MILLBIO

INNOVATION, NATURALLY

TIA Technical Conference in Los Angeles 24-25 September

NOVEL PLANT-BASED INGREDIENTS for NATURAL & CLEAN LABEL SHELF-LIFE EXTENSION

IT ALL COMES SO NATURALLY

AGENDA

Intro MILLBO/MILLBIO

Baked products Protection

X-TRA GUARD™ Rowan Berry Extract

Millbo Natural Multiple Functions

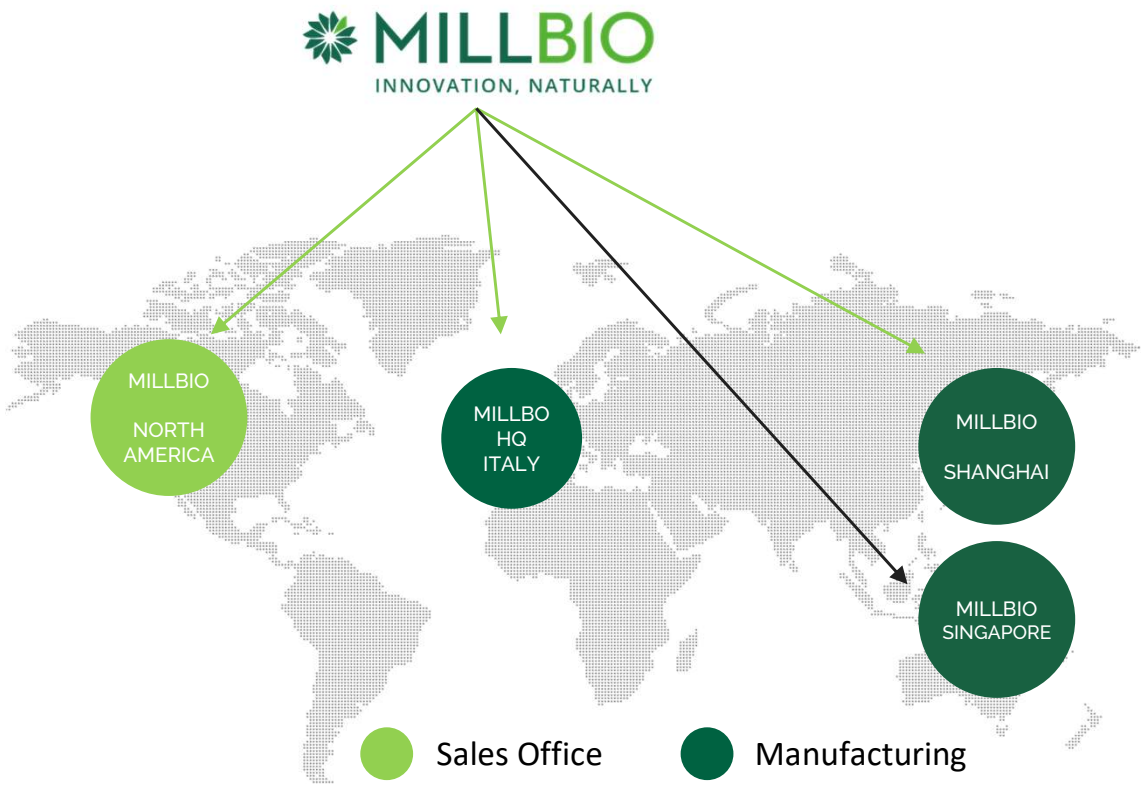
MILLBIO GROUP

MILLBIO, headquartered in Northern Italy (**MILLBO**), was founded in 1992 and focuses on highly innovative, clean-label and all-natural solutions for baking, food & beverage applications.

The acquisitions of **Bionaturals, Shanghai Biotec** and the creation of **Millbio Singapore** allowed expanding its position as a leading global player in food ingredients such as fermented/cultured flours and plant extracts addressing the increasing demand for clean-label shelf-life extension.

The group can now supply world-wide to reach global customers with a team of 8 sales managers and 3 customers services.

A state of the art laboratory service is located in Northern Italy and occupies 8 people in R&D.



THE RIGHT SOLUTION FOR YOUR PRODUCT

COLOR

Malts
Mixes

All the colors of nature to make your products even more appetizing, to eat with your eyes too.

TASTE

Fermented Flours
Sourdough
Malts

Natural solutions conceived to improve the aroma and flavor of bread and oven-baked products.

SHELF LIFE

Fermented Flours
Plant Extracts
Enzymes

A range of solutions created to increase the shelf life and freshness of your products.

STRUCTURE

Improvers
Enzymes

Products for high-quality baking: from softness to crispiness.

