Summary and Major Findings in the PLOS ONE Paper on the Fatty Acids in Organic vs. Conventional Milk

An 18-month, nationwide study confirms that there are large and consistent differences in the fatty acid profile of organic and conventional milk and dairy products in the U.S. The research was carried out by a team led by scientists at Washington State University and appeared in the prestigious peer-reviewed journal PLOS ONE December 9, 2013[1].

Whole cow's milk averages about 88% water, 3.3% fat, 3.9% protein, 4.8% carbohydrate, and it contains small amounts of many other nutrients. Milk is an excellent source of protein, health-promoting omega-3 fatty acids, and many vitamins and minerals.

Nearly all of the fat in milk consists of fatty acids—about 93.3% to be precise. The fatty acids can be saturated, monounsaturated, or polyunsaturated.

Fatty acids contain long chains of carbon atoms, commonly 14 to 22. **Omega-3 (ω-3)** and **omega-6 (ω-6)** fatty acids are polyunsaturated, meaning they have two or more unsaturated bonds along their chain. Both ω-3 and ω-6 fatty acids are essential nutrients. As is true for other essential nutrients, our bodies do not produce them, so we must get them from food.

In our bodies, ω-3 and ω-6 fatty acids often compete with each other in ways that affect our health. For this reason, our diets need to have a good balance between ω-3 and ω-6 fatty acids, which is one reason scientists pay attention to shifts in the **ω-6/ω-3 ratio**.

Alpha-linolenic acid (ALA) is the major ω-3 fatty acid in human diets and milk, fruits, vegetables, walnuts, soybeans, canola oil, and some seeds—especially flax seeds, which are about 23% ALA. This fatty acid plays vital roles in the structure and function of our cell membranes. It is important also because we have a limited ability to convert ALA to the other, also important longer-chain ω-3 fatty acids EPA, DPA, and DHA.

Linoleic acid (LA) is an ω-6 fatty acid that also plays key roles in cell membranes and can be converted to a longer-chain form that is used to make regulatory compounds. LA also decreases blood cholesterol levels, an attribute that has encouraged its over-abundance in U.S. diets. It is a major component in vegetable oils, margarine, and most baked and fried foods. Excessive intakes of LA are now common and have driven up the ω-6/ω-3 ratio to unhealthy levels for many Americans.

[1] Charles M. Benbrook, Gillian Butler, Maged A. Latif, Carlo Leifert, and Donald R. Davis. 2013. "Organic Production Enhances Milk Nutritional Quality by Shifting Fatty Acid Composition: A United States-Wide, 18-Month Study," PLOS ONE, 8(12), e82429.

Both ω-6 and ω-3 fatty acids serve dozens of functions, like building healthy cell membranes, regulating inflammation, blood pressure and blood clotting, and maintaining brain and nerve function. These functions, however, depend on a proper balance of ω-6 and ω-3 fatty acids.

In fact, too much of one relative to the other can increase the risk of health problems.

Over centuries of pre-historic survival, human diets likely contained roughly equal amounts of ω-6 and ω-3 fatty acids, and hence ***humans evolved with a ω-6/ω-3 ratio near 1.0.***

Despite the cholesterol lowering effect of LA, high ratios of LA/ALA are implicated as a risk factor for cardiovascular disease, obesity, diabetes, developmental and behavioral problems, immune disorders, and some cancers.

Although the optimal ω-6/ω-3 ratio depends on the health measure in question and genetic factors, there is some consensus that the ω-6/ω-3 ratio should be lowered to about 2.3 to minimize the risk of cardiovascular disease—a benchmark and target used in the PLOS ONE study.

Unfortunately, Western diets have skewed what nature intended, and today many diets have ω-6/ω-3 ratios between 10 and 20. This is largely due to high consumption of vegetable oils containing substantial levels of ω-6 fatty acids, such as soy, corn, cottonseed, and safflower oils.

A key goal in this study was to estimate the degree to which organic dairy products can improve health outcomes through changes in a person's overall ω-6/ω-3 ratio.

Key PLOS ONE Study Findings

The organic whole milk had 62% more total ω-3 fatty acids than conventionally produced milk. Among individual ω-3 fatty acids, organic milk concentrations were 60% higher for ALA (alpha-linolenic acid), 33% higher for EPA (eicosapentaenoic acid), and 18% higher for DPA (docosahexaenoic acid).

Organic whole milk had, on average year round, 18% higher levels of another heart-healthy fatty acid called CLA (conjugated linoleic acid) than conventional milk.

In addition, organic whole milk had 25% lower total ω-6 fatty acids, and 25% lower concentration of LA, the major ω-6 fatty acid.

For most Americans, both organic and conventional milk and dairy products help lower the key ω-6/ω-3 ratio. The average ω-6/ω-3 ratio found in this study for one brand of organic milk is 2.3, while in conventional milk the average ratio is 5.7, still substantially better than most sources of fat in the American diets.

The ω-6/ω-3 ratio in organic milk is much lower than in conventional milk, because pasture and forage-based feeds make up a much greater share of daily "Dry Matter Intake" on organic dairy farms, compared to conventional dairy farms.

The team also reports that simple steps by consumers can markedly lower an individual's overall dietary ω-6/ω-3 intake ratio. They estimated fatty acid intakes in hypothetical diet scenarios of a moderately active 30-year old woman, who had a ω-6/ω-3 ratio of 11.3 in the baseline scenario.

Just switching from a moderate consumption of conventional dairy products (equivalent to three servings of fluid milk per day) to a higher level of organic dairy consumption (4.5 servings per day) lowered this individual's ω-6/ω-3 ratio from 11.3 to 7.8. This 3.5-point decline in the ω-6/ω-3 ratio represents about 40% of the total reduction needed to reach the heart-healthy goal of 2.3.

By also avoiding some fried foods and condiments with very high levels of ω-6 fatty acids, a person can lower their overall ω-6/ω-3 ratio to around 4, achieving about 80% of the reduction necessary to reach the 2.3 heart-healthy ω-6/ω-3 goal.

The authors note an unexpected finding – recommended intakes of organic whole milk is far superior to recommended fish intakes in germs of improving ω-6/ω-3 fatty acid intake ratios. This is because fish meat contains relatively low levels of both LA and ALA. Plus, dietary guidelines call for only about 8 ounces of fish consumption per week (to avoid excessive heavy metal intakes). In addition, organic milk is a surprisingly good source of EPA and DPA, two of the three important, long-chain ω-3 fatty acids, EPA, DPA, and DHA.
