

A2 Milk Research

Comparing Milks with Different Beta-Casein Proteins

The issue of A2 milk has garnered considerable attention from both consumers and producers in recent years, including National All-Jersey Inc. (NAJ). Three factors served as catalysts for NAJ's interest. First, among the members of National All-Jersey Inc. (NAJ) are producers who are marketing Jersey milk direct to the public. These producers have ample anecdotal evidence from customers that say they have less digestive problems with Jersey milk than conventional milk. Second, social media abounds with claims from some consumers that A2 milk does not cause them the digestive stress they experience with conventional milk. Third, one significant difference known to exist between the two milks is that Jersey genetics have a higher frequency of A2 beta-casein than the general dairy cattle population. Therefore, NAJ decided to pursue A2 research with two primary goals:

1. To determine if there is a quantifiable benefit to consumers from A2 and/or Jersey milks.
2. If so, to determine the threshold of A2 at which the benefit can be realized. In other words, does milk need to be 100% A2, or will milks of lesser amounts of A2 also provide benefits.

A2 research holds the potential to increase the value of and demand for Jersey milk and cows given the breed's high genetic frequency of A2 genes.

Background

Beta-casein is one of the proteins found in milk. All dairy cows initially produced only the A2 variant of beta-casein until several thousand years ago, a natural genetic variation occurred that generated A1 beta-casein. Eight variants of beta-casein have been identified: A1, A2, A3, B, C, D, E and F. Bovine beta-casein comprises 209 amino acids, and the difference between A1 and A2 occurs at position 67. The A1 variant has a Histidine residue at position 67, while A2 has a Proline residue. The B, C and F variants are often characterized as subtypes of A1 because of their Histidine residue at position 67, while the A3, D and E variants are categorized as A2 because they have Proline residues at position 67. Most references to "A1" include the subtypes B, C and F, while references to "A2" include the subtypes A3, D and E.

Genetically, the alleles encoding for A1 and A2 beta-casein are expressed in a co-dominant fashion. Therefore, cows that are homozygous for the A1 allele will only produce milk containing A1 beta-casein, and cows homozygous for A2 will only produce milk containing A2 beta-casein. Cows that are heterozygous (A1/A2) will produce milk with a mixture of A1 and A2 beta-casein. Over 3,000 Jerseys have been genomic tested for A1/A2 by the GeneSeek laboratory in conjunction with the AJCA. The frequency of the A2 gene is approximately 80%.

The Research

NAJ launched its A2 research by funding two research projects at Purdue University. The first project being done in conjunction with the Department of Biochemistry is to develop a robust, highly sensitive and accurate method of measuring the beta caseins A1 and A2 in milk and milk products.

The second project is being led by Dr. Dennis Savaiano and involves clinical trials with persons known to be lactose maldigesters due to problematic digestive symptoms experienced after ingesting lactose. The A2 Milk Company also approached Dr. Savaiano about doing research similar or identical to NAJ's interests, which led to NAJ and the A2 Milk Company jointly funding the research project, "Comparing the digestion of milk with different beta-casein protein content in lactose maldigesters."

During digestion in the small intestine, the A1 beta-casein releases a bioactive-seven-amino-acid peptide called beta-casomorphin (BCM-7), while the digestion of A2 protein causes a minimal release of BCM-7. The primary hypothesis of the project is that BCM-7 could affect lactose tolerance, and that A2 milk which generates less BCM-7 could be more easily digested.

Dr. Savaiano's clinical trials will begin early this year and are expected to take approximately one year to complete. The trials will compare four milks (A2, conventional retail, Jersey milk, and lactose-free) in a randomized, double-blinded study.

Potential Research Benefits

Adequate calcium intake in the U.S. diet depends on dairy food consumption as dairy accounts for approximately 75% of the calcium consumed in the U.S. diet. Approximately one-fourth of the U.S. population maldigests lactose. If A2 beta-casein is discovered to aid lactose digestion, lactose maldigesters will have another option to include dairy in their diets. Given that Jerseys have a higher genetic frequency of A2 than the general dairy cattle population, this research holds the potential to increase the demand for and value of Jersey milk and cows.