NUTRITIONAL

Enzymes
Sourdough

Innovative solutions for increasingly good, nourishing and sustainable products.

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Baked Products Protection

. SPOILING AGENTS
. MULTIPLE HURDLES CONCEPTS
. TRADITIONAL PRESERVATIVES
. ORGANIC ACID FUNCTIONALITY
. ROLE OF PH

SPOILING AGENTS FOR BAKED PRODUCTS

Contamination comes from many sources:

Atmosphere, physical environment, ingredients, poor manufacturing practices, poor personal hygiene etc.

Microbial Spoilage in bread takes different forms:

Mold – *Aspergillus niger, glaucus, flavus; Penicillium sp; Rhizopus nigricans: Mucor sp., Neurospora sitophilia.*
Mold are present in the environment as spores. When spores are on food, they germinate and produce a visible colony

Yeast –There are two types of yeast spoilage: visible growth (chalk mold) with white, cream and pink colonies, and fermentative spoilage, causing off-flavors and off-odors.

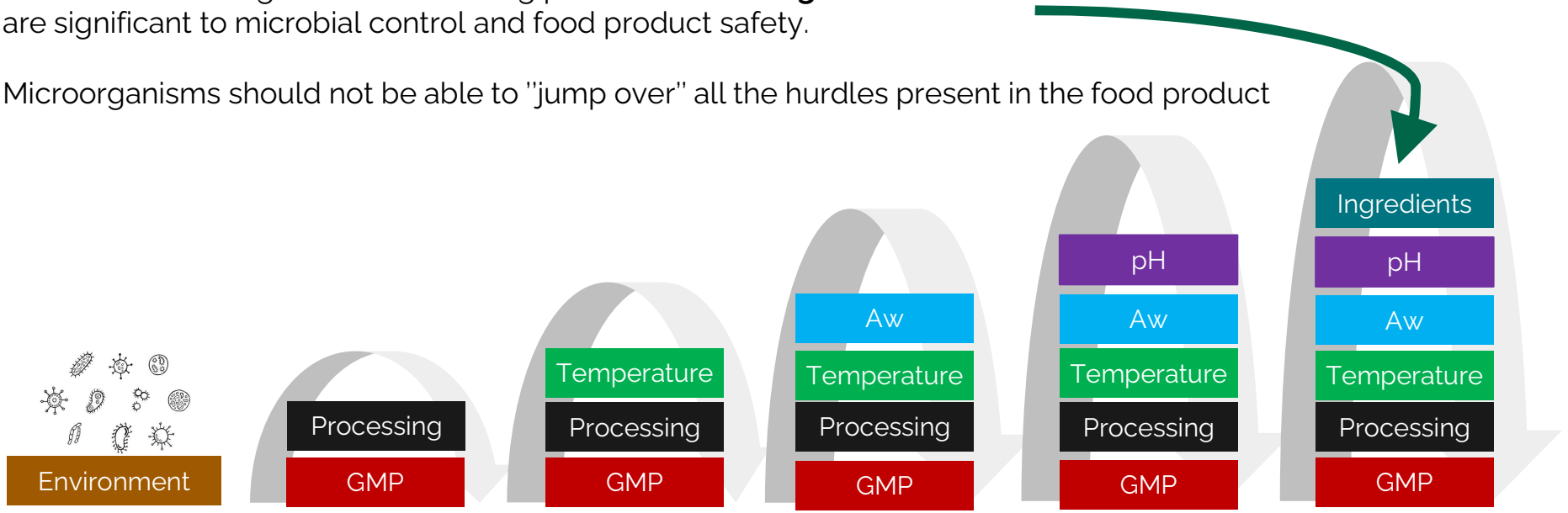
Bacterial – *Bacillus subtilis and Bacillus mesentericus.*
Bacillus produce heat-stable spores. They can germinate after baking causing "rope spoilage": stickiness, slime crumb, discoloration and off-odors similar to sweet fruity odor, often described as resembling overripe pineapples.

MULTIPLE HURDLE CONCEPT FOR FOOD PROTECTION

Hurdle technology is the combined use of several preservation methods to make a product stable, to improve quality and to provide additional safety.

The Hurdle concept illustrates complex interactions of **INTRINSIC FACTORS** temperature, water activity, pH, and **EXTRINSIC ONES**: good manufacturing practices (GMP), **ingredients** (**Internal Hurdles**),... are significant to microbial control and food product safety.

