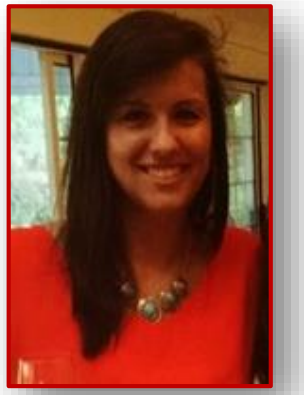
Delivering on the Growing Appeal of Dairy Alternatives

Cargill

Agenda

1. Introductions
2. Category Evolution and Trends
3. Formulation Challenges
4. Q&A

Introductions



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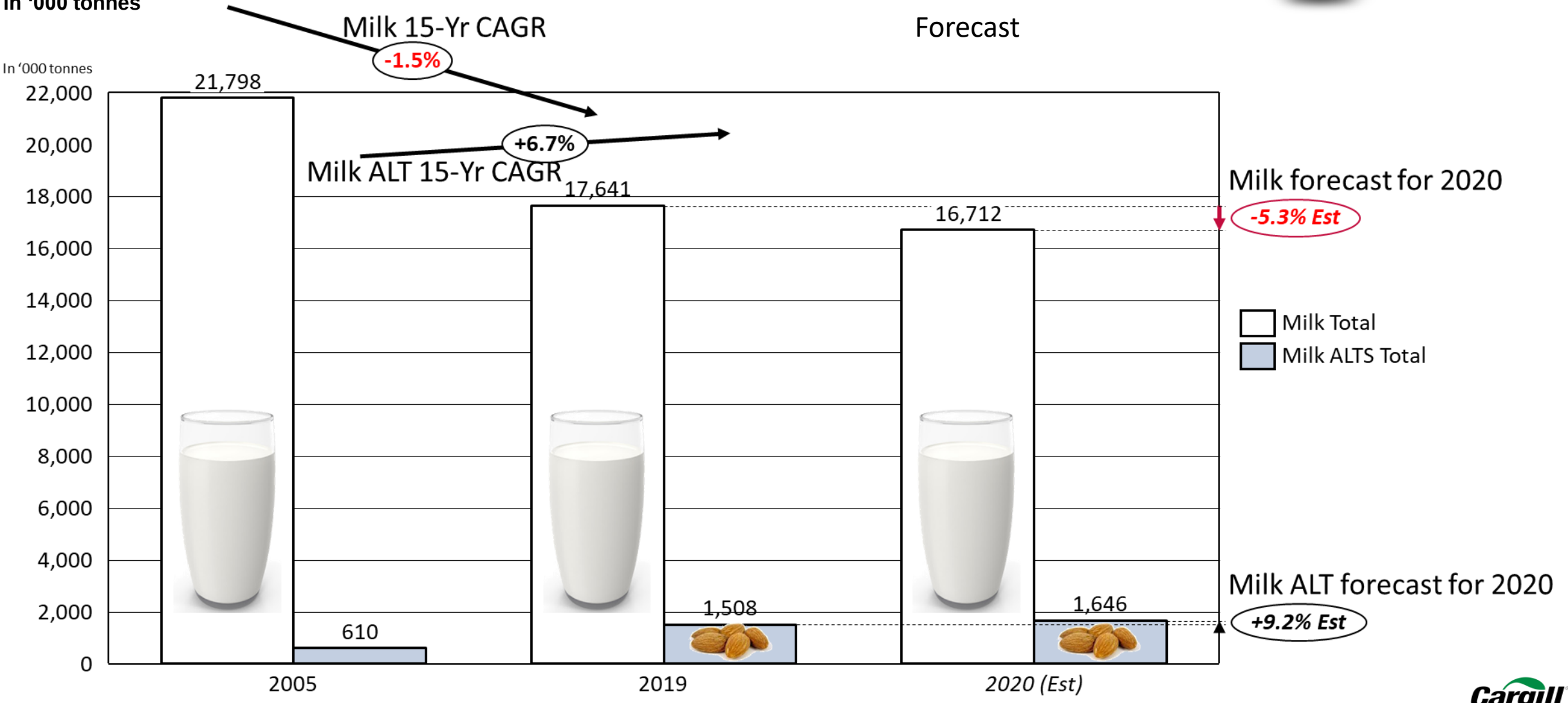
Plant-based Dairy Category Evolution