The Researcher

Dr. Dennis Savaiano serves as the Virginia Claypool Meredith Professor of Nutrition Policy at Purdue University and as the Director, North Central Nutrition Education Center for Excellence. Dr. Savaiano has studied lactose digestion for over four decades and has authored over 200 research papers and abstracts in scientific journals.

On June 27 Dr. Savaiano will be speaking to the World Jersey Cattle Bureau International Conference in Canton, Ohio, about A2 research in general and this project specifically.

**Mark Your Calendars!
Value-Added Workshop 101
March 21st-22nd
Dayton, Ohio**

More Information Coming Soon!

NAJ Milk & Component Outlook - November 2017 Jersey Price Comparisons

<u>NOV '17 STATISTICAL BLEND PRICE</u>		<u>NOV '17 MONTHLY MILK VOLUME</u> (Million #)		<u>NOV '17 JERSEY REGULATED BLEND PRICE</u>	
Northeast (Boston)	\$17.14	Northeast (Boston)	2,181	Northeast (Boston)	\$21.66
Appalachian (Charlotte)	\$18.63	Appalachian (Charlotte)	479	Appalachian (Charlotte)	\$21.81
Southeast (Atlanta)	\$19.07	Southeast (Atlanta)	423	Southeast (Atlanta)	\$20.35
Florida (Tampa)	\$20.66	Florida (Tampa)	218	Florida (Tampa)	\$24.22
Mideast (Cleveland)	\$16.24	Mideast (Cleveland)	1,486	Mideast (Cleveland)	\$20.54
Upper Midwest (Chicago)	\$16.67	Upper Midwest (Chicago)	2,099	Upper Midwest (Chicago)	\$20.97
Central (Kansas City)	\$15.98	Central (Kansas City)	1,016	Central (Kansas City)	\$20.23
Southwest (Dallas)	\$16.76	Southwest (Dallas)	695	Southwest (Dallas)	\$21.01
Arizona (Phoenix)	\$16.02	Arizona (Phoenix)	385	Arizona (Phoenix)	\$19.52
Pacific Northwest (Seattle)	\$15.69	Pacific Northwest (Seattle)	582	Pacific Northwest (Seattle)	\$19.34
ALL FMMO MARKET AVERAGE	\$17.29	ALL FMMO MARKET TOTAL	9,564	ALL FMMO MARKET AVERAGE	\$20.97
California 4b (Cheese Milk)	\$15.52			California 4b (Cheese Milk)	\$20.08
California Overbase	\$15.02			California Overbase	\$19.61

Prices reflect Federal Order minimum blend prices for city shown.

Total Grade A milk volume sold under FMMO during month.

Prices reflect FMMO minimum prices at Jersey component values.

<u>NOV '17 JERSEY BLEND WITH ESTIMATED PROTEIN OR CHEESE YIELD PREMIUMS</u>		<u>NOV '17 DOLLAR DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE</u>		<u>NOV '17 PERCENT DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE</u>	
Northeast (Boston)	\$21.93	Northeast (Boston)	\$4.79	Northeast (Boston)	27.9%
Appalachian (Charlotte) (includes protein prem.)	\$22.20	Appalachian (Charlotte)	\$3.57	Appalachian (Charlotte)	19.2%
Southeast (Atlanta)	\$20.35	Southeast (Atlanta)	\$3.21	Southeast (Atlanta)	18.7%
Florida (Tampa)	\$24.22	Florida (Tampa)	\$3.56	Florida (Tampa)	17.2%
Mideast (Cleveland) (includes protein premium)	\$21.24	Mideast (Cleveland)	\$5.00	Mideast (Cleveland)	30.8%
Upper Midwest (Chicago) (includes cy premium)	\$21.24	Upper Midwest (Chicago)	\$4.57	Upper Midwest (Chicago)	27.4%
Central (Kansas City)	\$20.23	Central (Kansas City)	\$4.25	Central (Kansas City)	26.6%
Southwest (Dallas)	\$21.01	Southwest (Dallas)	\$4.25	Southwest (Dallas)	25.4%
Arizona (Phoenix) (includes protein)	\$19.91	Arizona (Phoenix)	\$3.89	Arizona (Phoenix)	24.3%
Pacific Northwest (Seattle)	\$19.34	Pacific Northwest (Seattle)	\$3.65	Pacific Northwest (Seattle)	23.3%
ALL FMMO MARKET AVERAGE	\$21.17	ALL FMMO MARKET AVERAGE	\$4.07	ALL FMMO MARKET AVERAGE	24.1%
California 4b (Includes CY Premium)	\$21.52	California 4b (Includes CY Premium)	\$6.00	California 4b (Includes CY Premium)	38.7%
California Overbase	\$21.05	California Overbase	\$6.03	California Overbase	40.1%