Microorganisms should not be able to "jump over" all the hurdles present in the food product



PRESERVATIVES FOR BAKED PRODUCTS

Synthetic food preservatives are crucial for keeping our food safe. The biggest worry with food spoilage is microbiological contamination. Eating contaminated food products leads to critical illnesses. Additives control microbes responsible for the contamination of baking products. The most commonly used are **weak organic acids:**

Calcium Propionate is very effective against mold. It creates an unpleasant smell and unpalatable flavors if the used amount is excessive.

Potassium Sorbate can be added to baked products, besides pie fillings and icings. This preservative is four times more effective than Calcium Propionate in fighting off bacteria and mold.

Sodium Benzoate slows down the fermentation rate and yeast activity. You can add it in jams and fruits too.

Calcium Acetate is effective against mold, yeast and bacteria. It has a pungent smell and taste

FUNCTIONALITY OF WHEAK ORGANIC ACIDS

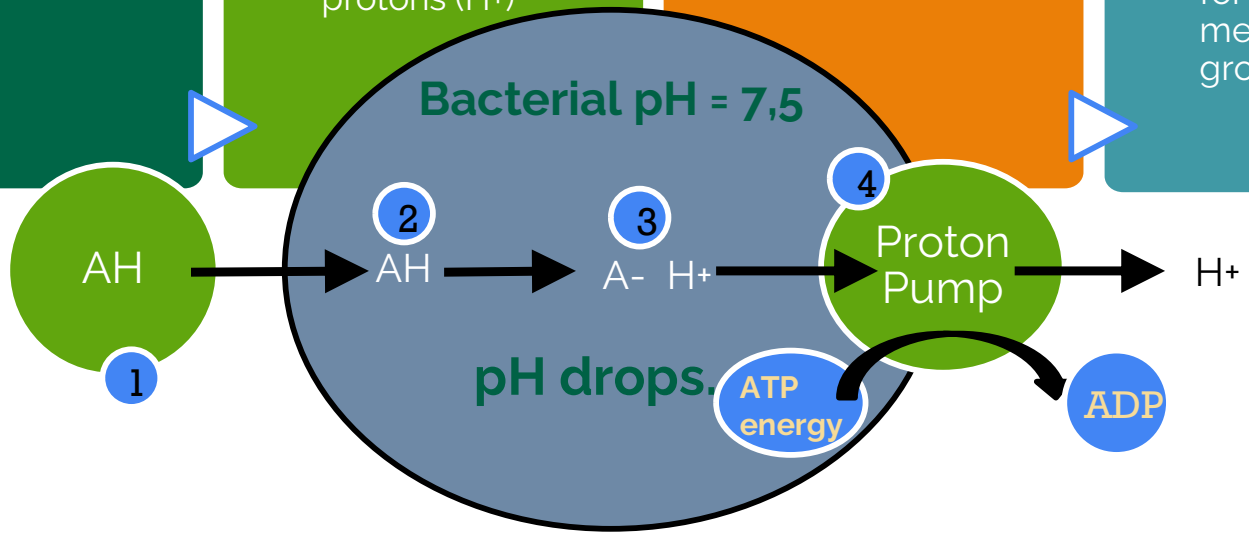
Organic Acid are known for their preserving activity in food, inhibiting bacteria, yeast and moulds
Understanding their functionality is a key point, in allowing their optimal use

Step 1 Only the undissociated organic acid (AH) passively diffuses into bacterial cell walls

Step 2 Once inside the bacteria cell, the organic acid (AH) dissociates, increasing the protons (H+)

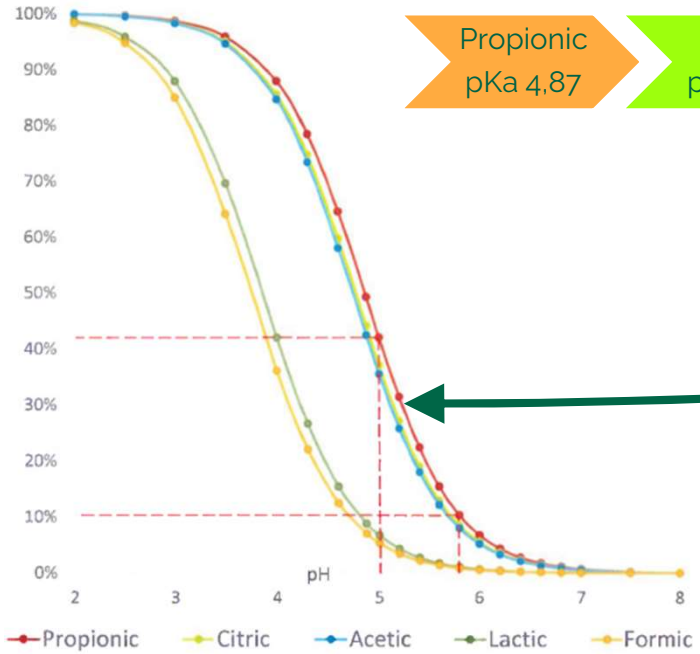
Step 3 Bacterial intracellular pH rapidly drops