Mark Fahlin
Business Development – Dairy, Plant-based, Meat ALTS

Cargill

On 15-Yr CAGR basis, Milk declined -1.5% while Milk ALTS grew 6.7%

Total market size & growth by category 2005 – 2020 in USA
in '000 tonnes

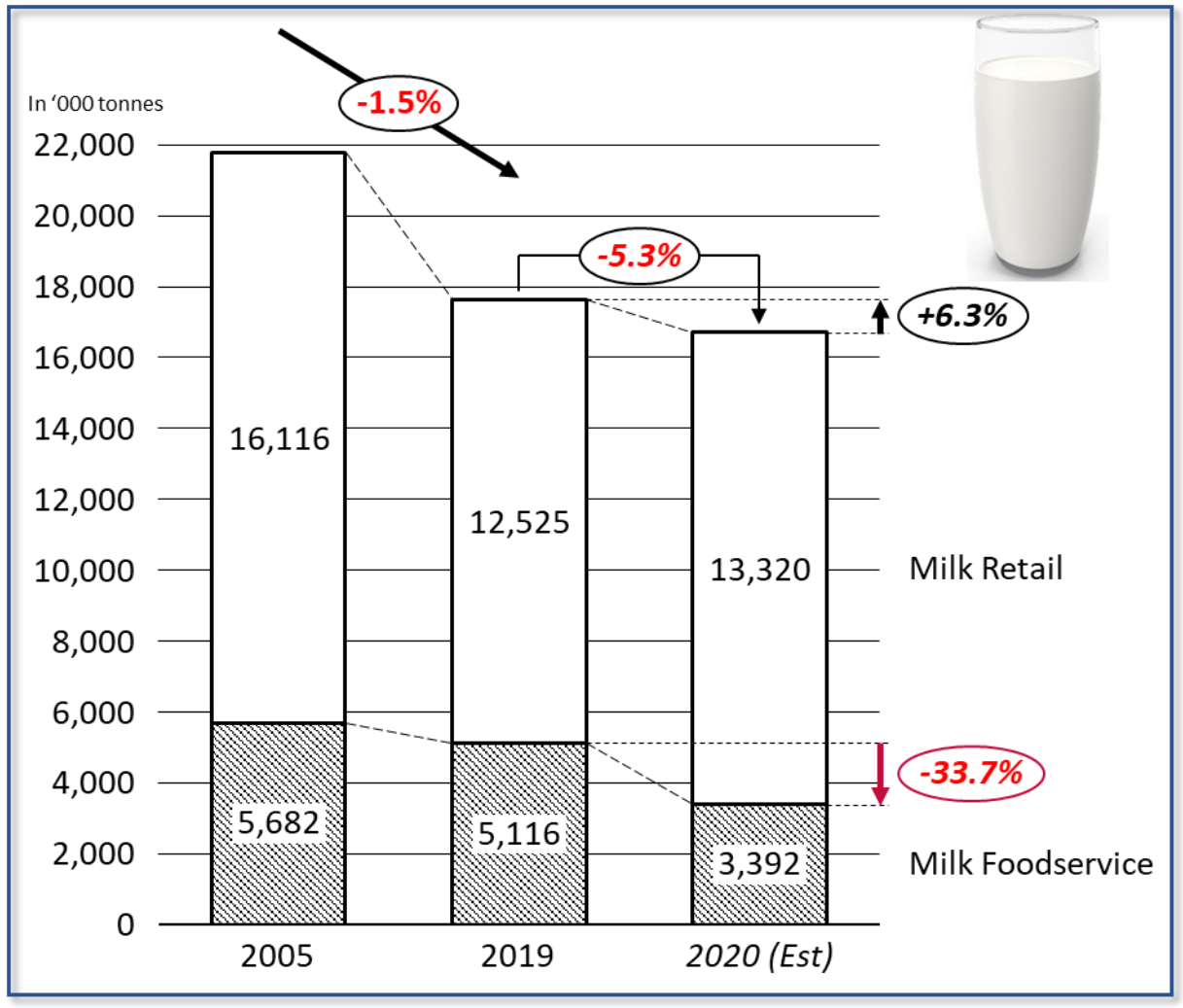


Source: Euromonitor May 2020

Milk volume forecasted to decline -5.3% in 2020

In 2019, Milk volume in Foodservice was ~30%. Milk ALTS was 15%

Total market size & growth by category 2005 – 2020 in USA
in '000 tonnes

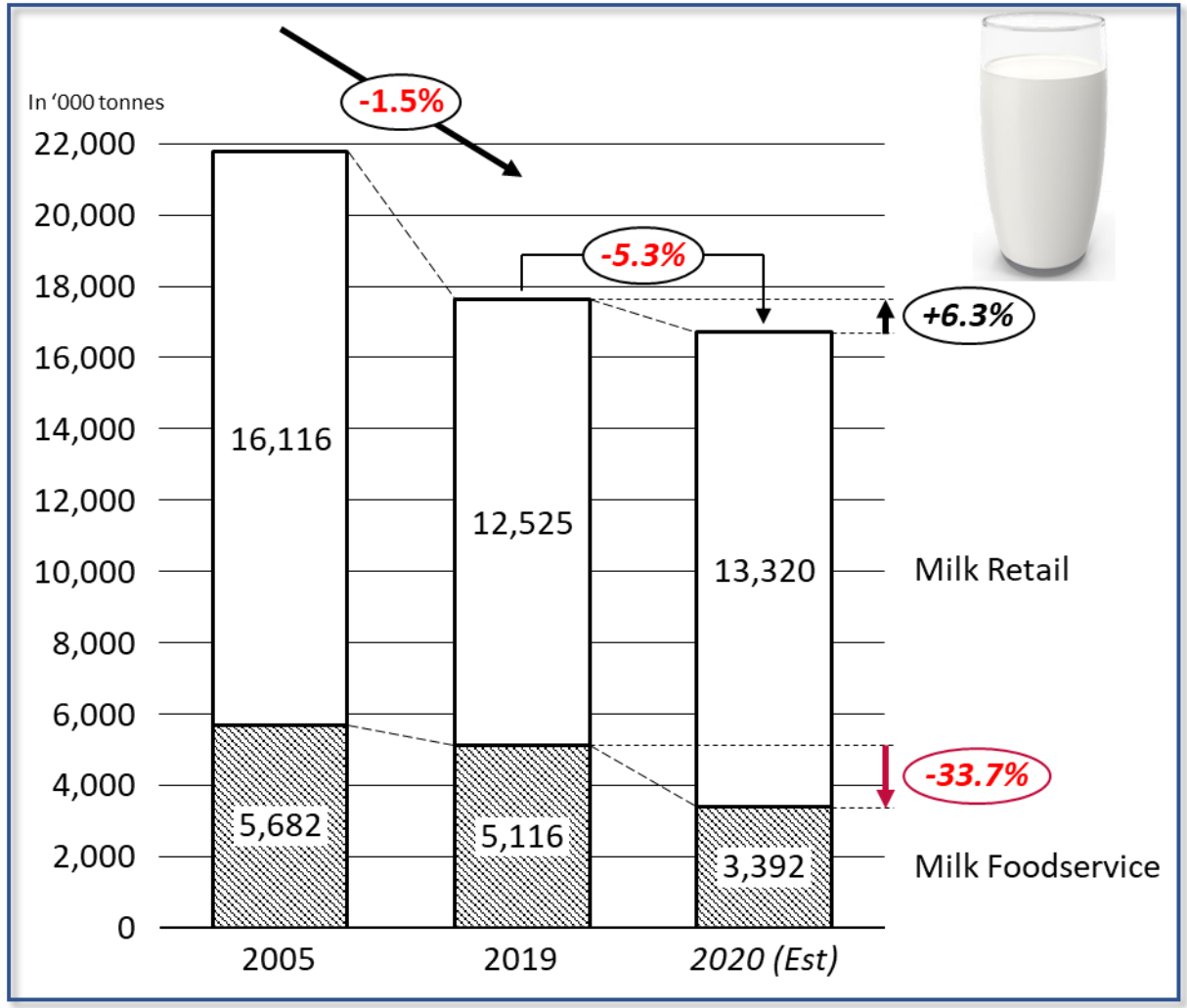


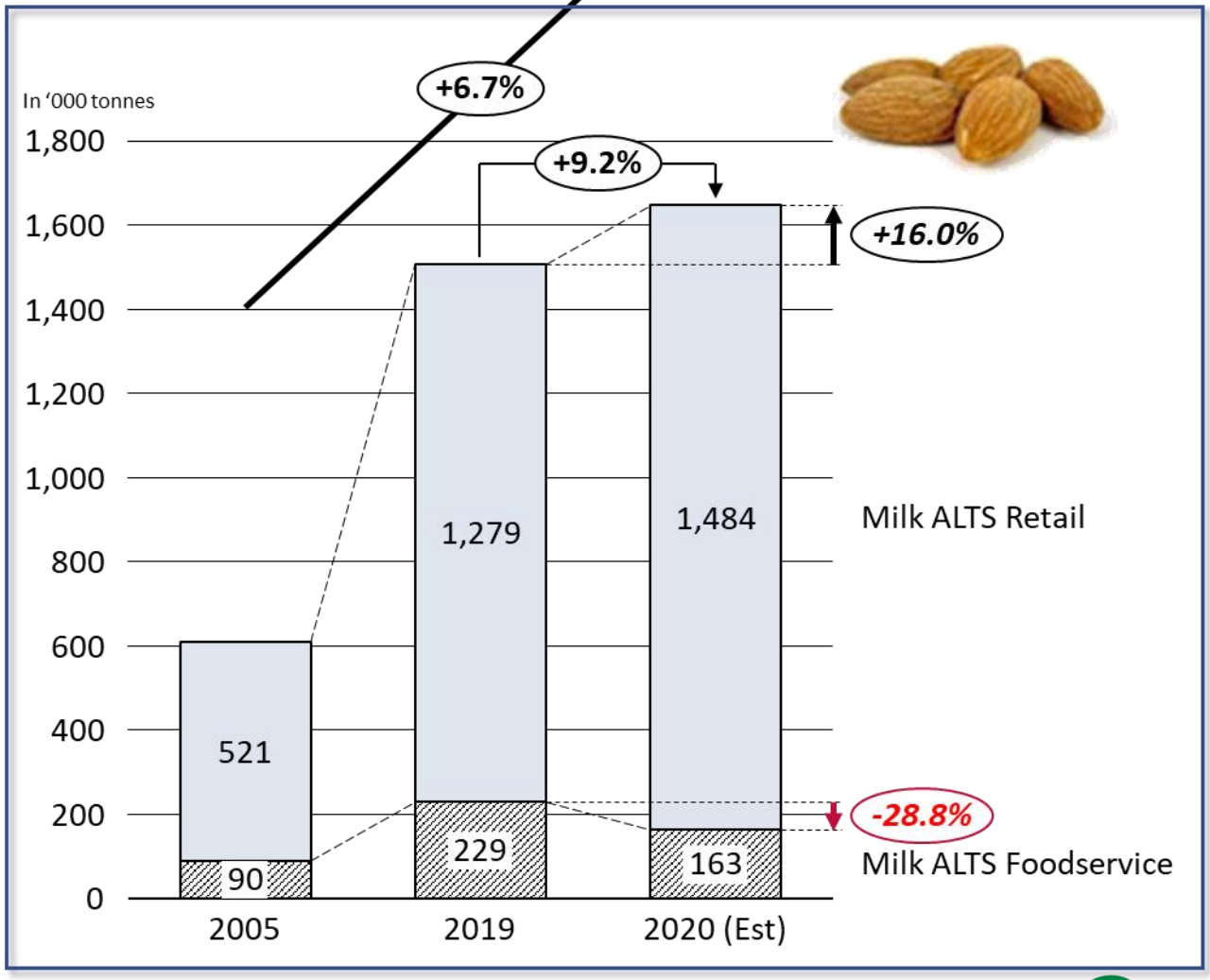
Source: Euromonitor May 2020

Milk ALT volume forecasted to grow 9.2% in 2020

In 2019, Milk volume in Foodservice was ~30%. Milk ALTS was 15%

Total market size & growth by category 2005 – 2020 in USA
in '000 tonnes





Source: Euromonitor May 2020

What our post-pandemic future looks like

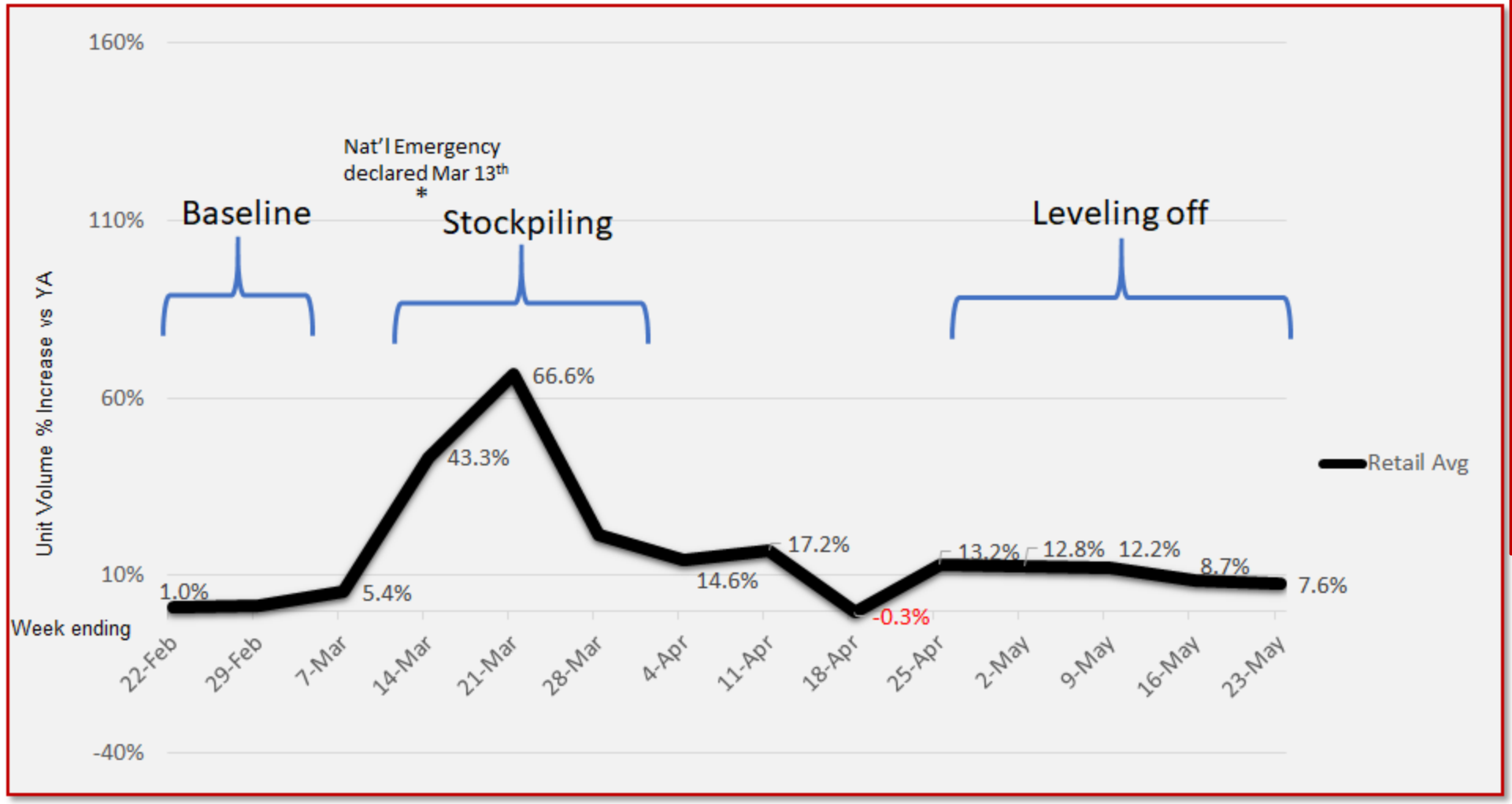
"The Great Lockdown and coronavirus pandemic have forced economists, financiers, executives, and policymakers to jettison or dramatically revise their forecasts for 2020. But what will the future look like on the other side of the crisis?"

Sheltering at home is having a dramatic impact on our various food channels. The following is a look at how this is impacting Retail channels.

Bloomberg News

Retail tracking during COVID – Total Retail Average

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

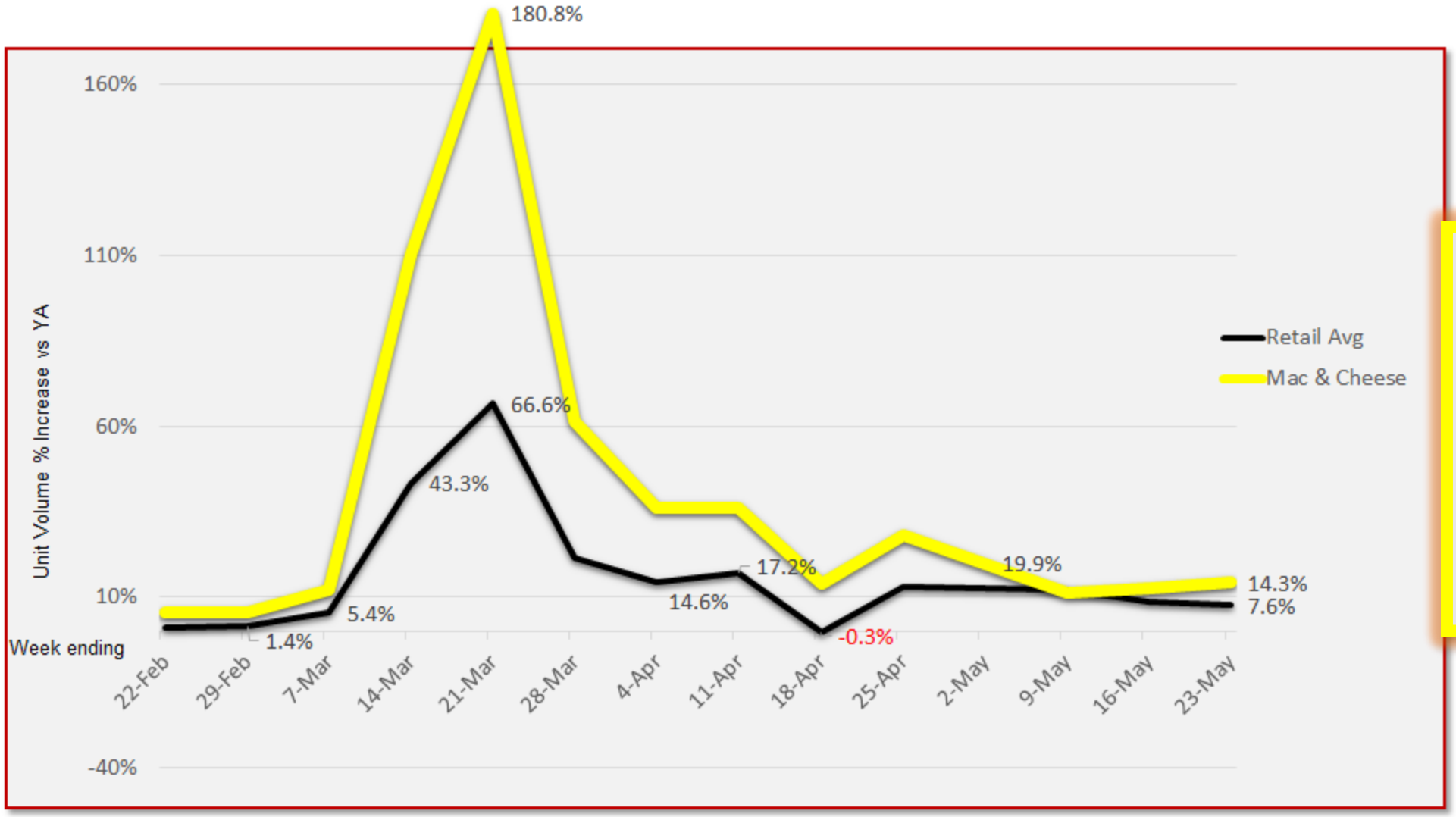


- Prior to March, Retail growth flat vs YA
- Nat'l emergency declared Mar 13th
- Peak stockpiling by shoppers occurred during the Week ending March 21st
- Shopper drivers:
  - Staple foods, comfort, shelf-life
  - On-the-go food occasions is reduced
- As of May, Retail averages are leveling off in low double-digit growth vs YA

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Total Retail Average

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020



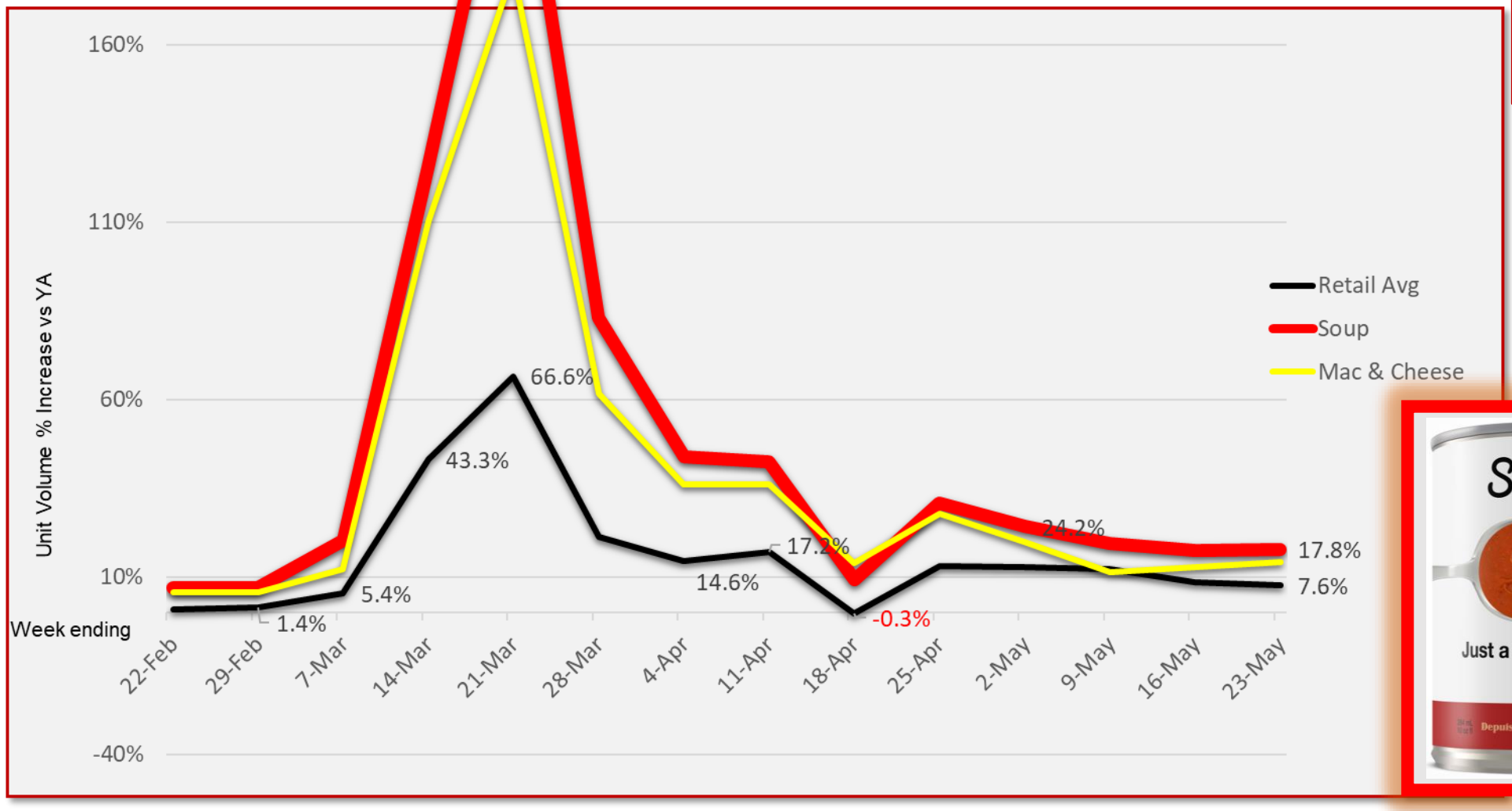
- During peak, the M&C spike was tempered by out-of-stocks
- M&C continues to trend above Retail average

