PERSPECTIVE

Enhancing Nutritional Security:
How Dairy Optimizes Natural Resources

While the impact of population growth and the resulting challenge to nutritional security is well understood, the criteria for what constitutes sustainable nutrition is still evolving. The dairy community has an important role in ensuring that science-backed data and accurate information is used to evaluate dairy's nutritional profile and the natural resources used in its production.

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GLOBAL DAIRY PLATFORM

The Challenge to Food and Nutrition Security

World population growth, combined with economic development, will drive increased needs for food, especially in developing nations.

PROJECTED GLOBAL POPULATION CHANGE 2011-2050

Region	2011	2050	Change	Percent
World	6,987	9,587	+ 2,600	+ 38
High Income	1,242	1,333	+ 91	+ 7
Low Income	5,745	8,254	+ 2,509	+ 44
East & S.E. Asia	2,183	2,308	+ 125	+ 6
South Central Asia	1,795	2,574	+ 779	+ 43
Sub-Saharan Africa	883	2,069	+ 1,186	+ 134
Lat. America/Carib	596	746	+ 150	+ 125
N. Africa & W. Asia	451	725	+ 274	+ 61

Source: *2011 World Population Data Sheet*. Population Reference Bureau[3]

The world's population is projected to rise to 9.5 billion by 2050 – the equivalent of adding another India and China to the world. Of the anticipated additional 2.6 billion people, 96.5% are expected to emerge in developing nations and only 3.5% of the growth occurring in developed countries.[1]

With increased population comes the obvious increased need for food – world food demand is projected to grow by 70-80% by 2050.[2] This global food challenge is not just about affordable caloric intake, but it's also about diet quality, as expected economic development leads families to move beyond the minimum needed to prevent starvation to food for growth, development and nutrition security. Ensuring food availability, in both quantity and quality, to those most disadvantaged will be the top priority.[4]

"Economic and agricultural growth should be nutrition sensitive. Growth needs to result in better nutritional outcomes through enhanced opportunities for the poor to diversify their diets…"

- The State of Food Insecurity in the World 2012 (FAO, WFP, IFAD)[4]

Given the projected global food challenge, it's important that accurate information is used to evaluate a food's nutritional profile and the natural resources used in its production. It's also critical to correct misconceptions around the resource efficiencies of foods such as dairy, that will be needed for future sustainable diets. This paper provides a perspective on the proficient conversion of raw materials into nutritious dairy-based foods.

Misconceptions of Dairy as an Efficient Use of Resources

Milk production is highly efficient in terms of resource use, yet dairy foods are perceived as having a disproportionate impact on the environment.

It is important to note that all foods have an effect on Earth's natural resources and in order to adequately meet future nutrient requirements greater efficiencies in food production and manufacturing across all sectors will be needed.

Three broad misconceptions are at the core of dairy's challenge:

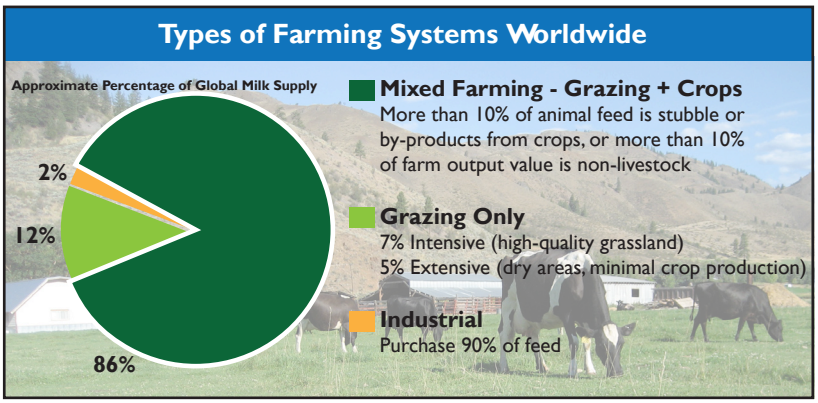
1. Cow feed competes with human food; i.e., crops fed to cows reduce the food and nutrition available to people
2. Protein from plants is a more efficient use of resources than protein from milk
3. Dairy's contribution to global warming is out of balance.