Step 4 Cell resists the change by using part of its energy pumping out H+. It causes less energy for growth, which means bacterial growth inhibition



UNDISSOCIATED ACID PERCENTAGE AT VARIOUS PH

The undissociated percentage depends on the environmental pH
Organic acids have different balances between dissociated and undissociated forms, named **pKa**
pKa => pH when the organic acid is 50% undissociated and 50% dissociated

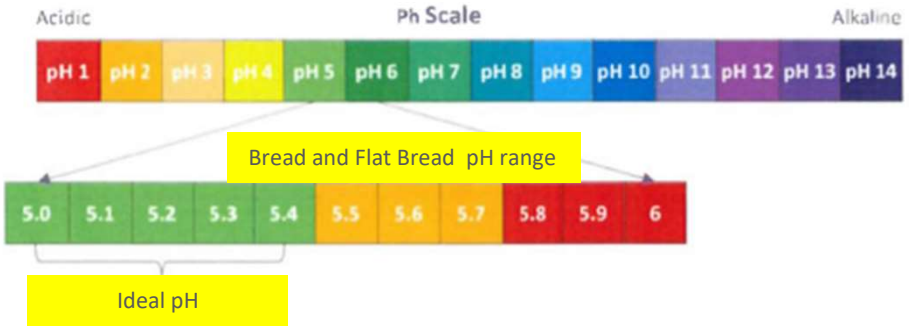


Propionic pKa 4,87 | Acetic pKa 4,76 | Sorbic pKa 4,75 | Lactic pKa 3,83

The higher the pKa, the higher the undissociated % at the same pH

The lower the food pH, the higher the undissociated % of the organic acid

pH ROLE IN BAKED PRODUCTS



To improve organic acid efficacy (propionic, acetic, sorbic ..) the ideal pH is below 5,4.
The lower, the best, and compatible with bread structure

At 5,4-5,7 pH the functionality decreases, requiring a higher dosage of organic acid

At pH above 5,8 the efficacy of organic acids is limited and the multiple hurdle approach becomes fundamental.

Undissociated Organic Acid Comparison	pH	Undiss. %	Increase in Effectiveness with Sourdough
0,1% prop. acid	5,65	0,024	-
0,1% propionic acid + Sourdough	5,30	0,046	+ 90%

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MILLBIO NATURAL SOLUTIONS FOR CLEAN LABEL PRESERVATION

The transition to Natural Sources of Organic Acids

Synthetic and Purified

- Calcium Propionate
- Sorbic Acid
- Acetic Acid
  Lactic Acid
  Citric Acid
  Fumaric Acid

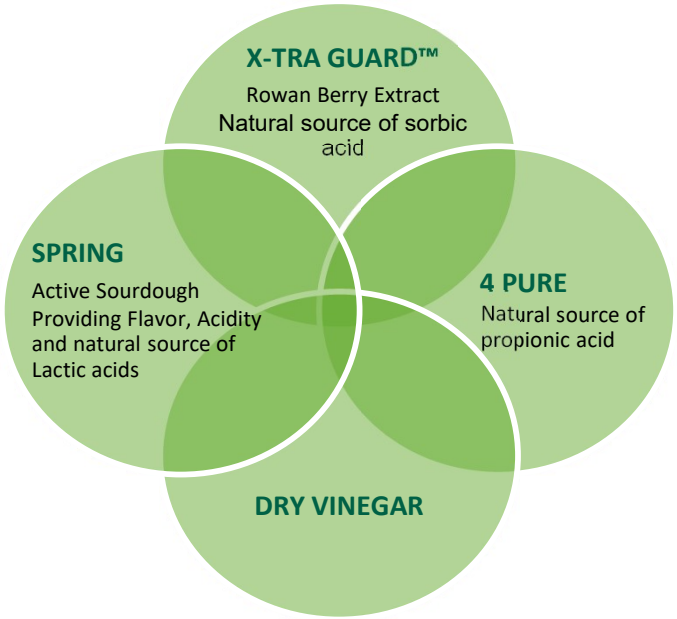
- Expand your product portfolio to **meet the clean-label consumer demands**
- **Create value** with a clean-label product/brand positioning
- Reduced spoilage and waste with **sustainable solutions**

Natural

- **Cultured Wheat or Rice Flour Cultured dextrose**
- **Rowan Berry Extract**
- **Sourdough Dry Viger**

CLEAN LABEL SOLUTIONS MANUFACTURED BY MILLBIO

Fermented Flours **X-TRA LIFE**	• Natural source of Propionic and Acetic acids
Sourdough **SPRING**	• Natural source of Lactic acid
Crystalized Dry Vinegar	• Natural source of Acetic acid
Rowanberry Extract **X-TRA GUARD™**	• Natural source of Sorbic acid



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X-TRA LIFE Fermented Flours

WHAT IS X-TRA LIFE ?