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Total Retail Average

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

- Peaked at 235% vs YA
- Canned Soup continues to trend above Retail average

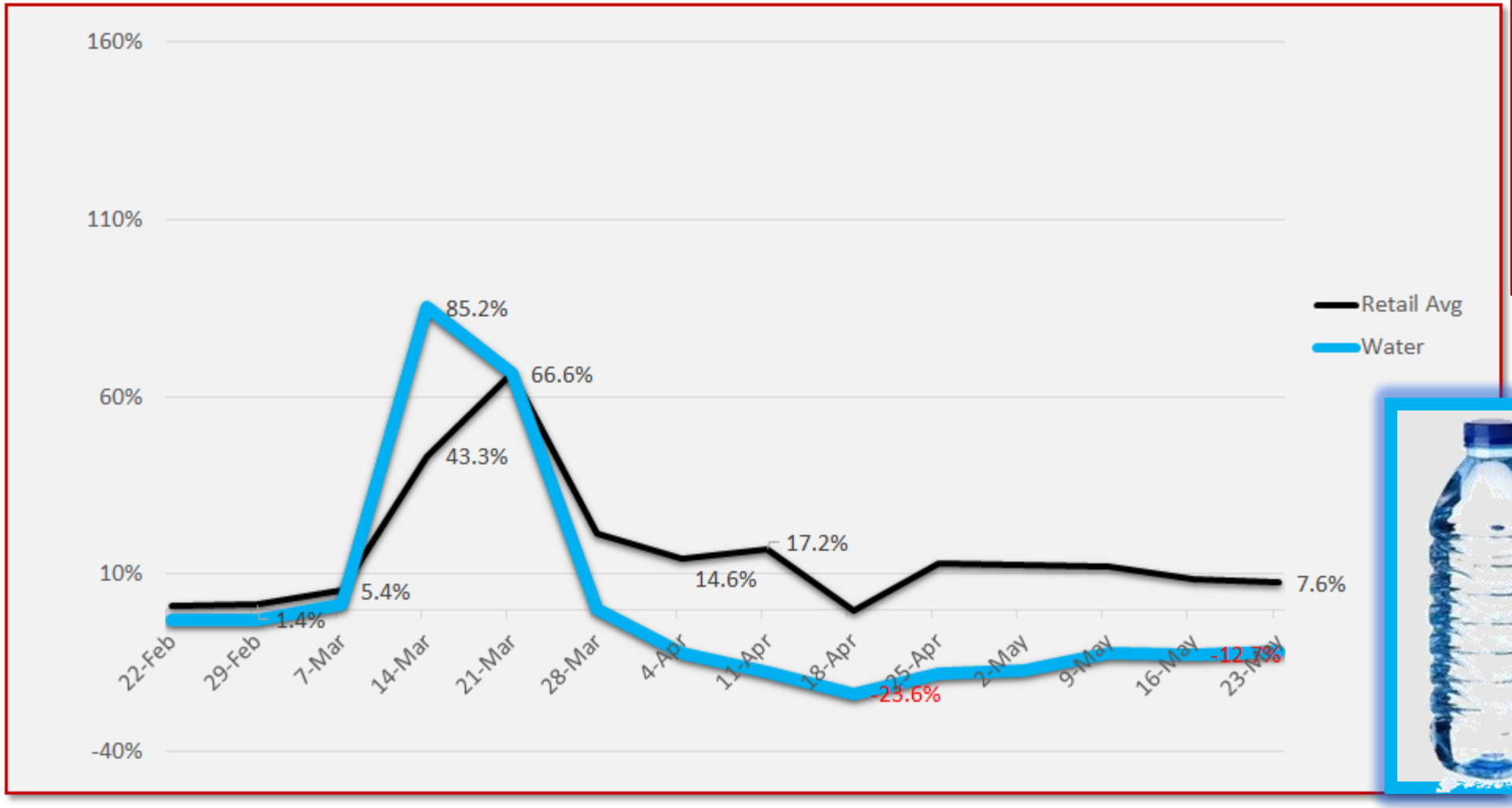


Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Total Retail Average

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

- On-the-go occasions are underperforming during stay-at home behavior
- Bottled water not consumed at home as often



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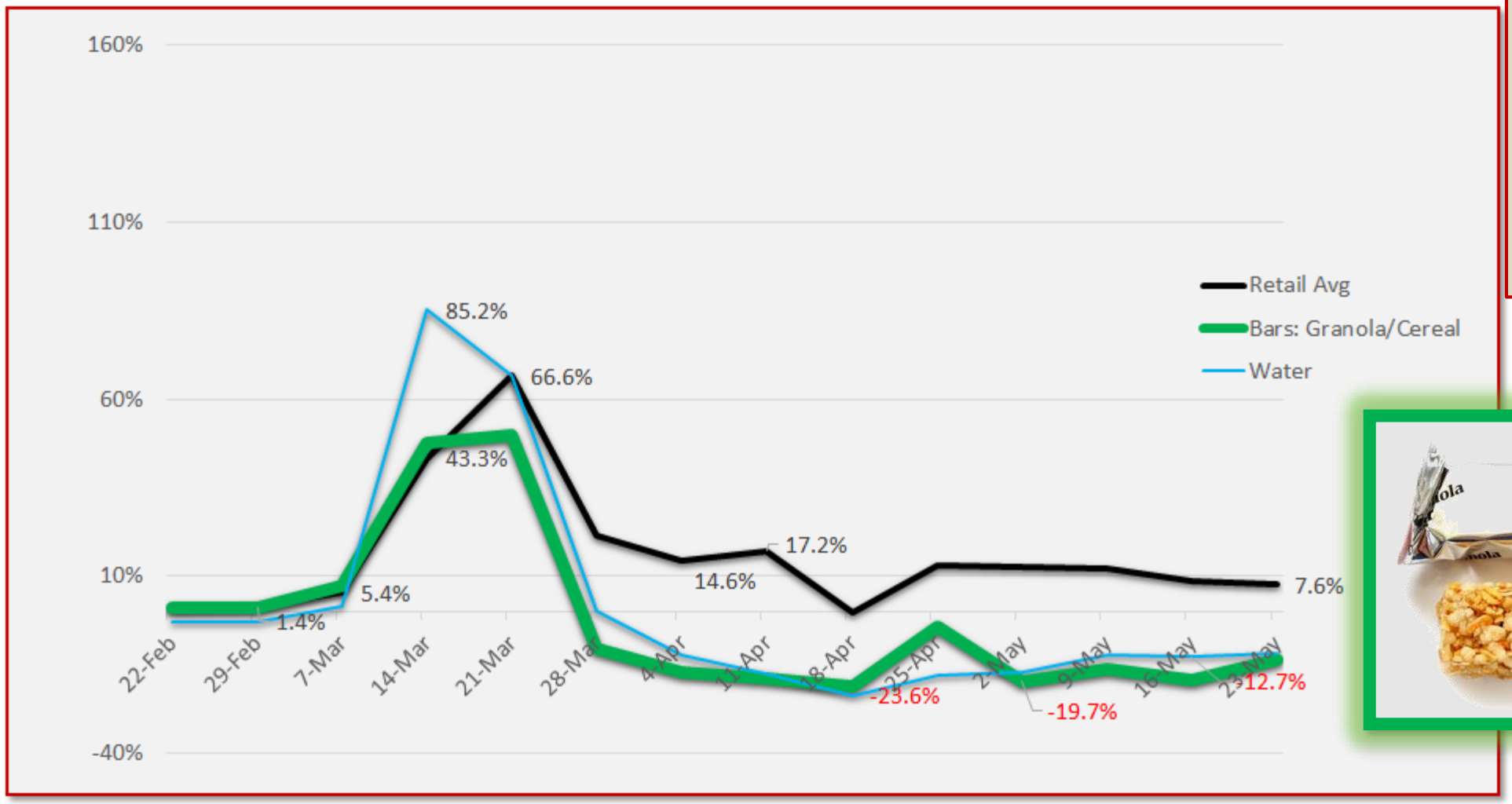
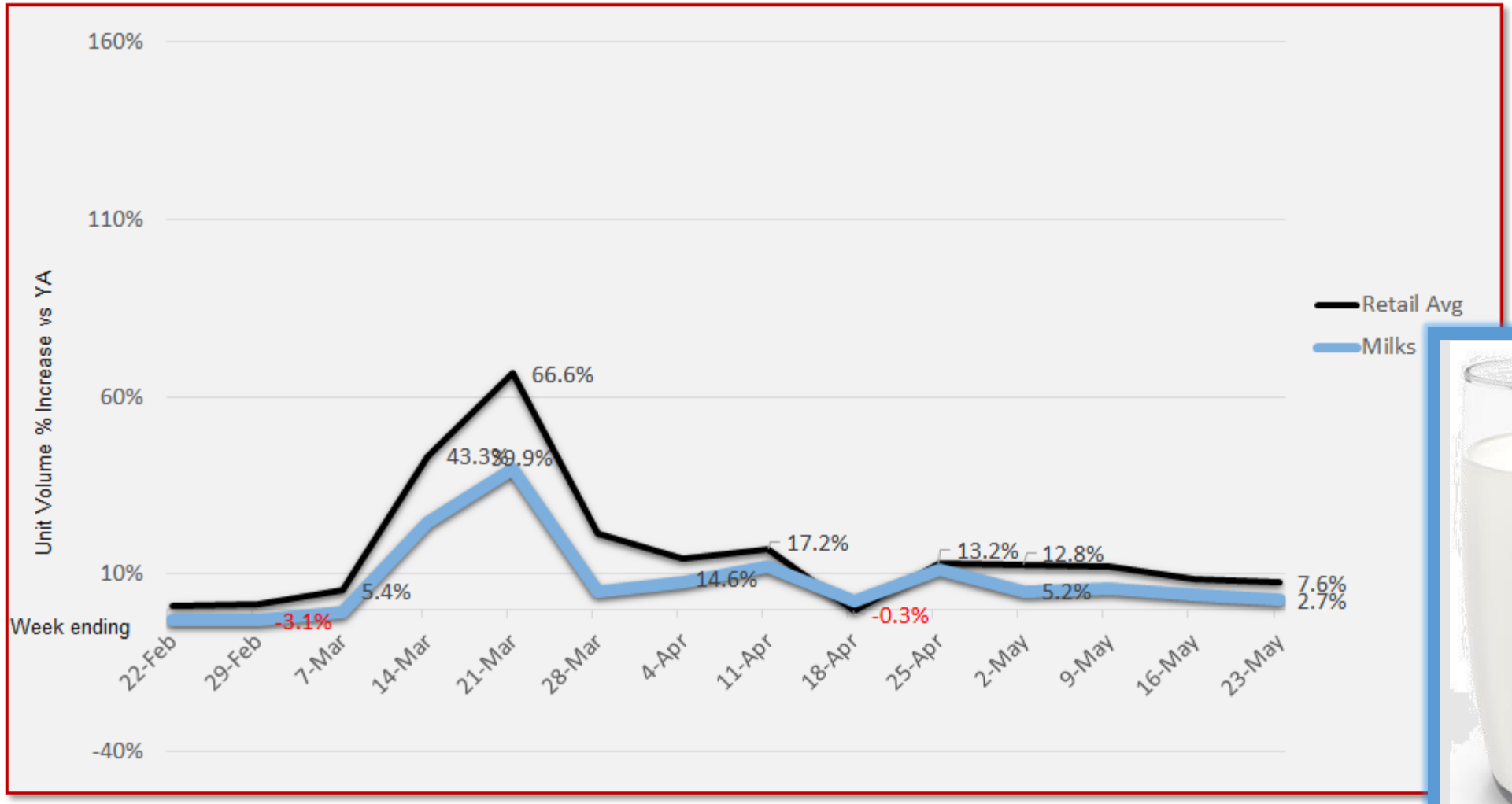


- On-the-go occasions are underperforming during stay-at home behavior
- Bottled water consumed less often at home
- On-the-go snacking is underperforming during stay-at home behavior

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

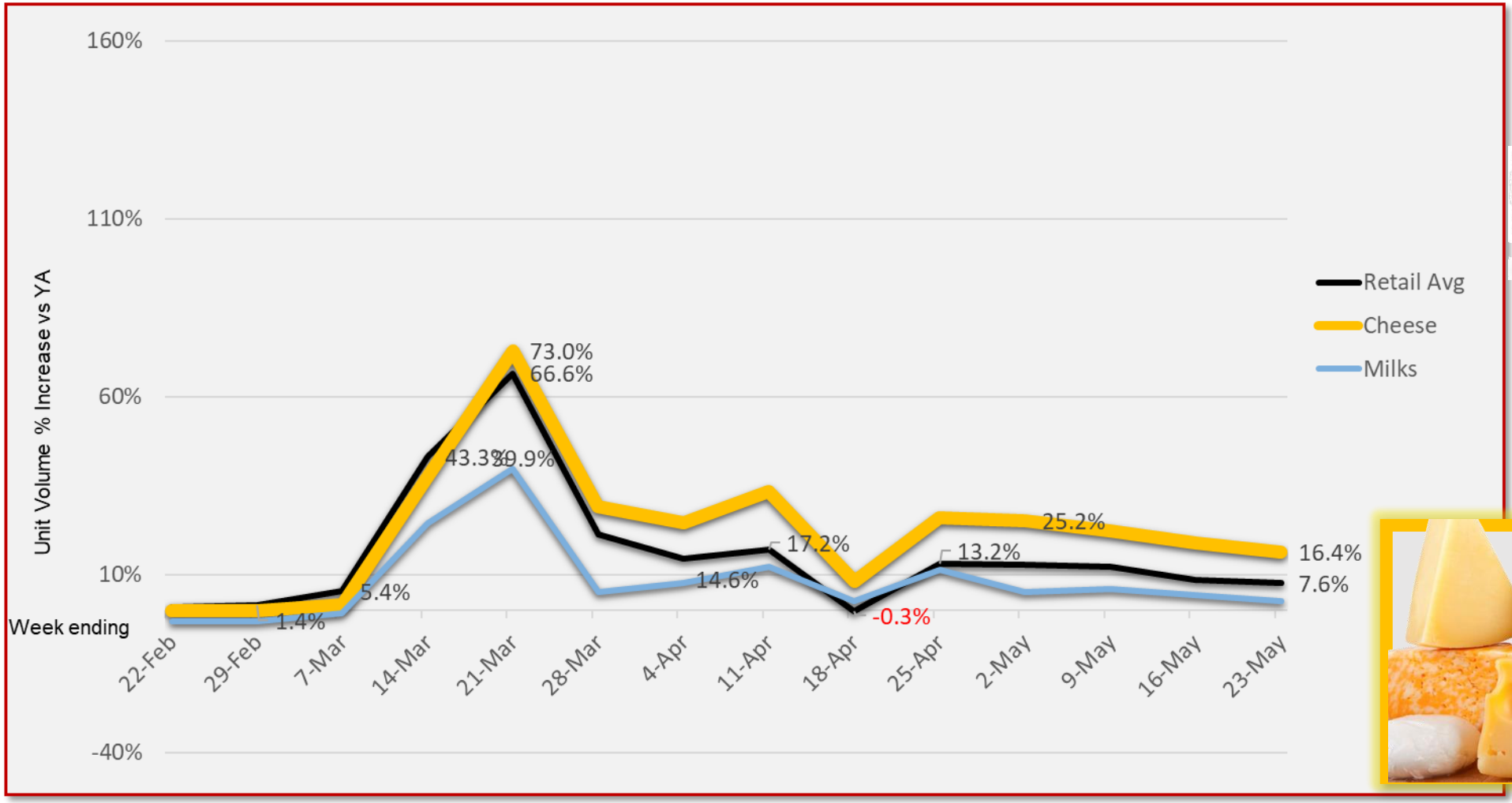


- Milk stockpiling constrained by shelf life, excl. powdered milk
- Milk trending with retail average during