Misconception 1: Cow feed competes with human food

The assumption that dairy cow feed could be human food available for a growing population sounds logical, but is largely not true. To the contrary, cows "are particularly useful in converting vast renewable resources from rangeland, pasture and crop residues or other by-products into food edible for humans."[5]

Worldwide, cows primarily eat roughage including grass, hay, silage, and by-products of the food and biofuel industries. In fact, only a small percentage of dairy cows' diets contain grains or cereals that could be consumed by

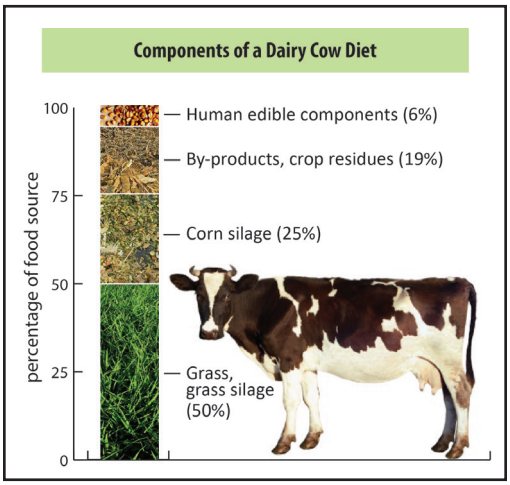
Misconceptions of Dairy as an Efficient Use of Resources



Source: *FAO Livestock in the Balance, 2009*[6]

people. One way this can be seen is by looking at the different types of dairy farming systems. Approximately 86% of the global supply of milk comes from diverse, mixed farming systems that utilize a combination of pasture grazing plus field stubble or crop by-products as feed sources. Another 12% of the global milk supply comes from farms that use grazing exclusively.[6]

Among mixed farming systems, roughage is complemented with concentrates that are primarily made from crop by-products, such as the rest of the plant when the human edible portion is removed. Common examples include the solid remains after processing grain, soy, potatoes, fruits and sugarcane (e.g. stems, leaves, skins, pulp).[6] These crop by-products would otherwise be considered waste as they are not consumable by people. Ruminants, however, reduce this waste by consuming and utilizing the nutrients in these by-products.[5]



Source: *Bannink, 2011. A model of enteric fermentation in dairy cows to estimate methane emission for the Dutch National Inventory Report using the IPCC Tier 3 approach.*[7]

A minor portion of the concentrate contains grain or meal people can consume. It also improves the productivity and efficiency of milk production, resulting in the optimal use of the forage resource.[7] Data from the Netherlands showed that 75% of a dairy cow's feed is grass and pasture roughage, while approximately 25% is concentrates. Human edible grains comprised only a quarter of concentrates, which calculates to less than 10% of the total cow's diet being comprised of human edible material.[7]

Cows utilize land incapable of growing crops

Ruminants such as dairy cows add value to the food system by grazing land that cannot be crop farmed. Only 1/32 of the earth's surface area is suitable for farming,[8] and the area of grazing land is more than double that of cropping land,[9] making food production on land that cannot produce crops

a critical part of the food system. Research has shown that ruminants are much more efficient than non-ruminants in using inedible resources from pastures and producing outputs that people can eat.[11] The result is that hilly or highly erodible land that cannot be planted with crops and has no other sustainable economic use becomes productive.[5]

> ***"Improving food security and nutrition is about more than just increasing the quantity of energy intake – it is also about improving the quality of the food in terms of dietary diversity, variety, nutrient content and safety."***
>
> ***- The State of Food Insecurity in the World 2012 (FAO, WFP, IFAD)[4]***

Grain fed to livestock wouldn't necessarily go to the most needy
Some recent research shows that trying to shift crops intended for consumption by animals to consumption by humans is not a simple effort, complicated by changes in supply and demand, prices and other effects.

A study by Rosegrant hypothesized that "reduced meat consumption in developed countries would release cereals from livestock feed to food for poorer populations."[12] Using global food projection models, when meat intake was cut by 50% and replaced by mostly wheat products in developed nations, higher demand led to higher wheat prices, adversely affecting grain available to poor populations that rely on wheat.