- **X-TRA LIFE** is a product range obtained from **Flours Fermentation**
- Fermentation is a natural process that develops a range of organic acids, mainly **propionic and acetic acids**
- **X-TRA LIFE** range includes **WHEAT and RICE Flours and Dextrose**
- The declarations are **Cultured/Fermented Wheat Flour, Rice Flour or Dextrose**
- **X-TRA LIFE** is a **clean label replacer of calcium propionate**, preventing the molds' growth in baked products
- The range includes Kosher and Halal certified
- Available as Organic and Gluten-free

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X-TRA GUARD
Rowanberry extract

X-TRAGUARD™

MILLBIO NATURAL
SHELF-LIFE SOLUTIONS
FOR FOOD & BEVERAGES

ROWAN BERRY EXTRACT

Sòrbus aucuparia L.
(n.) [cent. XV; lat. Scient. sŏrbus]

"Latin name used in the botanical classification to indicate trees and saplings of the rosaceae pomoidee genus: The Rowan Berry Tree.
The tree has orange or scarlet fruits with a 1cm diameter from which an edible essence, much loved by birds, (Aucuparia) can be extracted".

X-TRA GUARD is a natural ingredient which has been extracted from the Rowan berry with the use of a tapioca flour carrier.
It has been meticulously developed to help long shelf life products and is wholly derived from the Rowan berry's natural botanical compounds, which includes Organic Acids.
It protects against spoilage (yeasts & molds)

HOW IS X-TRA GUARD ™ MADE?

BERRY COLLECTION → HOT WATER EXTRACTION → SPRAY DRYING → BLENDING STANDARDIZATION → PACKAGING → QUALITY CONTROL

X-TRAGUARD™

A product rich in natural organic acids

WHAT IS X-TRA GUARD ™?

- **X-TRA GUARD™** is an aqueous extract from **Rowan Berries**
- Incorporating a **tapioca starch carrier** to standardize the content and to facilitate extraction and handling
- A fully cold-water-soluble version, **X-TRA GUARD™ S**, uses **maltodextrin** as a carrier.
- Possible declarations include botanical / Rowan Berry extract (Sorbus aucuparia L.), plant/fruit extract.*
- Self-affirmed GRAS
- Kosher and Halal certified
- Available as Gluten-free

* Declarations and labeling claims are manufacturer's responsibility

WHY AND HOW TO USE X-TRA GUARD ™ ?

TORTILLA / WRAPS / FLATBREADS

- X-TRA GUARD™ is **rich in natural sorbic acid**
- Sorbic acid was first discovered in the rowan berry in the 1800s
- **Primarily protects against yeast & mold** spoilage in a wide range of applications
- Off-white, easy to handle, free flowing powder
- **Overall impact on taste, aroma, texture and colour is usually minimal / not noticeable**
- Interaction with other ingredients in the recipe usually minimal / not noticeable
- Recommended level of use is very application specific but broadly 1,000 to 8,000 ppm
- Guide: approx. 3 – 4 times the level of potassium sorbate that might be considered effective

CAKES / MUFFINS

JAMS / FILLINGS / CREAMS

SAUCES / DRESSINGS / DIPS

BEVERAGES

CHEESE / PLANT-BASED DAIRY

MARKET EXAMPLES

X-TRAGUARD™

Rowan Extract

Rowanberry extract

Rowanberry (Sorbus aucuparia L.) extract

Tortilla, USA

TORTILLAS

NUTRITION FACTS

6 SERVINGS PER CONTAINER	
SERVING SIZE	1 TORTILLA (44g)
AMOUNT PER SERVING	
CALORIES	80
TOTAL FAT 5g	6%
SATURATED FAT 0.5g	3%
TRANS FAT 0g	
CHOLESTEROL 0mg	0%
SODIUM 290mg	13%
TOTAL CARBOHYDRATE 17g	6%
DIETARY FIBER 16g	57%
TOTAL SUGARS 0g	
INCLUDES 0g ADDED SUGARS	0%
PROTEIN 7g	
VITAMIN D 0mcg	0%
CALCIUM 66mg	6%
IRON 1mg	6%
POTASSIUM 15mg	0%