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020



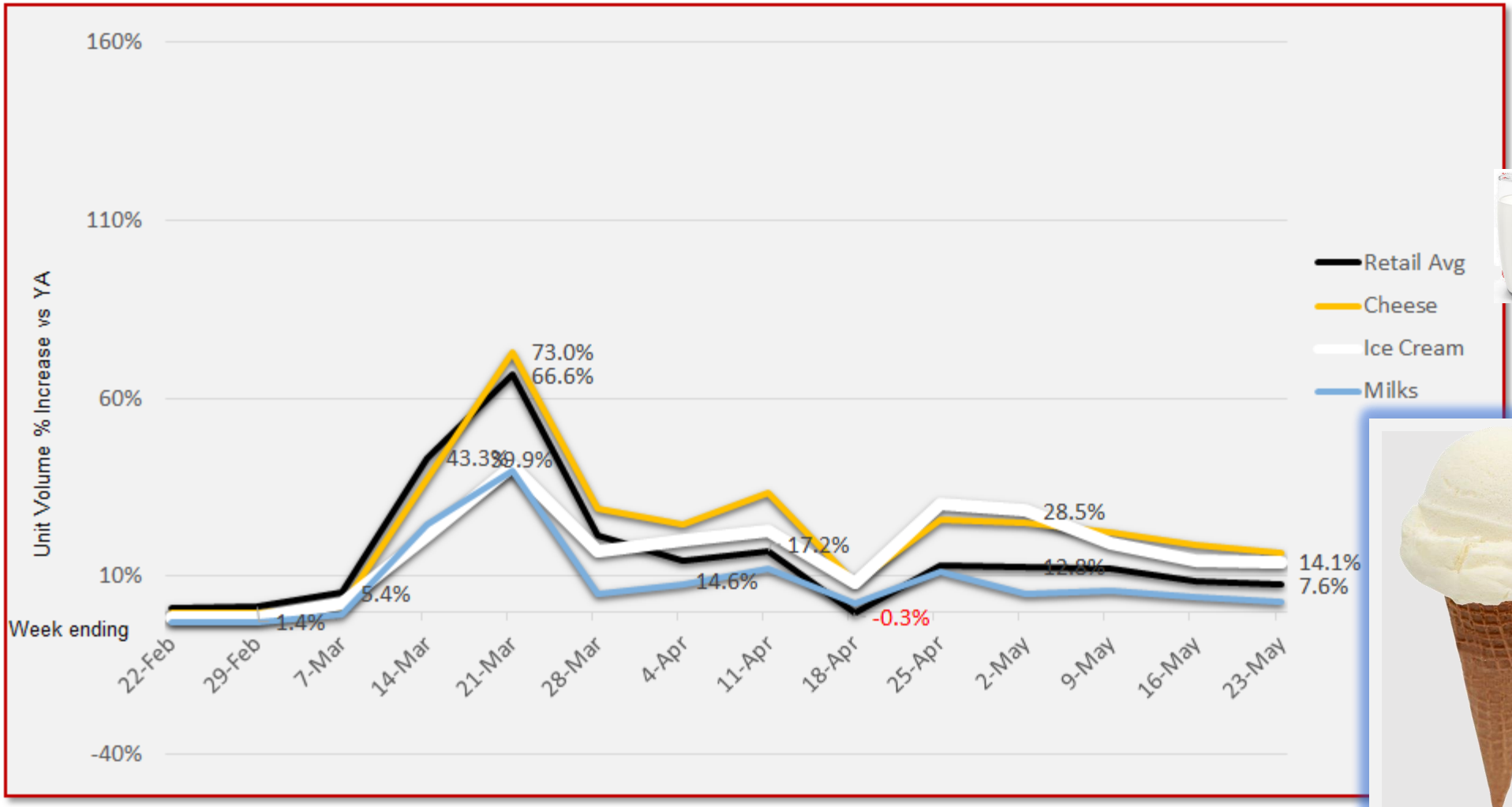
- Cheese trending above driven by longer shelf life and use in cheese-intensive home meals, sandwiches and for snacking

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

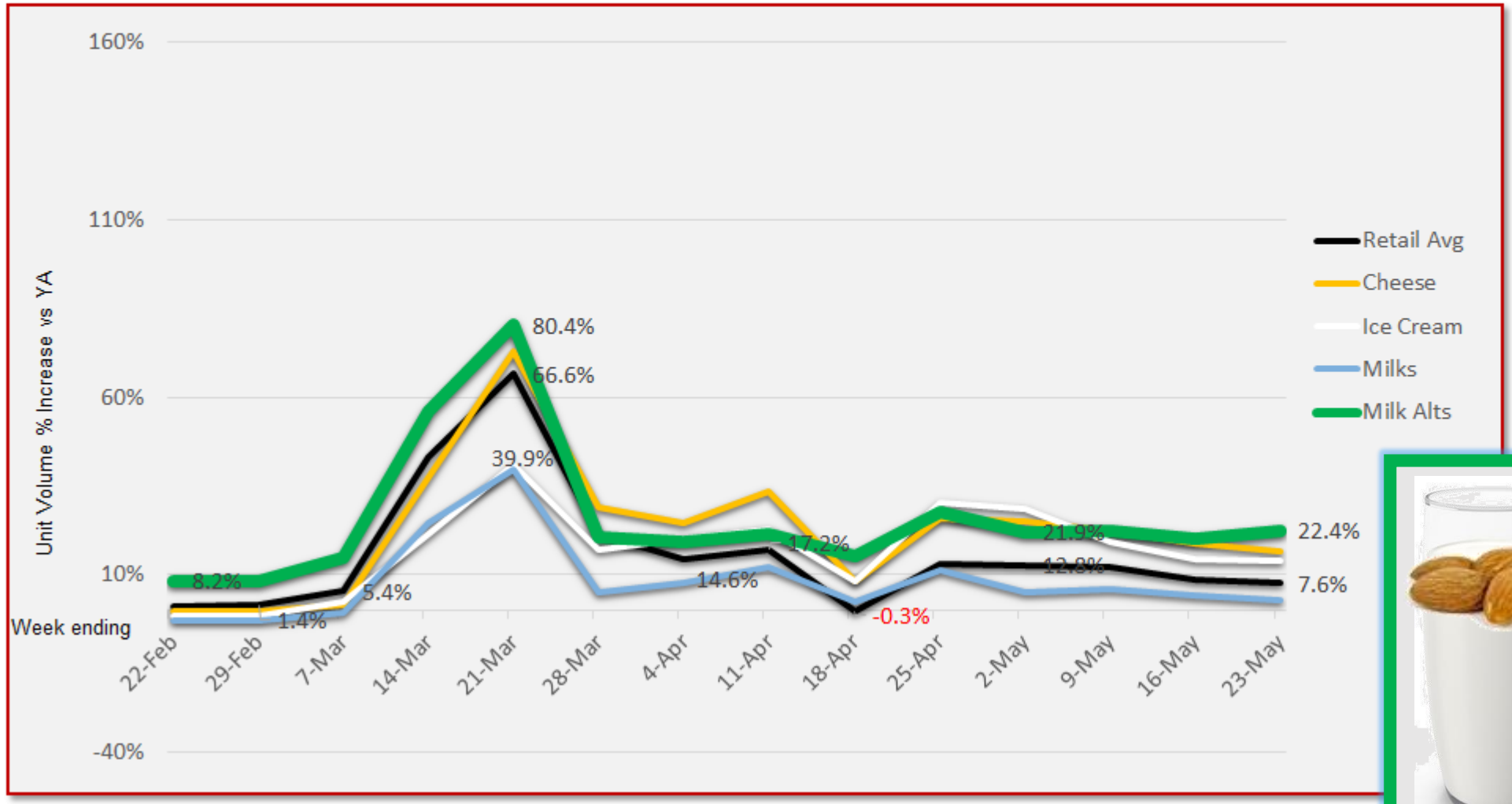
- Stockpiling constrained in part due to at-home freezer capacity
- Ice Cream trending ahead of retail



Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

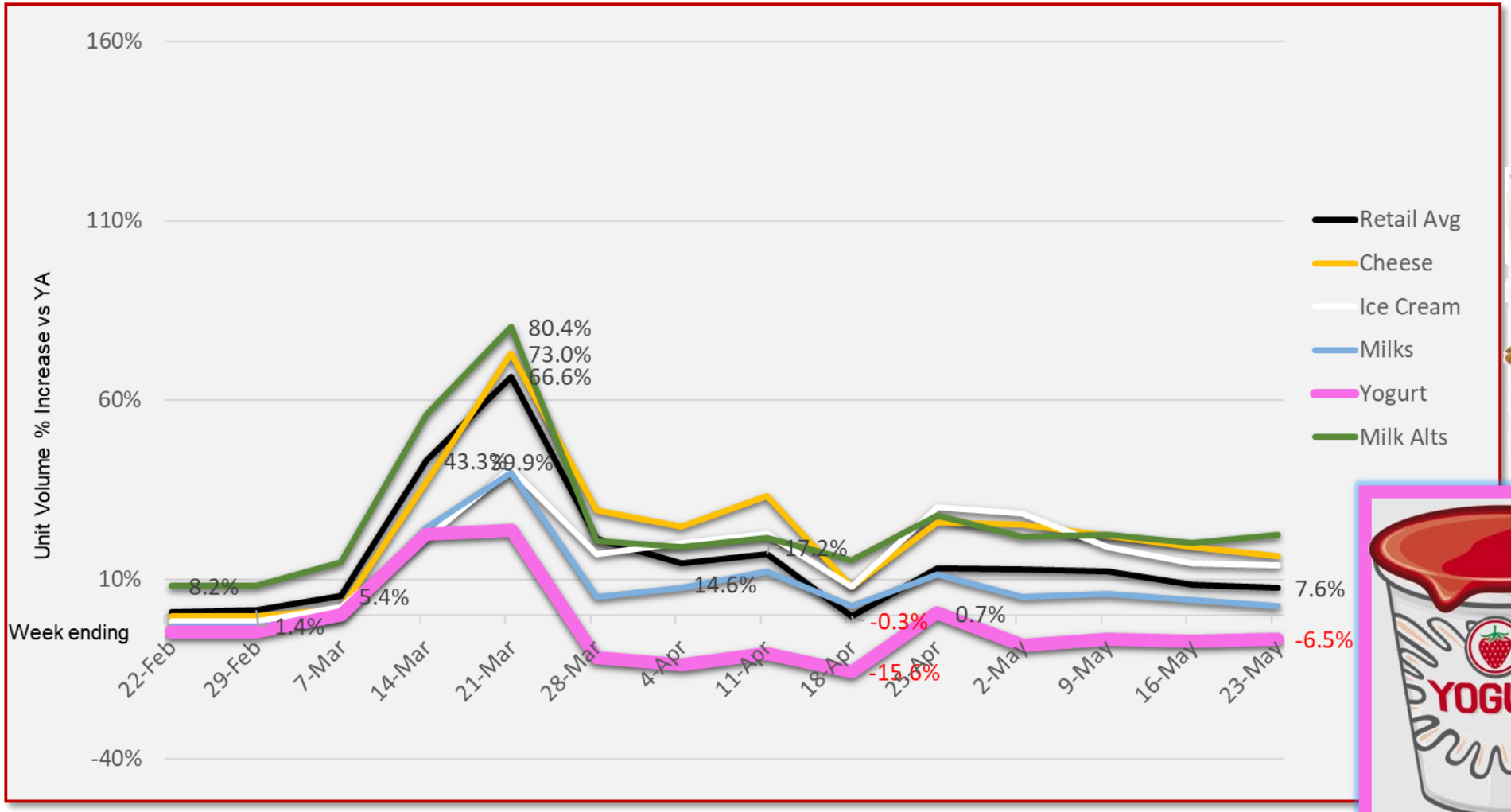


- In February, growth vs YA was 8.2% → considered the baseline prior to COVID
- Milk ALTS longer shelf life help propel above Retail average

Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020



- Yogurt underperformance continues in COVID environment
- On-the-go morning meals, lunches reduced during stay-at-home behavior