When farmers fed less corn and soy to livestock, prices of these commodities dropped with benefits to those countries with a staple diet of corn, but no benefits to large populations whose staple foods are rice and wheat. Overall, researchers concluded that reducing meat consumption in developed nations would be a small contribution to food security. This illustrates the complexity of global commodity markets, and puts emphasis on the challenge to reach the populations of greatest need with both food and nutrition security.[12]

Misconceptions of Dairy as an Efficient Use of Resources

Misconception 2: Protein from plants is a more efficient use of resources than protein from milk

The basis of this assumption arises from generalizations about livestock statistics that are applied to dairy and a mistaken belief that all proteins are nutritionally equal.

A recent example from the Dutch Health Council demonstrates a lack of distinction between milk production from cows and meat production from cattle. A 2011 paper states "the production of meat and dairy forms the biggest food related burden…the production of a single kilo of meat protein requires six kilos of vegetable protein."[13] These statements are factually incorrect and bundle meat and dairy into the same food production system.

The Dairy Cow: A Protein Conversion Expert

An examination of the conversion rates to change the energy and protein consumed by animals into human food energy and protein shows considerable variability depending on species, farming system, feed type and the type of food product.

Research by the Council for Agricultural Science and Technology (CAST) found that due to the mixed diet of dairy cows, only 0.3kg of grain (developed nations) or 0.2kg of grain (developing nations) is required to produce 1kg of milk, the lowest amount compared to foods such as pork, chicken or eggs.[14]

It is often overlooked that ruminants, such as dairy cows, return more food per unit of human edible feed consumed because, as described earlier, most of their feed is roughage that cannot be digested by people. In the process of transforming grass, straw and crop by-products into nutrient-rich milk, dairy cows increase the value to the food supply by converting these inedible plant materials and inferior plant proteins into higher quality proteins with greater biological value.[11]

Kilo's of cereals consumed per kilo of product produced

	Developed Countries	Developing Countries
Beef	2.6	0.3
Pork	3.7	1.8
Poultry	2.2	1.6
Milk	0.3	0.2
Eggs	2.2	1.6

Source: *CAST, 1999. Animal Agriculture and Global Food Supply 1999*[14]

Misconceptions of Dairy as an Efficient Use of Resources

On a simple mass balance basis of total output divided by total input, studies of dairy cows in the Netherlands showed an average conversion rate of 19% for total energy and 23% for total protein. However, calculations based on total output divided by the human digestible (edible) input showed conversion rates much higher: 291% for energy and 338% for protein. In the United States, the value-added human edible efficiency is lower due to greater use of concentrates, and in South Korea efficiency on human edible inputs is higher. Based on the data among high-yielding farming systems, the conversion rates range from 107 to 374% for energy and from 208 to 1430% for protein, demonstrating the exceptional capability of the dairy cow to convert inedible plant material and crop by-products into highly-nutritious food that people can eat.[10,14]

Efficiency Rates of Energy and Protein by Dairy Cows
Milk Output/Feed Input (%)

Reference		Total Efficiency		Human Edible Efficiency	
		Energy	Protein	Energy	Protein
Dijkstra (2013)[10]	Netherlands	19	23	291	338
CAST (1999)[14]	USA	25	21	107	208
	South Korea	26	19	374	1430
	Kenya*	7	9	∞	∞
	Argentina	19	16	461	164

*In terms of Kenya's Human Edible Efficiency, no human edible food used, so return is infinite.

Not all proteins are nutritionally equal

An additional consideration when comparing plant proteins to milk proteins is the biological value. In truth, not all proteins are the same, as they vary in amino acid composition, digestibility and bioavailability. "High-quality proteins" such as those found in milk and dairy products have essential amino acids that are both easy to digest and in proportions that meet human needs.[15] In general, plant proteins are of lower quality than animal proteins due to lack of certain essential amino acids and the presence of components (such as fiber rich plant cell walls or other "anti-nutritionals") that impair absorption.