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

17g TOTAL CARBOHYDRATES
-16g DIETARY FIBER

1g
NET CARBS

INGREDIENTS
Resistant Wheat Starch, Water, Wheat Protein, Olive Oil, Milled Flaxseed, Contains 2% or less of Leavening (Calcium Acid Pyrophosphate, Calcium Sulfate, Potassium Bicarbonate, Calcium Carbonate), Jerusalem Artichoke Fiber, Salt, Fava Bean Protein, Yeast, Guar Gum, Rowan Berry Extract, Tapioca Starch, Cultured Wheat Flour, Wheat Flour, Fumaric Acid, Enzymes

ALLERGENS
Contains Wheat. Produced in a facility that also uses Soy.

Cake M&S, UK

a red coloured chocolate sponge cake with cream cheese frosting, finished with red velvet cake crumb

NUTRITION

Typical values	per 100g
Energy kJ	1796
Energy kcal	429
Fat	23.0g
of which saturates	7.9g
Carbohydrate	50.9g
of which sugars	34.7g
Fibre	<0.5g
Protein	4.7g
Salt	0.58g

Reference intake (adult)
Energy 8400kJ/2000kcal Fat 70g
Saturates 20g Sugars 90g Salt 6g

STORAGE
NOT SUITABLE FOR FREEZING.
For Best Before, see top of pack.
Store in a cool, dry place. Once opened, store in an airtight container.

INGREDIENTS
Sugar · Full Fat Soft Cheese (Milk) (13%) · Wheatflour contains Gluten (with Wheatflour, Calcium Carbonate, Iron, Niacin, Thiamin) · Pasteurised Egg · Rapeseed Oil · Butter (Milk) · Humectant: Glycerol · Glucose Syrup · Invert Sugar Syrup · Dried Skimmed Milk · Fat Reduced Cocoa Powder · Cornflour · Rowan Extract · Raising Agent: E450, Sodium Bicarbonate · Emulsifier: E471, E475, E481 · Salt · Palm Oil · Colour: E120.

For allergens see ingredients in bold. Not suitable for those with a Nut and Peanut allergy.

Made in the UK with cream cheese from Ireland.

Jam Good Good, Iceland (US)

Strawberry Jam 12 oz – Keto Friendly - No Added Sugars

$9.99

Containing only natural occurring sugars from real fruits, our low-calorie jams have the same sweet taste without the added sugar. Combine our strawberry jam with sweet like syrup, peanut butter & oats for a healthy, grab & go breakfast.

- ✓ Made With Natural Sweeteners (Stevia & Erythritol)
- ✓ Keto & Vegan Friendly
- ✓ Suitable For Diabetics
- ✓ Includes Only Natural Occurring Sugars from Real Fruits
- ✓ No Added Sugars
- ✓ Gluten Free
- ✓ Non GMO

Click here to save up to 40% and create your own Jam Bundle

INGREDIENTS

Strawberries (58%), water, sweeteners (erythritol, stevia extract), pectin, rowanberry (Sorbus aucuparia L.) extract, lemon powder, citric acid, concentrate (carrot, blackcurrant), ascorbic acid.

PRESERVATIVES FOR BAKED PRODUCTS – LABEL EXAMPLE

FLATBREAD

Nutrition Facts

Serving Size ⅛ Package (63g)
Servings Per Container 6

Calories 240
Calories from Fat 120

Amount Per Serving	%DV*	Amount Per Serving	%DV*
Total Fat 13g	20%	**Total Carbohydrate** 26g	9%
Saturated Fat 6g	30%	Dietary Fiber <1g	3%
Trans Fat 0g		Sugars 2g	
Cholesterol 0mg	0%	**Protein** 4g	
Sodium 210mg	9%		

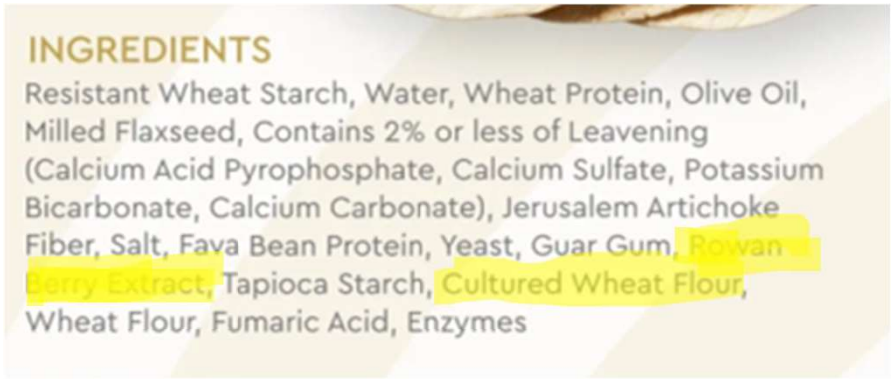
Vitamin A 0% • Vitamin C 0% • Calcium 0% • Iron 0%