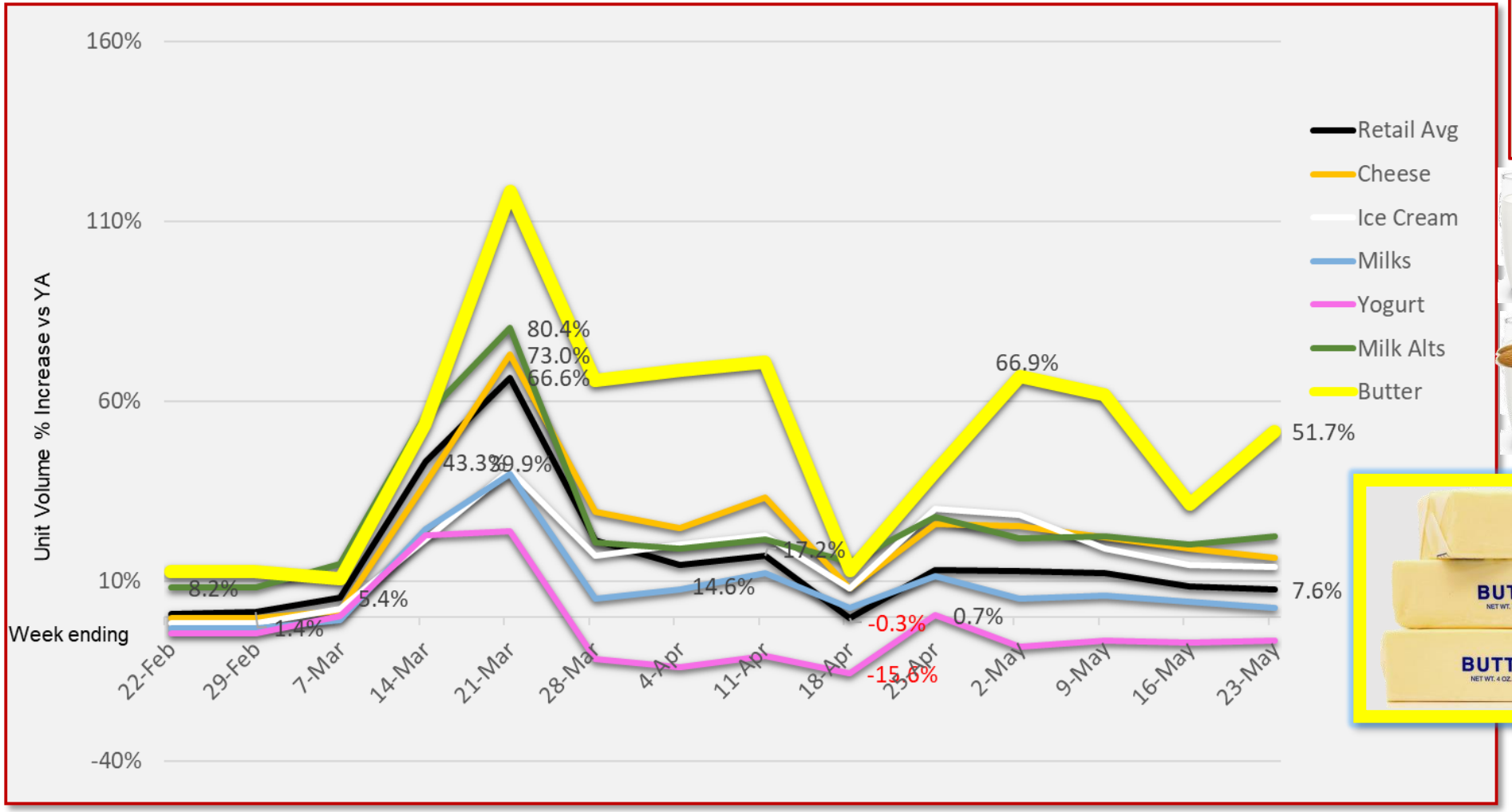



Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
Nielsen xAOC as of 5/23/2020

- Butter trending well above retail average driven by at-home cooking



Source: Nielsen xAOC Unit Volume

Retail tracking during COVID – Dairy + ALTS

Weekly category unit volume change vs YA
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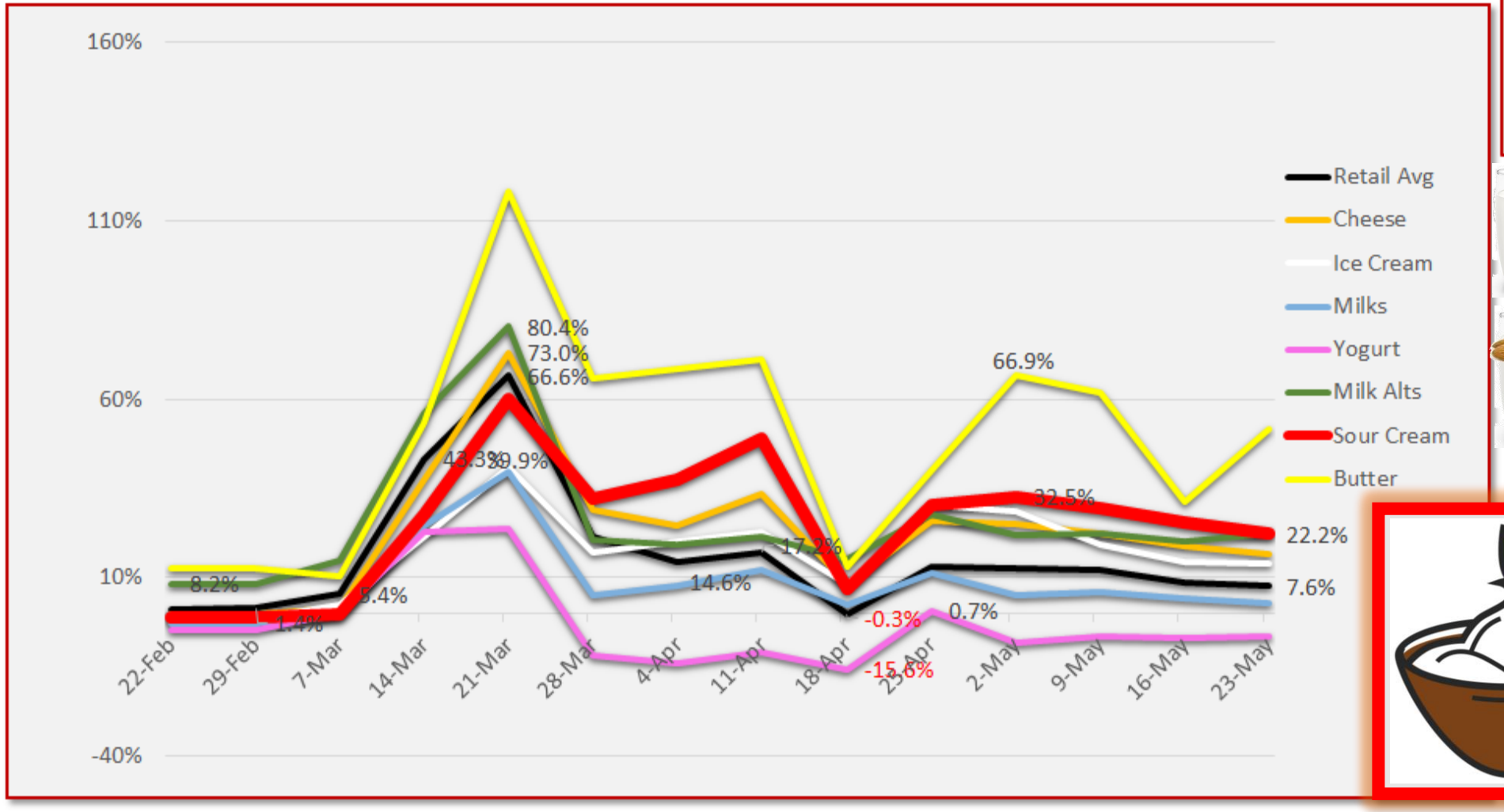
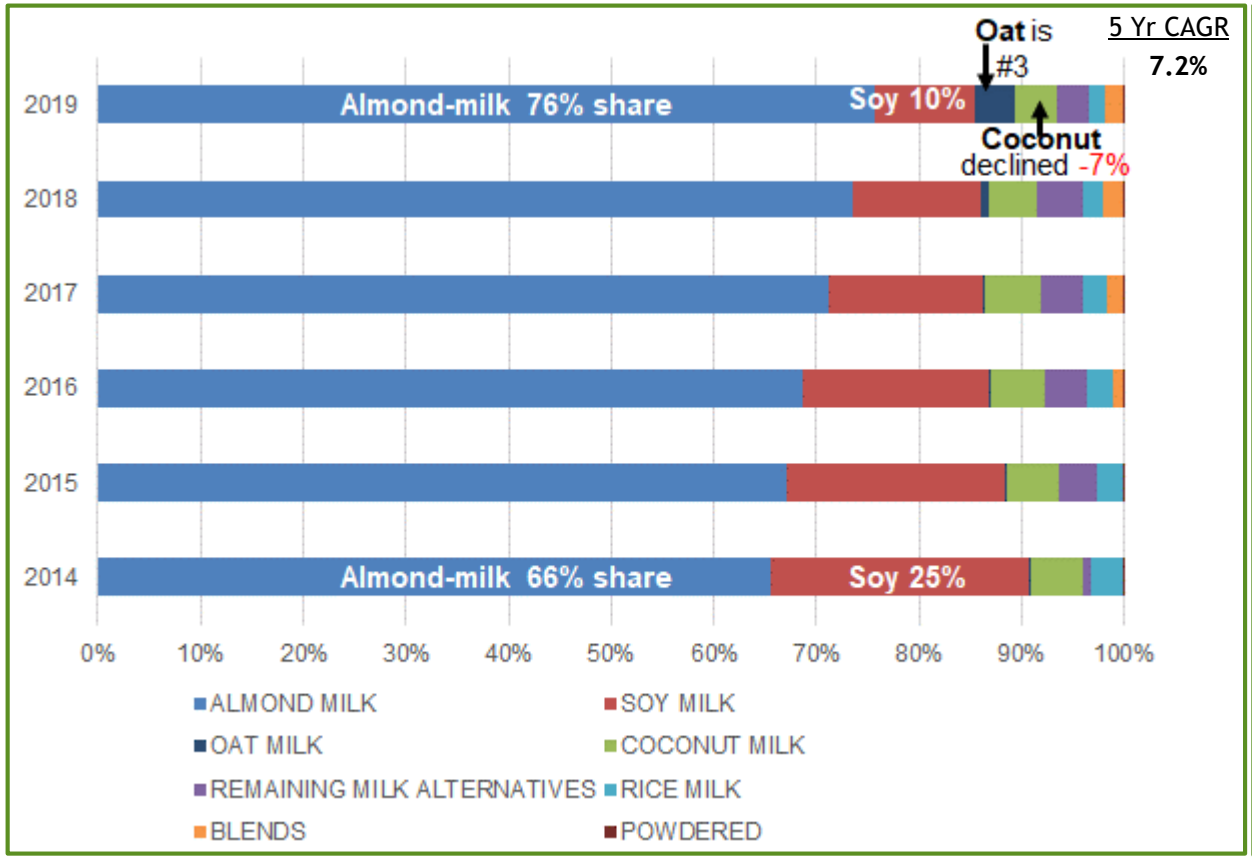


- Sour Cream trending above retail average driven by at-home cooking
- Used in dips, dressings, potatoes, soups, tacos, baking recipes casseroles, risotto

Source: Nielsen xAOC Unit Volume

Plant-based Milk Shares Continue to Shift toward Almond-Milk

Grocery Plant-based Cat. Volume Shares – USA
Volume Shares per Lbs

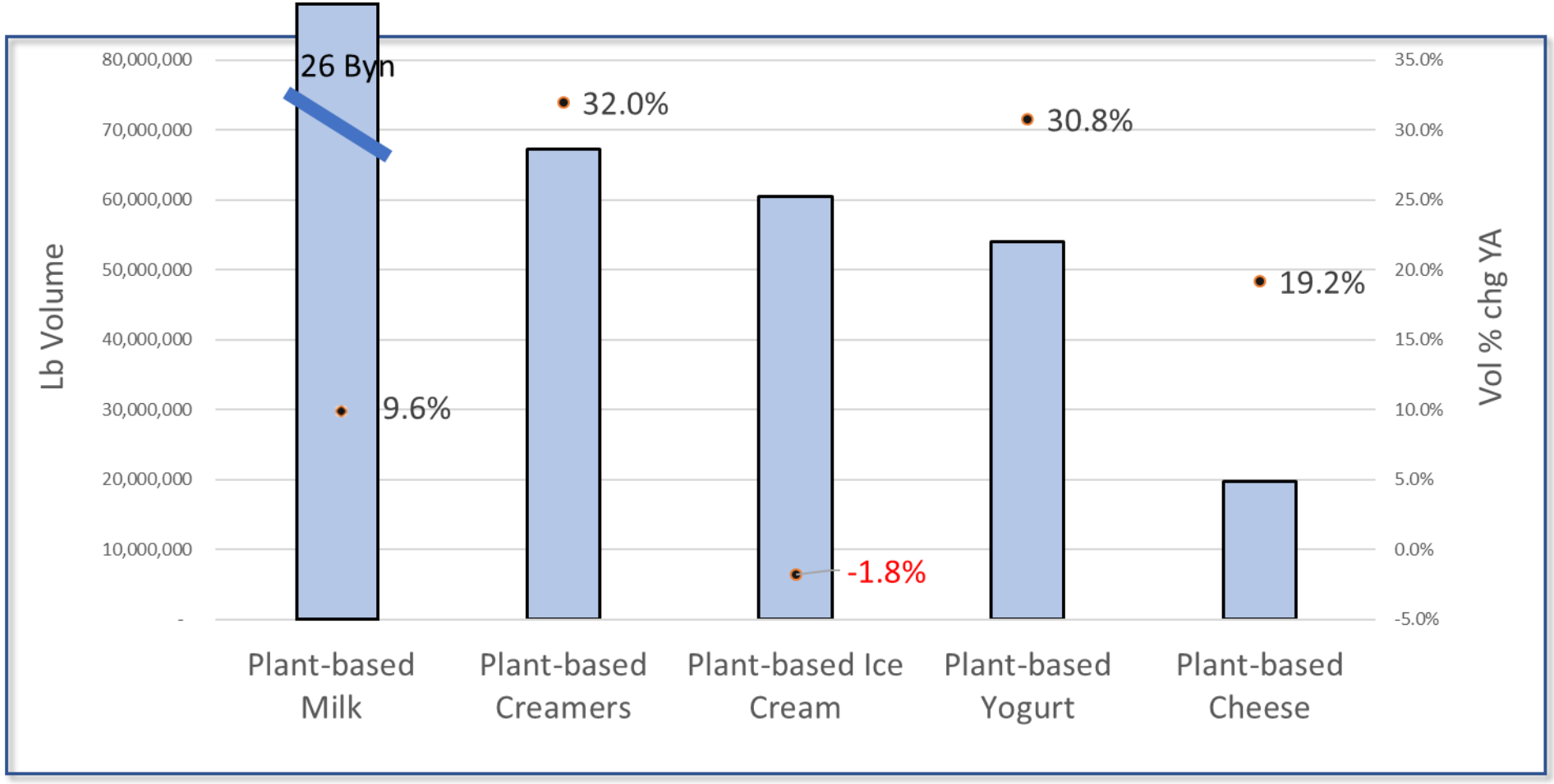


- In 2019, Almond-milk accounts for 76% of Segment share, growing at 10% CAGR
- In 2019, Soy accounts for 10% of Segment share, compared to 25% in 2014. CAGR is -11%
- Coconut-milk declined by -7% vs. 2018
- Oat-milk is nascent, has 4% Share and in 2019 became #3 botanical in plant-based milk