Greater emphasis is being placed on the role of individual amino acids and protein quality for growth and maintenance of human health with a view towards sustainable diets. A report published by the United Nations Food and Agriculture Organization (FAO) in January 2013[15] states

Misconceptions of Dairy as an Efficient Use of Resources

"In dietary protein quality evaluation, dietary amino acids should be treated as individual nutrients and wherever possible data for digestible or bio-available amino acids should be given in food tables on an individual amino acid basis"

- Dietary Protein Evaluation in Human Nutrition 2013 Report of an FAO Expert Consultation [15]

"Creating a sustainable diet to meet…nutritive needs is an extraordinary challenge that we won't be able to meet unless we have accurate information to evaluate a food's profile and its ability to deliver nutrition… (DIAAS) will be an important piece of information for decision makers assessing which foods should be part of a sustainable diet for our growing global population."

- Paul Moughan, Riddet Institute Chair of the FAO Expert Consultation[16]

"As the world's population increases rapidly and against the constraints of limiting land, water and food resources, it is more important than ever to be able to define accurately the amount and quality of protein required to meet human nutritional needs and describe appropriately the protein supplied by food ingredients, whole foods, sole-source foods and mixed diets. The match between dietary supply and human protein needs is vital to support the health and well-being of human populations."[15]

The report recommended a revised system to determine protein quality called Digestible Indispensable Amino Acid Score (DIAAS). Examples of using the DIAAS method confirmed the higher bioavailability of dairy proteins when compared to plant-based protein sources: whole milk powder scored 1.22, compared to 0.64 for peas and 0.40 for wheat.[15]

Misconception 3: Dairy Disproportionately Contributes to Global Warming

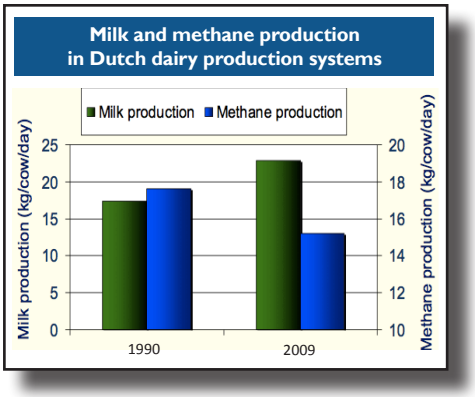
Understanding the environmental impact of any food requires the best available measurements of their life cycle effects on air, land or water such as greenhouse gases (GHG). Dairy products in particular are challenged as efficient resources for sustainable diets by the assumption that broad statements made regarding global warming and livestock overall apply equally to dairy.

As one example, the contribution of livestock production to greenhouse gas (GHG) emissions estimated by FAO in 2006 at 18% has become a well-known statistic.[17] Unfortunately, many people apply this GHG estimate to milk production, which is significantly less. A more recent FAO dairy-specific study concluded that "the overall contribution of global milk production, processing and transportation to total emissions of GHG is estimated at 2.7%."[18]

Misconceptions of Dairy as an Efficient Use of Resources

More Milk, Less Methane

Dairy farmers are proactive in reducing climate related impacts, recognizing the importance of good management practices that benefit both natural resources as well as their bottom line. Significant improvements in animal breeding, care and feeding increases milk yield, which means using fewer cows to produce the same amount of milk, resulting in less feed used and less methane produced. Low yields in some parts of the world are gradually increasing with the use of these strategies and new technologies to improve performance and reduce methane emissions per unit of milk.[10]



Source: *Bannink, 2011. A model of enteric fermentation in dairy cows to estimate methane emission for the Dutch National Inventory Report using the IPCC Tier 3 approach.*[7]

For example, in just two decades protein efficiency on a total basis improved by 50% (from 18.1% to 27.2%)[10] in the Netherlands between 1990 to 2009. At the same time there was a 15% decline in emissions of methane – the single most important greenhouse gas for livestock – from 17.6 g to 15.2 g per kilogram of milk. "Such improvements were achieved without increasing the proportion of concentrates and wet by-products in the diet (these actually decreased slightly) and while reducing nitrogen fertilizer input. Thus major gains in reducing excretion and emissions are possible in modern dairy cattle production systems."[10]

"The global average milk yield per cow in the world is less than 3000 kg/year, good breeding and feeding increases milk yield, improves resource efficiency and reduces GHG per kg of milk."

