outcomes for different audiences. Her primary project this summer is analyzing NHANES data related to dairy consumption patterns and preparing a manuscript

PR

Status: In Press-Imminent.

Key Words: Fluid milk, nondairy alternative, means end chain analysis, conjoint analysis, consumer liking

Type of Research: Consumer survey study

Funding Source: National Dairy Council

NOT READY FOR
COMMUNICATION
Publication Pending

Drivers of choice for fluid milk versus plant-based alternatives: What are consumer perceptions of fluid milk?

McCarthy KS, Parker M, Ameerally A, Drake SL and Drake MA. 2017. *Journal of Dairy Science*. doi.org/10.3168/jds.2016-12519.

Headline: New study reveals consumer's personal values for selecting dairy vs nondairy beverages

Abstract

Fluid milk consumption has declined for decades while consumption of nondairy alternatives has increased. A better understanding of why consumers purchase fluid milk or nondairy alternatives is needed to assist increased sales of milk or maintain sales without further decline. The objective of this study was to determine the extrinsic attributes that drive purchase within each product category. The second objective was to determine the personal values behind the purchase of each beverage type to give further understanding why particular attributes are important. An online conjoint survey was launched with 702 dairy consumers, 172 nondairy consumers, and 125 consumers of both beverages. Individual means-end chain interviews were conducted with fluid milk consumers (n = 75), plant-based alternative consumers (n = 68), and consumers of both beverages (n = 78). Fat content (P < 0.05) was the most important attribute for dairy milk followed by package size and label claims. Consumers of fluid milk preferred 1 or 2% fat content, gallon, or half-gallon packaging, conventionally pasteurized store-brand milk. Sugar level was the most important attribute for plant-based beverages, followed by plant source and package size. Almond milk was the most desirable plant source, and half-gallon packaging was the most preferred packaging. Means-end chain interviews results suggested that maintaining a balanced diet and healthy lifestyle was important to all consumer groups. Lactose free was an important attribute for plant-based alternative consumers and consumers of both dairy and nondairy. A distinguishing characteristic of those who only drank nondairy plant-based alternatives was that plant-based beverages contributed to a goal to consume less animal products, beliefs about animal mistreatment, and perceived lesser effect on the environment than fluid milk. Unique to fluid milk consumers was that fluid milk was perceived as a staple food item. These results suggest that the dairy industry should focus on the nutrition value of milk and educating consumers about misconceptions regarding dairy milk. Future beverage innovation should include the development of lactose-free milk that is also appealing to consumers in flavor.

Contribution to the State of Science

For the past 10+ years, an increasing number of people have selected non-dairy beverages over cow's milk. Research suggests that lactose intolerance, allergies, and health claims are among the top reasons. The purpose of this study was to survey both dairy and nondairy fluid milk drinkers to gain insights on why and how people make their selections. Nondairy drinkers (~17% of those surveyed) appear to have heightened concern over animal health and their negative impact on the environment. They also perceive plant-based beverages as "healthier" options to cow's milk. This paper again demonstrates a strong need for educating people on dairy farming and the nutritional and health benefits of consuming dairy products over their lifetime.

Subject Matter Expert Comment – Siva Kaliappan, MS



The purpose of this study was to understand which personal values consumers use to select and consume dairy or nondairy beverages and learn which attributes are most important to them. Nearly 1000 people were surveyed in this study and over 80% were dairy drinkers. Consumers who regularly drink cow's milk reported that they were not concerned about their diet and did not experience any GI discomfort from lactose. Consumers who regularly drink plant-based milk beverages said their personal values centered on animal welfare, the environment, lactose intolerance, and the perceived "healthfulness" of plant-based products. Both groups of milk consumers reported that health and good tasting milk were their top two attributes in selecting these products. In general, consumers view milk as a comfort food and are interested in living long, healthy lives. The paper emphasizes the need for improving people awareness about farming practices, animal care, and promoting the nutritional benefits of consuming cow's milk during one's lifetime.

Review Article Commissioned by the Innovation Center for U.S. Dairy Receives JDS Most-Cited Award in Nutrition, Feeding and Calves



By Juan Tricarico, PhD

I'm very proud to report that the "Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions" is the recipient of the Most-Cited Award in Nutrition, Feeding and Calves section of the *Journal of Dairy Science*® (JDS). The award was presented during the 2017 American Dairy Science Association (ADSA) Annual Meeting (June 26) in Pittsburgh, Pa. and recognizes outstanding articles in JDS that are highly cited.

The 2014 invited review, commissioned by U.S. dairy farmers through the Innovation Center for U.S. Dairy® and partly funded by the Cow of the Future® program, was co-authored by Joanne R. Knapp, Fox Hollow Consulting, Columbus, OH; Gina Laur, Gwinn-Sawyer Veterinary Clinic, Gwinn, MI; Peter Vadas, USDA Agricultural Research Service Forage Research Center, Madison, WI; William Weiss, Department of Animal Sciences, The Ohio State University, Wooster, OH; and Juan Tricarico, Vice President of Sustainable Research, Dairy Management Inc. and the Innovation Center for U.S. Dairy, Rosemont, IL. Congratulations to this collaborative team whose expertise in dairy cow nutrition and enteric methane emissions made this publication possible.

The study discusses the advantages and limitations of current on-farm measures of dairy efficiency and describes the impacts of nutrition and feeding management on these measures regardless of dairy cow genotype. It also provides valuable information and guidance on on-farm measures of dairy efficiency that allow dairy farmers to identify critical factors needed to define and evaluate farm-specific dairy efficiency and sustainability goals. However, individual farm dairy efficiency measures are not recommended to directly address consumer and retailer questions about sustainability.

Why is this award important?

Recognition by ADSA and JDS through the Most-Cited Award is a tremendous honor. The number of times a scientific publication gets cited in other articles indicates its importance and relevance to the scientific community active in that field of knowledge and constitutes a relative measure of impact. Elsevier and ADSA established the annual JDS Most-Cited Award program to formally recognize contributors to JDS, whose work significantly affects research and the dairy industry. Awards are given annually in each of the four sections that make up JDS: Dairy Foods; Physiology and Management; Nutrition, Feeding and Calves; and Genetics and Breeding.

For a full copy of the study, visit: <http://www.sciencedirect.com/science/article/pii/S0022030214002896>

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Questions?

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