Includes a protein premium of \$0.05 for every 0.01% increase in protein over the market average.

Prices reflect difference between Jersey price with premiums, and the statistical blend price.

Percent difference in Jersey price with premiums, over the statistical blend price.

<u>ESTIMATED JERSEY MILK COMPOSITION</u>	<u>Nov-17</u>	<u>REGULATED MILK PRICES</u>	<u>Nov-17</u>	<u>AVERAGE JERSEY PRICE ADJUSTMENT PER CWT:</u>	<u>Nov-17</u>
Butterfat	5.07	FMMO Milkfat	\$ 2.5546	FMMO Milkfat Adjustment	\$2.99
TRUE Protein	3.87	FMMO True Protein	\$ 2.3412	FMMO True Protein Adjustment	\$1.45
Other Solids	5.73	FMMO Other Solids	\$ 0.1644	FMMO Other Solids Adjustment	(\$0.00)
Solids Not Fat (SNF)	9.60	CA 4b (Cheese Milk) Milkfat	\$ 2.4342	CA 4b (Cheese Milk) Milkfat	\$3.83
Cheese Yield (90% Fat Recovery, 38% Moisture)	13.41	CA 4b (Cheese Milk) SNF	\$ 0.8049	CA 4b (Cheese Milk) SNF	\$0.74
		CA Overbase Milkfat	\$ 2.5000	CA Overbase Milkfat	\$3.93
CME Block Cheese Price	\$ 1.66	CA Overbase SNF	\$ 0.7210	CA Overbase SNF	\$0.65

NAJ Milk & Component Outlook - 2017 Prices through November

2017 AVERAGE STATISTICAL BLEND PRICE FOR EACH FEDERAL ORDER		2017 MILK VOLUME (Million #)		2017 AVERAGE JERSEY REGULATED BLEND PRICE	
Northeast (Boston)	\$17.49	Northeast (Boston)	25,136	Northeast (Boston)	\$21.43
Appalachian (Charlotte)	\$18.97	Appalachian (Charlotte)	5,280	Appalachian (Charlotte)	\$22.25
Southeast (Atlanta)	\$19.13	Southeast (Atlanta)	4,999	Southeast (Atlanta)	\$22.27
Florida (Tampa)	\$20.24	Florida (Tampa)	2,375	Florida (Tampa)	\$23.88
Mideast (Cleveland)	\$16.63	Mideast (Cleveland)	18,580	Mideast (Cleveland)	\$20.49
Upper Midwest (Chicago)	\$16.34	Upper Midwest (Chicago)	29,730	Upper Midwest (Chicago)	\$20.30
Central (Kansas City)	\$16.41	Central (Kansas City)	14,662	Central (Kansas City)	\$20.27
Southwest (Dallas)	\$17.25	Southwest (Dallas)	11,781	Southwest (Dallas)	\$20.89
Arizona (Phoenix)	\$16.48	Arizona (Phoenix)	4,642	Arizona (Phoenix)	\$19.87
Pacific Northwest (Seattle)	\$16.27	Pacific Northwest (Seattle)	7,051	Pacific Northwest (Seattle)	\$19.53
ALL FMMO MARKET AVERAGE	\$17.52	ALL FMMO MARKET TOTAL	124,236	ALL FMMO MARKET AVERAGE	\$21.12
California 4b (Cheese Milk)	\$15.35			California 4b (Cheese Milk)	\$19.57
California Overbase	\$15.33			California Overbase	\$19.55

Prices reflect Federal Order minimum blend prices for city shown.