– Prof. Toon van Hooijdonk,
Dairy Science and Technology, Wageningen University

The Paradox of Desertification and Grazing Herds

While the importance of milk production to meet human nutritional requirements is well recognized, much less attention has been placed on the value of livestock to preserve and restore soil fertility and the biodiversity of plants and wildlife. Instead, livestock have been associated with overgrazing land and creating desertification which

contributes to global climate change. Desertification has significant impacts on climate change and the ability to produce food.

In decades of research, Dr. Allan Savory, a biologist and former Zimbabwean farmer, concluded that moving herds of animals – once wild grazing animals followed by predator packs – are critical to preventing and reversing desertification. These large herds were frequently on the move, which kept them from exhausting the supply of living plants, trampled their scattered droppings into a full blanket of high-quality fertilizer, and kept the repeated trod of untold tons from packing down the dirt. Modern herds can mimic the natural process through the concept of rotational grazing on smaller plots of land.

Utilizing animals that graze and move through areas where crops often can't grow provides food and economic viability to local people and helps reduce global warming by reversing desertification.[20]

Time to Reset the Big Picture

The role of ruminants in converting inedible plant material into nutrient rich food for people is undervalued.

The higher quality protein and essential nutrients found in dairy foods are of increasing value for food security goals that hope to ensure nutritional quality.[4] This provides the worldwide dairy community with a unique role in supporting global food and nutrition security. Taking action now can help reset a broader picture of the role of dairy and animal agriculture as an important part of diversified, resilient food security solutions. Actions include:

Establishing ruminant and their unique contribution to the food chain as part of the solution to food and nutrition security

- Demonstrate and promote the difference between the ruminant and the human food chain;
- Research and communicate that the most efficient use of total land and water resources is through the inclusion of ruminant agriculture;
- Continue research to improve milk yields as a way to provide more food and reduce environmental impacts such as GHG.

Ensure food security dialogue is "nutrition sensitive" and leverages dairy's nutrient richness and higher protein quality

- Increase research investment in protein quality, digestibility and bioavailability of dairy foods;
- Step up communication of dairy's nutrient contribution to feeding and nourishing populations worldwide;
- Find ways to work with and support an integrated agriculture-nutrition-health framework as suggested by the FAO.[4]

Time to Reset the Big Picture

We are at a time when global leaders are considering the diverse issues surrounding food and nutrition security as essential factors towards the development of a sustainable global diet. The dairy community has a responsibility and an opportunity to support food security that is "nutrition-sensitive." Ruminants' ability to add to the food supply, and the fact that dairy foods are nutrient rich with higher quality protein, make it a valuable contributor to the sustainable diets of the future.

There still is, however, a widespread prevalence of misinformation regarding the resource efficiencies of dairy-based foods, and specifically a cow's ability to convert resources into high-quality nutrition. Moreover, changes in the media landscape, including the predominance of social media, have fundamentally influenced the ways in which information is communicated and misinformation is spread. There is a role for the dairy industry in presenting itself as a resource that is dedicated, has science-backed data and is knowledgeable about the issues. We must seek to build relationships and pathways with key influencers such as health professionals, regulators, policy makers and world bodies to not only ensure that they have the correct facts, but also the latest research, the latest science and the latest interpretation.

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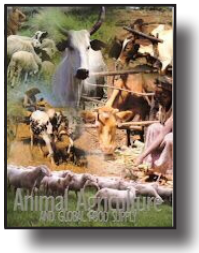
Useful Links



Animal Agriculture and Global Food Supply –Task force report, no. 135
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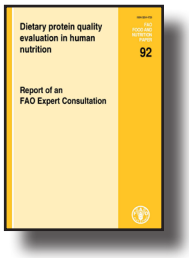
http://www.cast-science.org/publications



Dietary protein quality evaluation in human nutrition
Report of an FAO Expert Consultation
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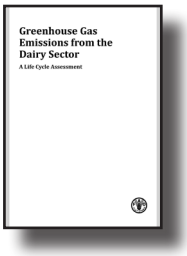

Greenhouse Gas Emissions from the Dairy Sector - A Life Cycle Assessment
Food and Agriculture Organization of the United Nations
http://www.fao.org/docrep/012/k7930e/k7930e00.pdf