* Percent Daily Values (%DV) are based on a 2,000 Calorie diet. Your daily values may be higher or lower depending on your calorie needs:

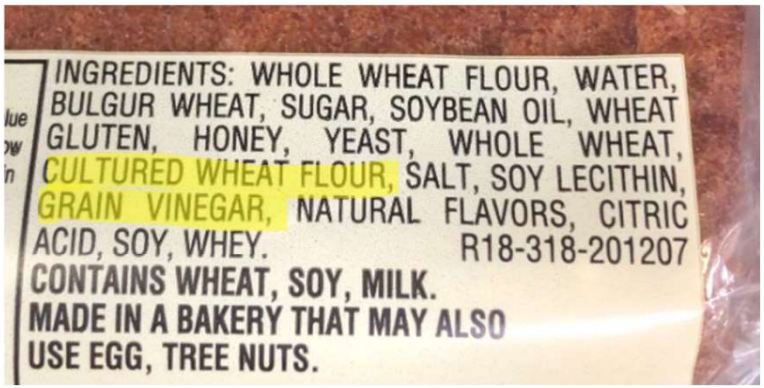
	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 3 • Carbohydrate 4 • Protein 4

Ingredients: Wheat Flour, Water, Palm Oil, Contains 2% or less of: Ethyl Alcohol, Salt, Wheat Starch, Wheat Gluten, Leavening (Sodium Acid Pyrophosphate, Baking Soda), Sorbic Acid (Preservative), Citric Acid, Ascorbic Acid (Dough Conditioner), Yeast.
Contains: Wheat. May contain traces of milk.



MADE FROM: WHOLE WHEAT FLOUR, WATER, CRACKED WHEAT, WHEAT GLUTEN, SUGAR, MOLASSES, YEAST, CONTAINS 2% OR LESS OF: SUGARCANE FIBER, VEGETABLE OILS (SOYBEAN AND/OR CANOLA), WHEAT, SALT, CALCIUM PROPIONATE AND SORBIC ACID TO EXTEND FRESHNESS, MONOGLYCERIDES, DATEM, SOY LECITHIN, WHEY.
CONTAINS: WHEAT, MILK, SOY.



SHELF LIFE TRIAL on TORTILLA

Trial Purpose

- Compare X-Tra Guard vs conventional preservatives
- Evaluate Technical and Organoleptic benefits and/or negatives

Recipe

Wheat Flour AP, enr, malted, unbl.		100,00
Shortening		10,00
Batch Pack		6,55
Water		51,00
Sodium Metabisulfite		0,0033
Ca Prop & Sorbic acid	**REF**	**0,5 & 0,3**
X- Tra Guard	**TRIAL**	**2,4**

Tortilla Preparation

X-TRA GUARD doesn't influence the dough and the production process

Dough Appearance at Mixer	Smooth / Developed
Dough Texture	Soft / Not Sticky
Divider	Clean cut / Dough balls didn't adhere to the unit
Dough Temperature	84-85 F
Dough balls frozen	48 h – then thawed, press and baked
Press Unit	no adhesion to the press
Tortilla pillowing	slight
Tortilla pH	Ref: 5,49 - Trial 5,7
Tortilla moisture	Ref 0,92 - Trial 0,91
Tortilla Appearance	Ref 25-50% Translucent – Trial Slightly Translucent Round Shape
Rollable w/o Breaks	
Foldability w/o cracks or tears	

SHELF-LIFE TRIAL on TORTILLA

Yeast & Molds

	9 weeks
Reference	no visible growth
Trial	no visible growth

Organoleptic

Reference From a sharp aroma with an **acidic and light chemical taste** to a light **pungent aroma with a lingering aftertaste**

Trial **From a bland neutral aroma without aftertaste to a mild spicy aroma without aftertaste**

Texture

Trial is lightly softer than Reference

Rollable w/o Breaks	2 week	Ref & Trial
Foldability w/o cracks or tears	2 week	Ref & Trial
Rollable w Breaks	3 weeks	Ref
Rollable w Breaks	**3 weeks (light)**	Trial
Foldability w cracks or tears	3 weeks	Ref
Foldability w cracks or tears	**3 weeks (light)**	Trial
Rollable w Breaks	9 weeks	Ref & Trial
Foldability w cracks or tears	9 weeks	Ref & Trial