Source: Nielsen xAOC, Cargill Analysis

Plant-based dairy volume by category; plant-based milk is the most developed at 26 Byn Lbs

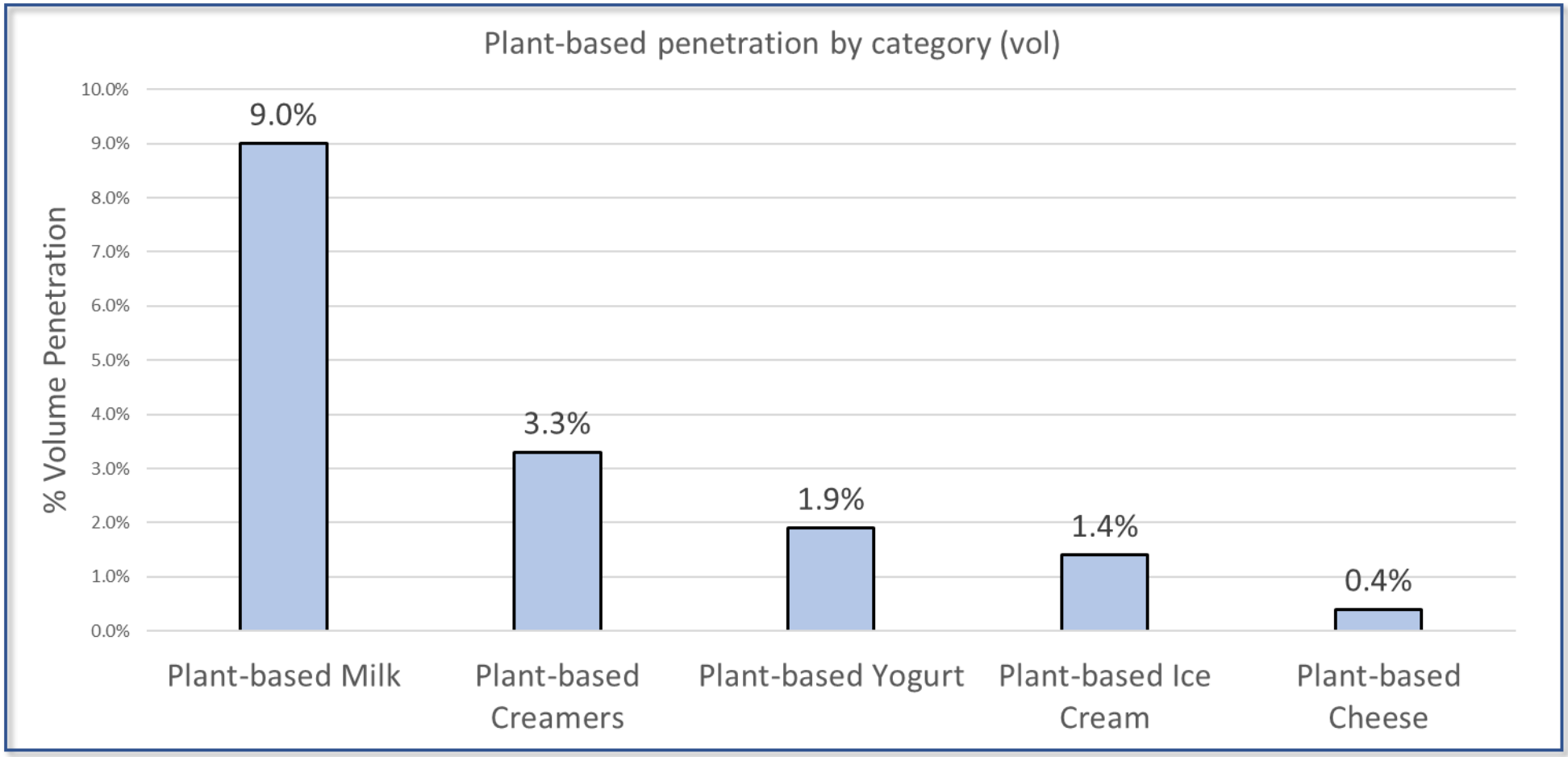
52 wks ending April 18, 2020
Nielsen xAOC Lb volume change vs YA



Source: Nielsen xAOC Lb Volume. 52 weeks ending April 18, 2020

Plant-based milk has the greatest penetration of overall category. Plant-based Cheese poised as next opportunity

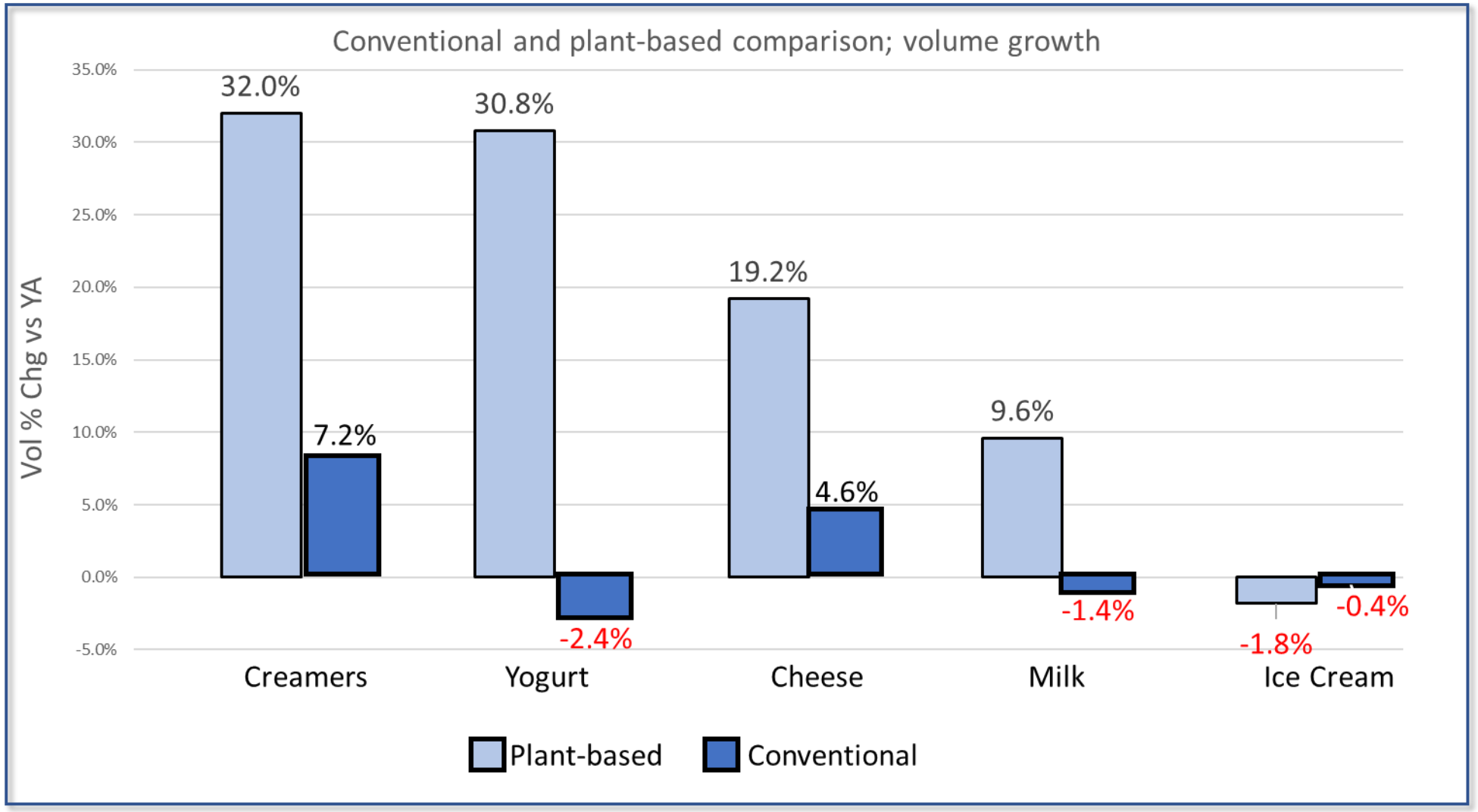
52 wks ending April 18, 2020
Nielsen xAOC Lb volume penetration relative to overall category (includes conventional)



Source: Nielsen xAOC Lb Volume. 52 weeks ending April 18, 2020

Retail tracking during COVID – Dairy + ALTS

52 wks ending April 18, 2020
Nielsen xAOC Lb volume



Source: Nielsen xAOC Unit Volume

INGREDIENTRACKER™

- What is it?
  - Cargill's proprietary annual tracker of U.S. consumer perceptions about ingredients
  - 2020 results assessed 231 ingredients
  - 10,643 (rep sample) respondents completed online survey

- What can we learn?
  - Identifies ingredients that drive seeking or avoidance of a product
  - Highlights changes over time
  - Looks at the relationship between purchase impact and other factors (e.g., perceived healthfulness & ingredient familiarity)

2020 research assessed 231 ingredients

Acidulants, processing aids, & preservatives

Ascorbic acid*
Citric acid
Malic acid
Mixed tocopherols
Sodium bicarbonate (soda)
Sodium carbonate (soda ash)

Grains

Barley flakes*
Barley flour*
Beta glucan
Bleached flour
Brown rice flour*
Corn bran
Corn flour*
Eikorn
Farro
Masa
Millet*
Oat flakes
Oat flour*
Organic corn*
Organic yellow corn*
Quinoa
Rye flour*
Sorghum
Spelt
Wheat flour
Wheatberries*
Whole grain corn
Whole wheat flour*

Animal proteins

Beef protein isolate
Bone broth
Cage free eggs*
Collagen hydrolysate
Dehydrated egg whites
Dehydrated turkey broth
Dried egg whites
Egg replacer*
Egg whites
Eggs*
Finely textured beef
Hydrolyzed collagen
Hydrolyzed collagen peptides
Hydrolyzed turkey protein
Mechanically separated chicken
Mechanically separated turkey
Milk protein concentrate*
Turkey broth
Turkey stock
Whey protein
Whey protein concentrate
Whey protein isolate

Plant proteins

Algae protein
Almond butter*
Almond protein powder*
Canola protein
Chickpea flour
Corn protein
Corn protein isolate
Hemp protein*
Lentil flour*
Mung bean protein*
Pea protein
Potato protein
Rapeseed protein
Rice protein
Soy flour
Soy protein concentrate*
Soy protein isolate
Sunflower seed protein
Textured vegetable protein
Wheat protein

Fats & oils

Almond oil*
Avocado oil*
Cannabadiol (CBD) oil*
Canola oil*
Cocoa butter*
Coconut oil*
DMPS
Expeller pressed oil
Expeller pressed canola oil*
Fully hydrogenated oil
Hemp oil*
Hexane
Interesterified oils
Lard
Medium chain triglycerides*
Mono & diglycerides
Palm oil*
Refined coconut oil*
Soybean oil *
Sunflower oil*
Tallow
TBHQ
Vegetable oil

Chocolate

Chocolate
Cocoa
Cocoa processed with alkali*

Salts

Kosher salt
Potassium
Potassium chloride
Potassium chloride salt*
Potassium chloride, salt
Potassium chloride, sea salt
Potassium salt
Potassium salt, salt
Potassium salt, sea salt
Salt
Salt blend (salt. potassium chloride)*
Salt blend (potassium chloride, salt)*
Sea salt
Sea salt blend (sea salt, potassium chloride)
Sea salt blend (potassium chloride, sea salt)
Sodium

Sweeteners & bulking agents

Acesulfame potassium
Agave
Allulose
Aspartame
Barley syrup
Beet sugar
Brazzein*
Brown rice syrup
Brown sugar
Cane juice
Cane sugar
Caramelized sugar
Coconut sugar
Corn syrup
Crystalline fructose
Cultured dextrose*
Date sugar
Dextrose
Enzyme treated stevia leaf extract
Erythritol
Evaporated cane juice
Glucose syrup
Glycerol*
High fructose corn syrup
Honey
Invert sugar
Maltitol
Mogroside
Monkfruit extract
Organic cane sugar
Organic corn syrup*
Organic tapioca syrup
Palm sugar
Pea syrup
Polydextrose
Pomegranate fruit powder*
Reb M
Rice syrup*
Siratose
Soluble corn fiber
Sorbitol
Sorghum syrup
Stevia
Stevia leaf extract
Stevia leaf extract, allulose*
Stevia leaf extract, erythritol
Stevia leaf extract, stevia sweetener*
Stevia sweetener*
Stevia sweetener, erythritol*
Steviol glycosides
Steviol glycosides, erythritol
Sucralose
Sugar
Tagatose*
Tapioca syrup
Turbinado sugar
Wheat syrup
Xylitol