Allan Savory: How to fight desertification and reverse climate change
http://www.ted.com. Feburary 2013
http://www.ted.com/talks/allan_savory_how_to_green_the_world_s_deserts_and_reverse_climate_change.html

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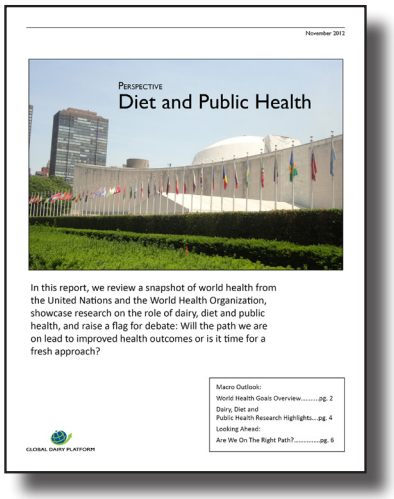
November 2012

PERSPECTIVE
Diet and Public Health

In this report, we review a snapshot of world health from the United Nations and the World Health Organization, showcase research on the role of dairy, diet and public health, and raise a flag for debate: Will the path we are on lead to improved health outcomes or is it time for a fresh approach?

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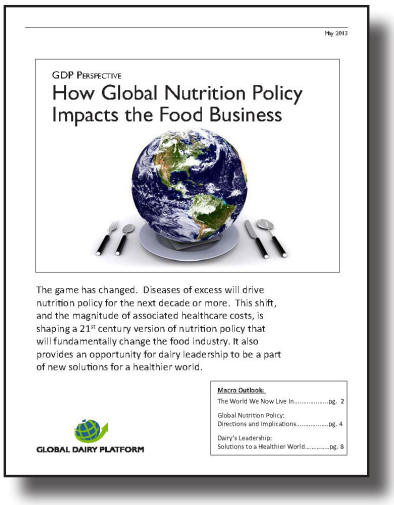
GLOBAL DAIRY PLATFORM


May 2013

GDP PERSPECTIVE
How Global Nutrition Policy Impacts the Food Business

The game has changed. Diseases of excess will drive nutrition policy for the next decade or more. This shift, and the magnitude of associated healthcare costs, is shaping a 21st century version of nutrition policy that will fundamentally change the food industry. It also provides an opportunity for dairy leadership to be a part of new solutions for a healthier world.

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GLOBAL DAIRY PLATFORM

How Global Nutrition Policy Impacts the Food Business looks at how obesity, non-communicable diseases and the financial burden of healthcare have created a more complex global nutrition policy environment.

Regulators and policy makers have limited tools they can employ to change dietary behavior. The availability and how they use those tools – such as taxing, placing restrictions on the sale of specific foods or mandating warning labels on packages - often have a focus on nutrients to limit, which may have the unintended consequence of teaching consumers to not take into consideration a food's total nutritional quality.

The paper proposes that when working with governments, NGOs, public health and healthcare entities, dairy leaders should encourage the inclusion of whole foods in the decision criteria of nutritional policy.

Diet and Public Health showcases research on the role of dairy, diet and public health. The paper looks specifically at a 2011 United Nations General Assembly declaration calling for measures to address non-communicable diseases (NCDs).

Tasked with setting up a global monitoring framework on common risk factors such as poor diet, The World Health Organization has indicated it plans to focus on nutrients to avoid – the same framework that has been used for decades, but yet to date has not produced desired results.

With growing evidence supporting the importance of "whole foods" such as dairy products rather than single nutrients to foster healthy aging with lower risk of chronic disease, this approach begs for more industry dialogue. As leaders in food and nutrition, the paper argues, global dairy leaders and their customers need to ask: How can we proactively challenge current NCD monitoring and measuring approaches and engage in constructive debate?

GLOBAL DAIRY PLATFORM

For download or reprint information, contact:
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GLOBAL DAIRY PLATFORM leads the development of a collaborative, unified approach on common industry issues and the nurturing of innovative research so that consumers value milk and dairy products as naturally nutritious, enjoyable and an essential part of a healthy diet. Our membership of CEOs, executives and researchers from corporations, communication and scientific bodies work in partnership to align and support the dairy industry in the promotion of sustainable dairy nutrition.

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