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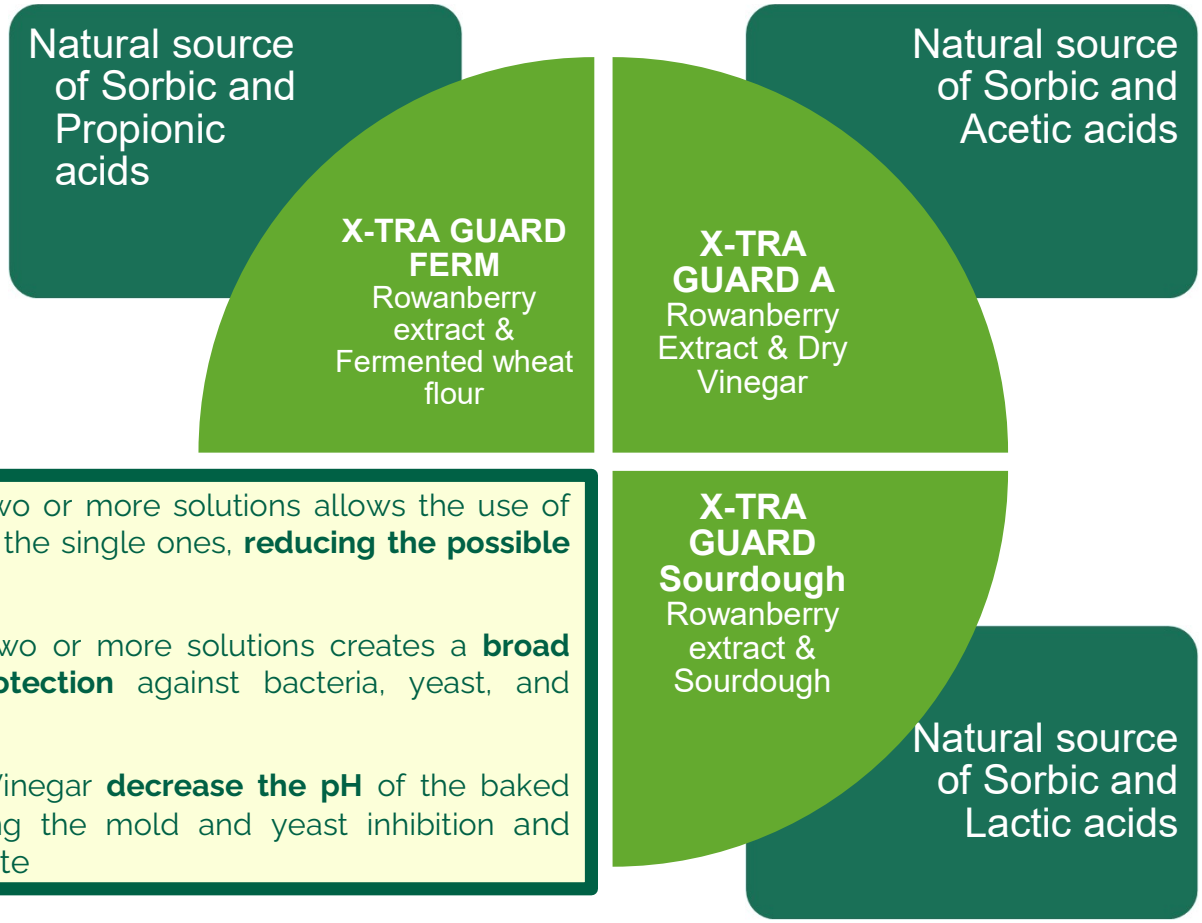
* MILLBIO NATURAL MULTIPLE FUNCTION

THE NATURAL MULTIPLE FUNCTION



The synergy of two or more solutions allows the use of lower dosages of the single ones, **reducing the possible off-taste**

The synergy of two or more solutions creates a **broad spectrum of protection** against bacteria, yeast, and molds

Sourdough and Vinegar **decrease the pH** of the baked product enhancing the mold and yeast inhibition and improving the taste

CONCLUSION

IT ALL COMES SO NATURALLY

- Millbio is at your side to keep your products healthy and good, with innovative and **completely natural solutions**
- **Millbio is your partner for the transition from synthetic to NATURAL**
- Millbio can provide single or multifunctional solutions, designed to your need
- Millbio **owns the entire development and production process** ensuring the highest quality products

Thank you!

MILLBIO
INNOVATION, NATURALLY

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