Texturizers, fibers, & emulsifiers

Apple pectin*
Bamboo cellulose*
Black chia*
Brown flax*
Canola lecithin
Carrageenan
Cellulose powder*
Chia*
Chicory root fiber
Citrus fiber*
Citrus pectin
Corn lecithin
Corn starch
Gelatin
Gellan gum
Glycerin*
Golden flax*
Guar gum
Gum acacia
Gum arabic
Inulin
Isolated oat product*
Locust bean gum
Maltodextrin
Methyl cellulose*
Modified cellulose*
Modified corn starch
Modified food starch
Non-GMO maltodextrin
Oat fiber*
Pea fiber*
Pea starch*
Pectin
Polysorbate 80*
Potato starch
Potato maltodextrin*
Psyllium fiber*
Rapeseed lecithin
Resistant dextrin
Rice starch
Seaweed flour
Seaweed powder*
Soluble rice flour*
Soy lecithin
Sunflower lecithin
Tapioca flour*
Tapioca starch
Tara gum
Xanthan gum

Other

Annatto
Apple extract*
Beet juice extract*
Cannabadiol (CBD)*
Cherry powder
Cinnamon*
Malt extract*
Natural flavoring
Paprika extract*
Rosemary extract
Vegetable juice*

*** = ingredients added this wave**
More ingredients added each wave:
Totals by Wave: Wave 1 (37), Wave 2 (67), Wave 3 (117), Wave 4 (137), Wave 5 (173), Wave 6 (231)

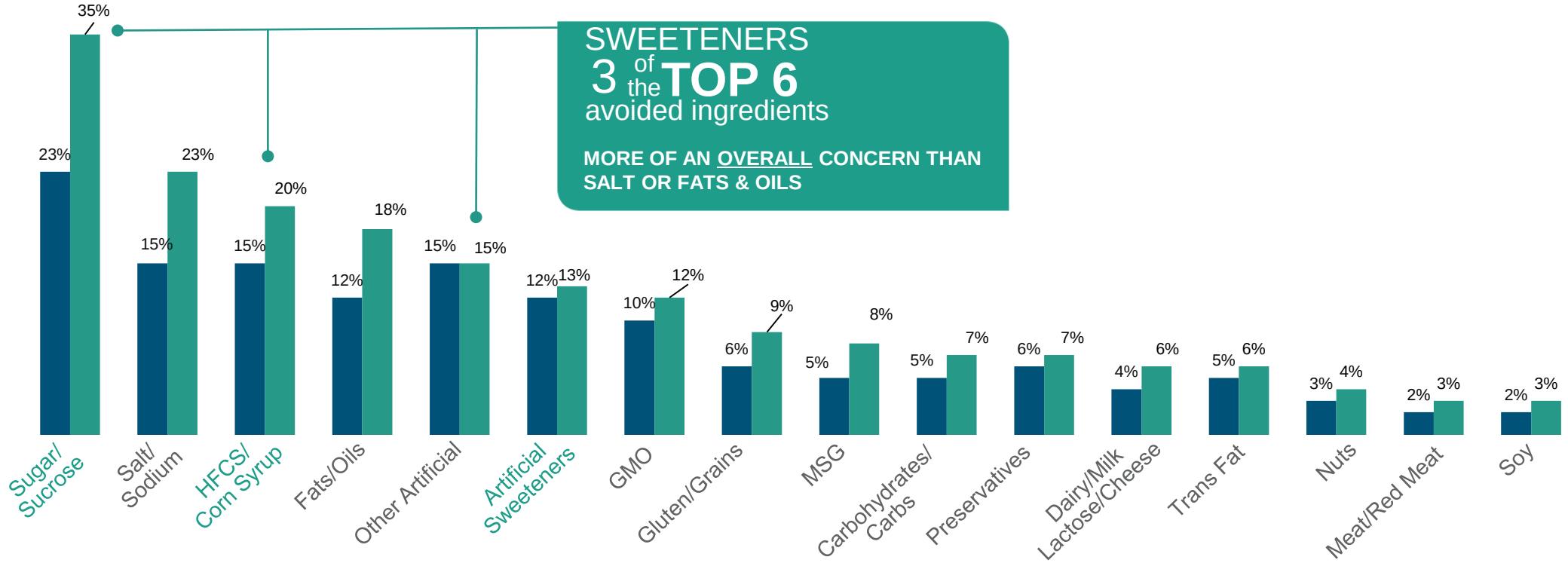
UNAIDED AVOIDANCE

QUESTION

What specific ingredients or types of ingredients do you avoid when you shop for packaged food or beverage? (open-ended response)

Top-of-mind avoidance has returned to previous levels after a dip across the board last wave

Of Consumers Who Stated They Avoid



Base: Wave 6 N=6223, Wave 5 N=8620 Respondents who avoid any ingredients
Q: What specific ingredients or types of ingredients do you avoid when you shop for packaged food or beverage?

HEALTH PERCEPTION

wellness

<u>QUESTION</u>

Please indicate how healthful you think each ingredient is. Select the number on the scale that best corresponds to your opinion.

<u>5-POINT SCALE</u>

Good for you (5 & 4), neutral (3), Bad for you (2 & 1)

Good for you – Bad for You = NET

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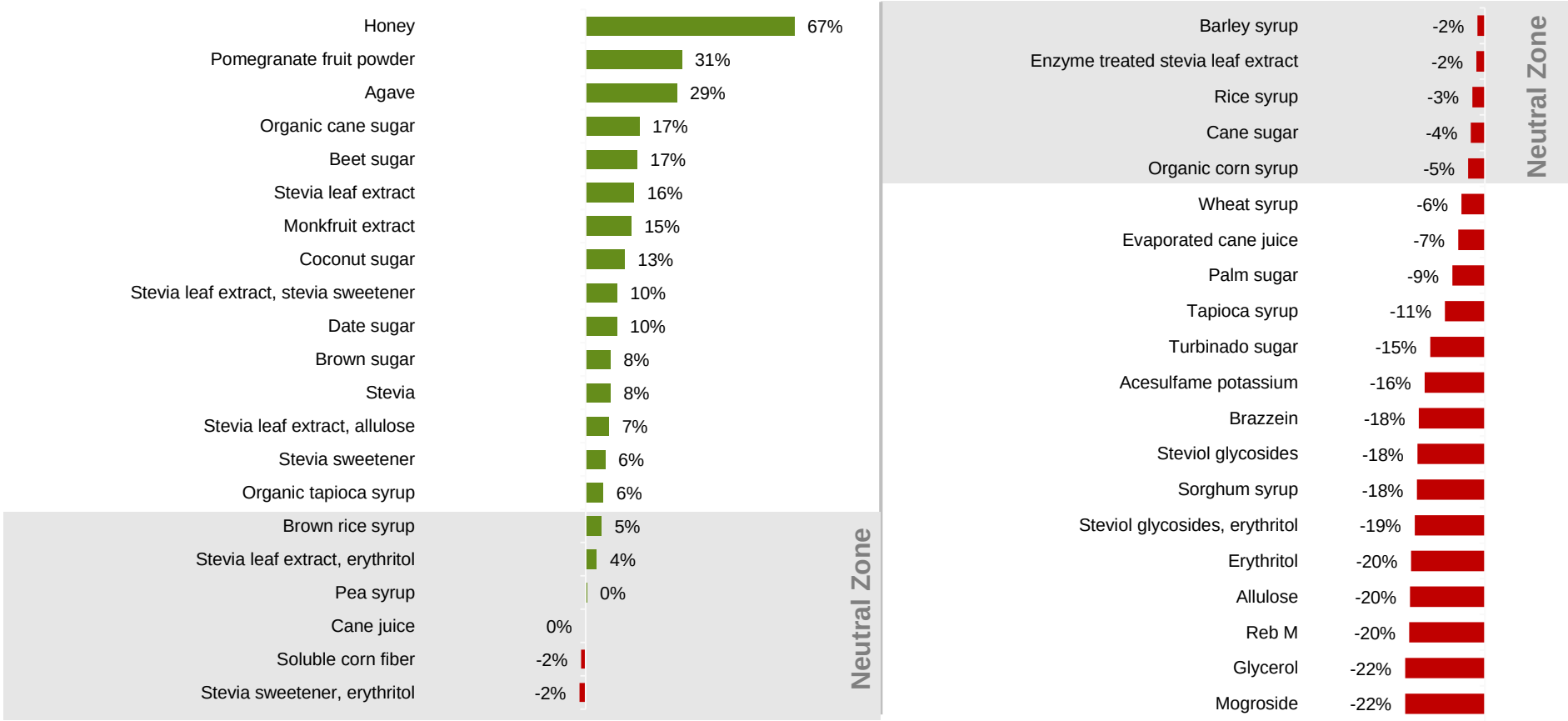
Sweeteners & Bulking Agents

Health perceptions on sweeteners are skewed to the negative

NET Health Perceptions

NET Scores = Good For You (T2B) minus Bad For You (B2B)

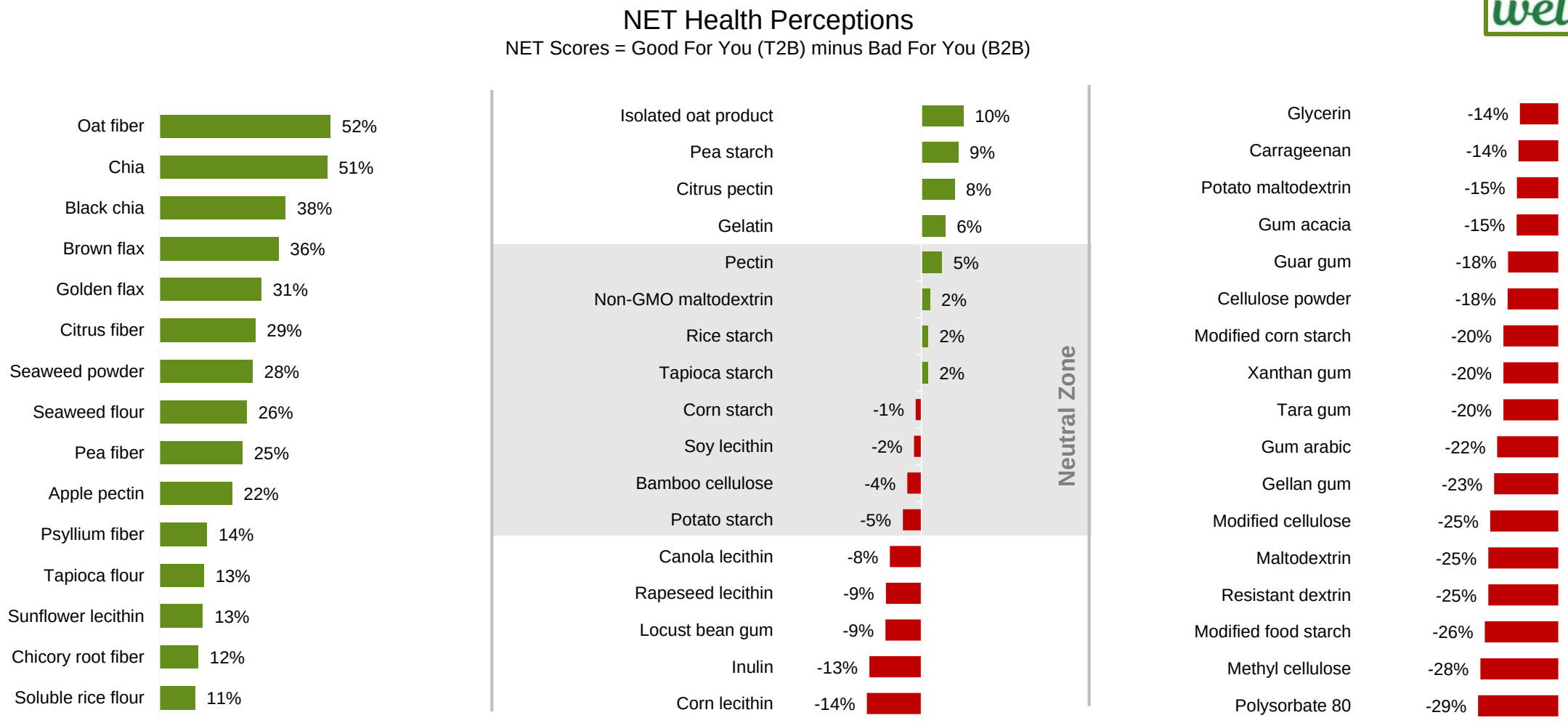


Base: Wave 6, N=1717-1816

Q: Please indicate how good or bad for you each of these ingredients is, in your opinion. Please select the number on the scale that best corresponds to your opinion.

Texturizers, Emulsifiers, and Fibers

Health perceptions are equally balanced to the positive and negative



Base: Wave 6, N=1720-1830
Q: Please indicate how good or bad for you each of these ingredients is, in your opinion. Please select the number on the scale that best corresponds to your opinion.

Plant-based Dairy Formulation Challenges

Christine Addington
Technical Account Manager – Dairy, Plant-based

Cargill

Dairy vs. Plant Based

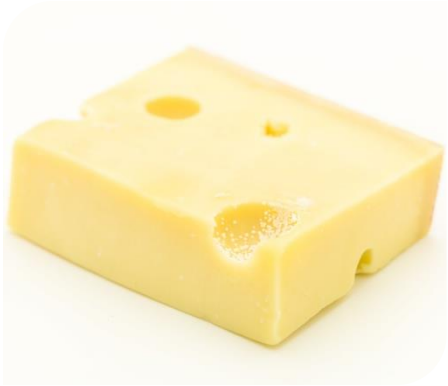
KEY DIFFERENCES

- Products made with a base other than dairy milk such as nuts, coconuts, legumes, or pulse proteins.
- Typically have lower protein than their dairy counterparts, unless fortified
- Can be cultured to create yogurts or cheeses

Plant Based Dairy Alternative Categories

Yogurt

Frozen Desserts and Ice Cream



Cheese

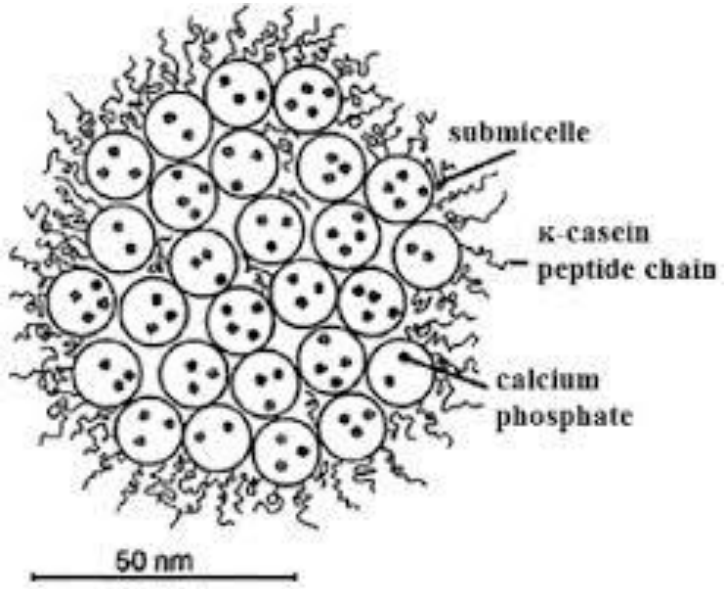
Milk, Beverages, Coffee Creamers

Why are Dairy Proteins so Hard to Replace?

