NORTHWEST CROPS & SOILS PROGRAM
UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

INCREASING HIGH QUALITY HOMEGROWN FEEDS FOR THE ORGANIC DAIRY FACT SHEET SERIES

Bovine Milk Fats and Organic Dairying

Introduction

Milk is a nutrient-rich beverage choice that includes all the macronutrients plus a good source of vitamins and minerals, including vitamins A and B and calcium; however, over the years, milk has gotten a bad rap for its fat content. In particular, research conducted in the 1970s and '80s (Oski, 1985; Trevisan et al., 1990; Koopman et al., 1984; Lee et al., 1978; Vergroesen, 1972) made correlations between an increase in intake of saturated fat with increased incidence of cardiovascular disease. But recent research (Williams, 2000; Connor, 2000) has revealed that saturated fats in milk may be more benign than we once thought. Further, unsaturated fats—like omega-3, omega-6, and conjugated linoleic acid— in milk have been shown to correlate with positive health attributes including decreased risks for metabolic syndrome, heart disease, and diabetes (Schwendel et al., 2014; Spitsberg, 2005; McGuire and McGuire, 2000; Lock and D.E. Bauman, 2004). The Western diet is typically low in omega-3 fatty acids relative to omega-6 fatty acids but a high ratio of omega-6 to omega-3 fatty acids may have possible negative consequences such as cardiovascular disease, cancer, and inflammatory and autoimmune diseases (Schwendel et al., 2014).

New research has also revealed that these healthful fatty acids are found in higher quantities in organic milk versus conventional, principally attributed to the high intake of pasture in the diets of organic livestock (Butler et al., 2008; 2011; Bloksma et al., 2008; Collomb et al., 2008; Ellis et al., 2006; Fall and Emanuelson, 2011; Molkentin and Giesmann, 2007). So what are these fats and what can organic dairy producers do to increase and/or maintain them? Drawing from a review of the scientific literature, this fact sheet describes the bovine milk fats that promote good health—both for humans and cows—and some management options to stimulate their production.

About Bovine Milk Fats

Milk contains about 3.4% fat and is said to have more than 400 individual fatty acids, making it one of the most complex fatty compositions of all edible fats (International Dairy Foods Association, 2000). Milk contains saturated, monounsaturated, and polyunsaturated fats; the goal is to reduce saturated fats in the milk and increase polyunsaturated fats (like omega-6 and omega-3), and further, to increase omega-3 in the diets of both cows and humans.

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For this fact sheet, three milk fatty acids are discussed.

1. ***Linoleic acid (LA)*** is found in grains and vegetable oils (like sunflower, canola, and soy). When grain, for example, is consumed by the cow, it is converted into omega-6 by the rumen microbes. So we associate greater grain consumption with greater omega-6 levels in milk and meat.
2. ***Alpha linolenic acid (ALA)*** is found in green leafy vegetables and pasture plants as well as flaxseed oil and fatty fish. When ALA is consumed by the cow, it is converted by the rumen microbes into omega-3. So, we associate greater consumption of dark green leafy pasture plants with increased omega-3 levels in milk and meat.
3. ***Conjugated linoleic acid (CLA)*** is a fatty acid only found in ruminant dairy and meat products. It is essentially a byproduct of the modification of LA and ALA by the rumen microbes. Research (Lock and Bauman, 2004; McGuire and McGuire, 2000) has shown a number of human health benefits from consuming milk and meat products containing higher levels CLAs including reducing the risk of diabetes, improving heart health, and its anti-carcinogenic properties.

Although both omega-6 and omega-3 are considered essential to human diets, it is their balance that is often described in the literature as either promoting or suppressing good health. Currently, the typical American diet contains about 15 to 20 omega-6 to 1 omega-3. However, the target for good health is 4 or less omega-6 to 1 omega-3 (Simopoulos, 2002; Schwendel et al., 2014).

Omega-3, in particular, provides a number of benefits to both human and cow health. In humans, omega-3 is important to human growth and development, and improves neurological function. It has been shown to reduce the risk of cardiovascular disease and improve heart health. It is anti-carcinogenic and is also an anti-inflammatory (Simopoulos, 1991; 2002).

Omega-3 also provides health benefits to cattle. Research has shown that omega-3 improves immunity, and can improve reproduction through decreased pregnancy loss and decreased time to conception (Petit and Twagiramungu, 2006; Santos et al., 2008). It has also been shown to reduce methane production in cattle. Research revealed that an increase in omega-3 by 1%, reduced methane production by 6% (Fievez et al., 2007).