Total Grade A milk volume sold under FMMO.

Prices reflect FMMO minimum prices at Jersey component values.

2017 AVERAGE JERSEY BLEND WITH ESTIMATED PROTEIN OR CHEESE YIELD PREMIUMS		2017 AVERAGE DOLLAR DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE		2017 AVERAGE PERCENT DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE	
Northeast (Boston)	\$21.66	Northeast (Boston)	\$4.15	Northeast (Boston)	23.8%
Appalachian (Charlotte) (includes protein prem.)	\$22.59	Appalachian (Charlotte)	\$3.41	Appalachian (Charlotte)	17.8%
Southeast (Atlanta)	\$22.27	Southeast (Atlanta)	\$3.15	Southeast (Atlanta)	16.5%
Florida (Tampa)	\$23.88	Florida (Tampa)	\$3.28	Florida (Tampa)	16.0%
Mideast (Cleveland) (includes protein premium)	\$21.07	Mideast (Cleveland)	\$4.43	Mideast (Cleveland)	26.7%
Upper Midwest (Chicago) (includes cy premium)	\$20.53	Upper Midwest (Chicago)	\$4.16	Upper Midwest (Chicago)	25.4%
Central (Kansas City)	\$20.27	Central (Kansas City)	\$3.86	Central (Kansas City)	23.5%
Southwest (Dallas)	\$20.89	Southwest (Dallas)	\$3.68	Southwest (Dallas)	21.4%
Arizona (Phoenix) (includes protein)	\$20.20	Arizona (Phoenix)	\$3.71	Arizona (Phoenix)	22.5%
Pacific Northwest (Seattle)	\$19.53	Pacific Northwest (Seattle)	\$3.29	Pacific Northwest (Seattle)	20.3%
ALL FMMO MARKET AVERAGE	\$21.29	ALL FMMO MARKET AVERAGE	\$3.71	ALL FMMO MARKET AVERAGE	21.4%
California 4b (Includes CY Premium)	\$20.84	California 4b (Includes CY Premium)	\$5.49	California 4b (Includes CY Premium)	35.8%
California Overbase	\$20.82	California Overbase	\$5.49	California Overbase	35.8%

Includes a protein premium of \$0.05 for every 0.01% increase in protein over the market average.

Prices reflect difference between Jersey price with premiums, and the statistical blend price.

Percent difference in Jersey price with premiums, over the statistical blend price.

ESTIMATED JERSEY MILK COMPOSITION	2017	REGULATED MILK PRICES	2017	AVERAGE JERSEY PRICE ADJUSTMENT PER CWT:	2017
Butterfat	4.93	FMMO Milkfat	\$2.6252	FMMO Milkfat Adjustment	\$2.98
TRUE Protein	3.76	FMMO True Protein	\$1.8528	FMMO True Protein Adjustment	\$1.11
Other Solids	5.73	FMMO Other Solids	\$0.2651	FMMO Other Solids Adjustment	(\$0.01)
Solids Not Fat (SNF)	9.49	CA 4b (Cheese Milk) Milkfat	\$2.5564	CA 4b (Cheese Milk) Milkfat	\$3.64
Cheese Yield (90% Fat Recovery, 38% Moisture)	13.00	CA 4b (Cheese Milk) SNF	\$0.7355	CA 4b (Cheese Milk) SNF	\$0.59
		CA Overbase Milkfat	\$2.5534	CA Overbase Milkfat	\$3.64
		CA Overbase SNF	\$0.7349	CA Overbase SNF	\$0.58