DAIRY PROTEINS ARE HIGHLY FUNCTIONAL!!!

Functionalities:

- Emulsification
- Mouthfeel
- Protein
- Flavor
- Thickening and gelling
- Synergies with other ingredients



Replacing Dairy Proteins is the #1 Hardest Challenge in this Space!

Flavor, Texture, Appearance

ALL 3 SENSORY ATTRIBUTES ARE AFFECTED BY REMOVING DAIRY

- Choose texturizing ingredients that provide functionality of their dairy counterparts
- Formulate with plant proteins that have a clean, less earthy/beany flavor notes for good organoleptic properties
- Ensure good solubility of all ingredients
- Choose a fat source that works best for your application

Typical Dairy Alternative Ingredient Needs

Water/Plant Based Butter

- Serves as the base
- Flavor
- Color

Plant Protein

- Protein fortification
- Structure
- Texture

Fat

- Emulate dairy nutrition and mouthfeel
- Texture
- Flavor

Texturizers

(Starches, Hydrocolloids, Fibers)

- Water binding
- Mouthfeel
- Emulsification
- Viscosity
- Gelling
- Freeze/Thaw Stability

Alternative proteins vary in functionality compared to Dairy Protein

Protein	Functional Attributes					
	Nutritional Value (PDCAAS)	Emulsification	Texture	Binding	Taste	Solubility
Caseinate	+++	+++	+++	+++	++	+++
Whey Protein Isolate	+++	++	+++	+++	+++	+++
Soy Protein[1]	+++	+++	+++	+++	++	+++
Pea Protein	++	++	++	++	++	+++
Canola Isolate	++	+++	+	+	+	++
Wheat Isolate	++	+	-	-	+	++
Corn Isolate	+	-	-	++	++	+
Rice Isolate	++	+	-	+	++	++
Potato Protein	+++	-	+	+	++	+

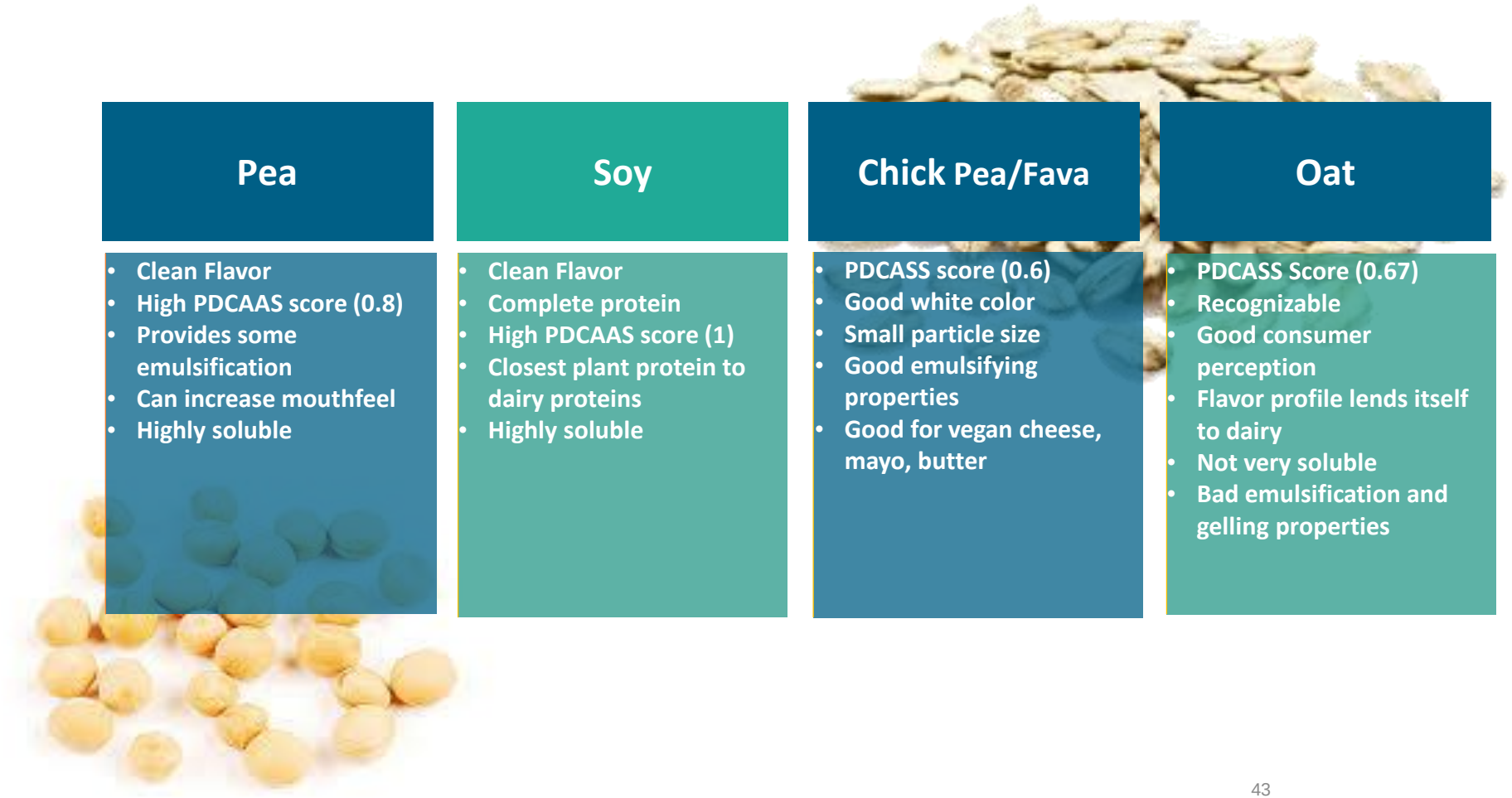
More functionality

Less functionality

Note: (1) Soy Protein has been around for many years and many different variations have been developed to match the dairy protein as close as possible

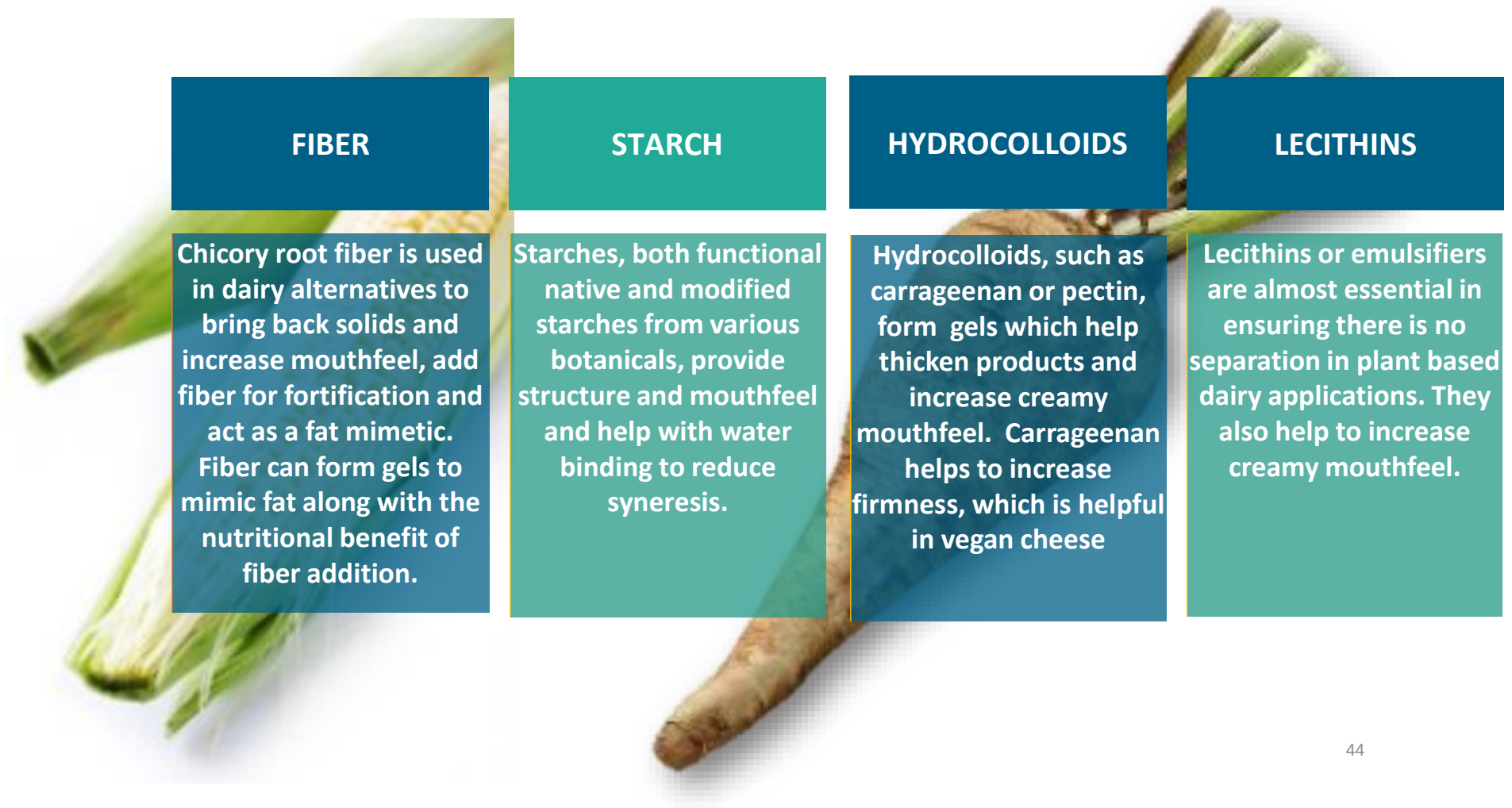
Source: Cargill Scientists and Applications Experts

Plant Proteins for Dairy Alternatives



Pea	Soy	Chick Pea/Fava	Oat
• Clean Flavor • High PDCAAS score (0.8) • Provides some emulsification • Can increase mouthfeel • Highly soluble	• Clean Flavor • Complete protein • High PDCAAS score (1) • Closest plant protein to dairy proteins • Highly soluble	• PDCASS score (0.6) • Good white color • Small particle size • Good emulsifying properties • Good for vegan cheese, mayo, butter	• PDCASS Score (0.67) • Recognizable • Good consumer perception • Flavor profile lends itself to dairy • Not very soluble • Bad emulsification and gelling properties

Texturizing Ingredients for Dairy Alternatives



FIBER	STARCH	HYDROCOLLOIDS	LECITHINS
Chicory root fiber is used in dairy alternatives to bring back solids and increase mouthfeel, add fiber for fortification and act as a fat mimetic. Fiber can form gels to mimic fat along with the nutritional benefit of fiber addition.	Starches, both functional native and modified starches from various botanicals, provide structure and mouthfeel and help with water binding to reduce syneresis.	Hydrocolloids, such as carrageenan or pectin, form gels which help thicken products and increase creamy mouthfeel. Carrageenan helps to increase firmness, which is helpful in vegan cheese	Lecithins or emulsifiers are almost essential in ensuring there is no separation in plant based dairy applications. They also help to increase creamy mouthfeel.

Plant Based Fat and Oil Sources for Dairy Alternatives

SUNFLOWER OIL	CANOLA OIL	COCONUT OIL	Palm Oil & Palm Kernel Oil	Cocoa Butter
• High stability • Mid Oleic • High Oleic •Non-GMO	• Lowest in saturated fat • High in monounsaturated fat	• Great functionality in dairy alternatives • High stability	•Good stability •Versatile in many applications •Great mouthfeel	• Good hardness, quick melting profile, gloss and shelf life • Deodorized and bleached available
				

Cargill

Ingredient Portfolio Overview

Salt

Alberger® Flake Salts

Sea Salts

Pretzel Salts

Seafood Processing Salts

Specialty Food Salts

Granulated Salts

Flour Salt

Sweeteners

Granulated Sugar

Tapioca

Corn Sweeteners

Stevia

Polyols

Sucromalt

Texturizers

Starch Native Cook-Up

Starch Native Instant Functional Label Friendly

Starch Modified Instant

Starch Modified Specialty Maltodextrin,

Corn Syrup Solids

Dextrin

Carrageenan

Pectin

Xanthan Gum

Lecithin Fluid – GM & NGM soy

Lecithin Fluid – Deoiled – GM & NGM soy, canola/grapeseed

Lecithin Fractionated – GM & NGM soy Custom Texturing Systems

Plant Protein

Plant Sterols

Dry Corn Ingredients

Chicory Root Fiber

Vitamin E

Tocophreols

Fats & Oils

Salad and cooking oil

Animal fats

Specialty fats

Shortenings

Flakes

High-stability oils

Frying oils

Specialty fats

Cocoa & Chocolate

Confectionery Coatings – milk, dark & white chocolate & flavored & colored

Chocolate Chips & Chunks – milk, dark and white

Confectionary Chips and Chunks – dark, white and flavored

Cocoa Powder – non-alkalized, lightly alkalized, moderately alkalized, strongly alkalized, heavily alkalized

Chocolate Liquor

Specialty – Decorettes, flakes, caramel, Wilbur® Peanut Butter Melt, Wilbur® Chocolate Duet, Wilbur® Buds

Cocoa Butter

Animal Protein

Cooked Burgers

Sausage patties & loaves

Crumbles

Diced, Sliced & Shredded Meats

Pepperoni

Eggs

French toast

Flours, Grains, Mixes & Blends

Traditional Flours

Sprouted

World Flours

Ultra grain *(white whole wheat flour)*

Organic Flours

Barley

Pulses

Ancient & Heirloom Grains

Mixes & Blends

Gluten-free Blends

Cargill®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