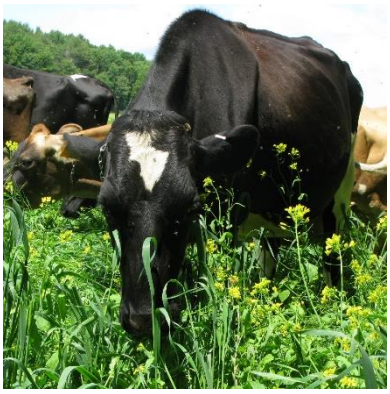
Management Options to Increase and/or Maintain Bovine Milk Fats

There are several factors that affect the composition of milk fatty acids (Schwendel et al., 2014), including:

- Breed (eg., Jerseys have more saturated fats than Holsteins);
- Stage of lactation (early lactation is associate with greater levels of omega-3);
- Parity; and
- Mastitis.

However, diet is the major factor, as 60% of milk fat comes from the cow's diet. The take home message here is the more omega-3 in the feed, the more omega-3 in the milk fat.

Research has shown that ALA, and therefore omega-3, were higher in organic milk as compared to conventional milk in all regions across the U.S., again attributed to high pasture intakes in organic herds (Bloksma et al., 2008; Butler et al., 2011; Collomb et al., 2008; Ellis et al., 2006; Fall and Emanuelson, 2011; Molkentin and Giesemann, 2007; Palupi et al., 2012; Schwendel et al., 2015). However, omega-3 levels in organic herds fluctuate during the year, generally increasing through the pasture season and then decreasing as cows switch to an indoor diet of stored feeds in the winter (Baars et al., 2012; Butler et al., 2008; Elgersma et al., 2006; Kraft et al., 2003; Thomson and Van Der Poel, 2000; Zunong et al., 2008).



If the management goal is to increase the level of these beneficial fats in livestock milk and meat, then we need to maximize the level of these fats in the feed that the animals are eating during the grazing season, as well as in the non-grazing months.

During the Grazing Season

A leafier plant with less stem will have higher omega-3 levels. Therefore, to increase omega-3 levels during the grazing season, be sure to graze animals when pastures are in the vegetative stage when plants are leafy and green.

Choose pasture species with greater leafiness. Some research has shown that nitrogen fertility will also increase omega-3 levels. Other research revealed that pastures with a high diversity of plants results in higher levels of CLA (Kraft et al., 2003; Lieber et al, 2005; Ström, 2012).

Research has also shown that feeding grain increases omega-6 (and reduces omega-3) and so if the goal is to maximize omega-3 levels, consideration should be given to reducing grain fed.

In general, managing pastures for high quality feed will help increase omega-3 levels. To address seasonal dips in pasture productivity (i.e., the beginning and end of the grazing season, as well as the "summer slump"), annual forages also provide higher levels of omega-3. The annual forages include winter annuals like rye, wheat, and triticale, as well as summer annuals like sudangrass and millets.

During the Non-Grazing Months

Unfortunately, all conserved forages will have reduced levels of omega-3 and CLAs, so typically there is a reduction in omega-3 in the milk during the winter months when cows are fed their indoor diets.

Of all conserved forages, corn silage tends to have the highest levels of omega 6 (and therefore lower levels of omega-3) because it is about 50% grain. Research has shown that silages made from orchardgrass, ryegrass, alfalfa or red clover all have lower omega-3 levels but not nearly to the extent of corn silage (Glasser et al., 2013).

Making dry hay will also see a loss in omega-3; however, the loss will not be as great with good quality hay. For example, cutting date plays a factor in omega-3 losses in hay production – the earlier plants are cut (still in vegetative stages), the less loss. So, omega-3 losses can be minimized in these feeds by putting up the highest quality of conserved forages (Glasser et al., 2013).

Researchers and farmers have also been interested in supplementation during winter months to help maintain omega-3 levels. Of particular interest is the use of ground flaxseed supplementation, as 55% of the oils in flaxseed are omega-3. Research has indicated that feeding flax can raise both omega-3 and CLA levels (Kraft et al., 2014). Flaxseed supplementation can also reduce methane emissions. However, flaxseed is expensive so profitability must be taken into account when considering flaxseed as a supplement.

In Summary

As consumers become more concerned about their health and where their food comes from, interest in purchasing milk products high in beneficial fatty acids like omega-3 and CLAs will undoubtedly continue to increase.

Maximizing grazing and managing pastures and stored feeds for quality will help certified organic dairy operations increase and/or maintain these beneficial fatty acid in livestock feed, and therefore, the animals' milk fat, providing health benefits to cattle and humans alike.

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