Enzyme Strategies for Healthier High Protein, High Fiber & Reduced Fat Tortillas

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ENZYME INNOVATION

TORTILLA INDUSTRY ASSOCIATION TIA

Understanding Healthier Tortilla Challenges

1 Challenges of Healthier Tortillas

2 High Protein Changes Dough Functionality

3 High Fiber Affects Dough & Product Quality

4 Fat Reduction Affects Dough & Shelf Life

5 Challenges Combining these Strategies

6 Enzymes Restore Dough Functionality

7 Formulation Strategies & Studies

Presentation Roadmap

Healthy Tortillas

Consumer Demand

- ✓ Higher Protein
- ✓ More Fiber
- ✓ Less Fat
- ✓ Clean Label
- ✓ Better Nutrition

VS

Industry Challenges

- ✓ Dough Machinability
- ✓ Tortilla Flexibility
- ✓ Softness
- ✓ Shelf Life

Slide 3

SH1 Norman - my version
Stephanie Harmatz, 2026-08-10T16:35:08.939

What Makes a Tortilla Healthier?

Higher Protein
- Satiety
- Muscle Support

Reduced Fat
- Lower Calories
- Cleaner Nutrition Profile

Clean Label
- Fewer Additives
- Consumer Preference

Higher Fiber
- Digestive Health
- Lower Glycemic Response

What Makes a Good Tortilla?

A healthier tortilla must still perform like a traditional tortilla

Process

- Processing Performance
- Machinability

Structure

- Flexibility
- Rollability
- No Cracking

Longevity

- Shelf Life
- Freshness
- Softness Retention

How Do Formulation Changes Affect Dough?

Healthy ingredients should not compromise quality attributes

Dough Functionality

- Gluten Development
- Tortilla Quality
- Water Absorption
- Dough Rheology
- Machinability

Why High-Protein Tortillas?

Benefits

- Growing Consumer Demand
- Better Nutrition
- Higher Satiety
- Active Lifestyle
- Increased Protein Content
- Muscle Health
- Nutritional Positioning Support

Common Protein Sources

- Whey
- Pea
- Soy
- Wheat
- Chickpea
- Faba Bean

What Happens When We Increase Protein?

- Added protein competes for water
- Decreased gluten hydration
- Reduced gluten network development
- Lower dough extensibility
- Higher dough strength
- Poor machinability
- Dryer, less flexible tortillas

How Does Protein Fortification Affect Tortilla Processing?

Dough Processing

- Higher Water Requirement
- Longer Mixing Time
- Stiffer Dough
- Reduced Sheetability
- More Shrink-Back

Finished Tortilla Quality

- Lower Puffing
- Reduced Flexibility
- Higher Firmness
- Edge Cracking
- Shorter Shelf Life

Different Protein Sources Present Different Formulation Challenges

Property	Whey	Pea	Soy	Wheat Gluten
Water-Binding Capacity	Medium	High	High	High
Gluten Dilution	High	High	Moderate	None
Dough Extensibility	↓	↓↓	↓	↑
Gluten Contribution	None	None	None	High
Processing Performance	↓	↓↓	↓	↑

Selecting the right protein is essential for balancing nutrition & dough performance.
Improving nutrition should not come at the expense of dough performance.

Why Increase Dietary Fiber in Tortillas?

Benefits

- Improves Digestive Health
- Lowers Blood Cholesterol
- Prevents Constipation
- Weight Management
- Diabetes Management
- Sugar Reduction

Challenges

- Harder, Drier Texture
- Bitterness
- Stiffer Dough
- Increased Water Absorption

Not All Fibers Behave the Same

Soluble Fiber	Insoluble Fiber
Inulin	Wheat Bran
Soluble Corn Fiber	Oat Fiber
β-Glucan	Cellulose

- Dissolves in water
- Strong water binding
- Increases dough viscosity

- Does not dissolve in water
- Interrupts gluten continuity
- Reduces dough extensibility

Soluble and insoluble fiber improve nutritional value but affect dough functionality through different mechanisms.

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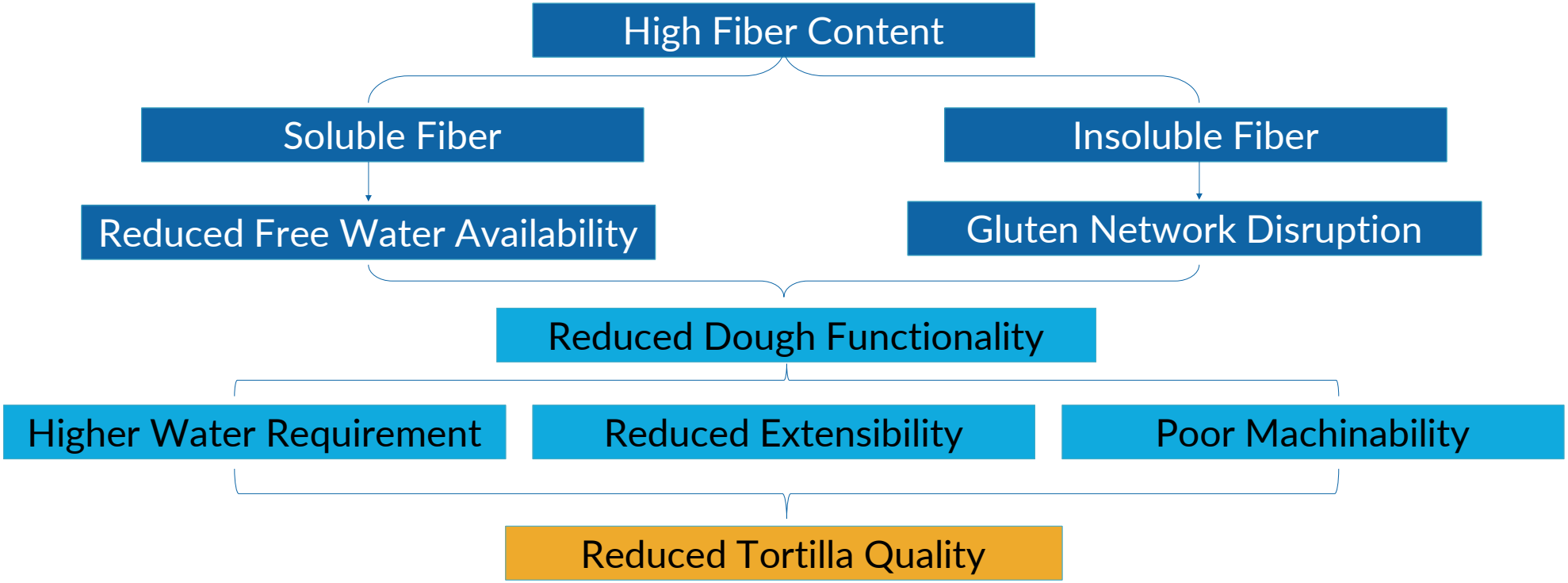
How Does Fiber Affect Dough Functionality?



- Higher Firmness
- Edge Cracking
- Shorter Shelf Life

Slide 13

SH1 my version. i think this makes more sense at the bottom, though overall this slide is kinda confusing. any way to make it clearer?
Stephanie Harmatz, 2026-08-10T17:59:25.405

How Does High Fiber Affect Tortilla Processing?

Dough Processing

- Higher Water Requirement
- Longer Mixing Time
- Stiffer Dough
- Reduced Sheetability
- More Shrink-Back

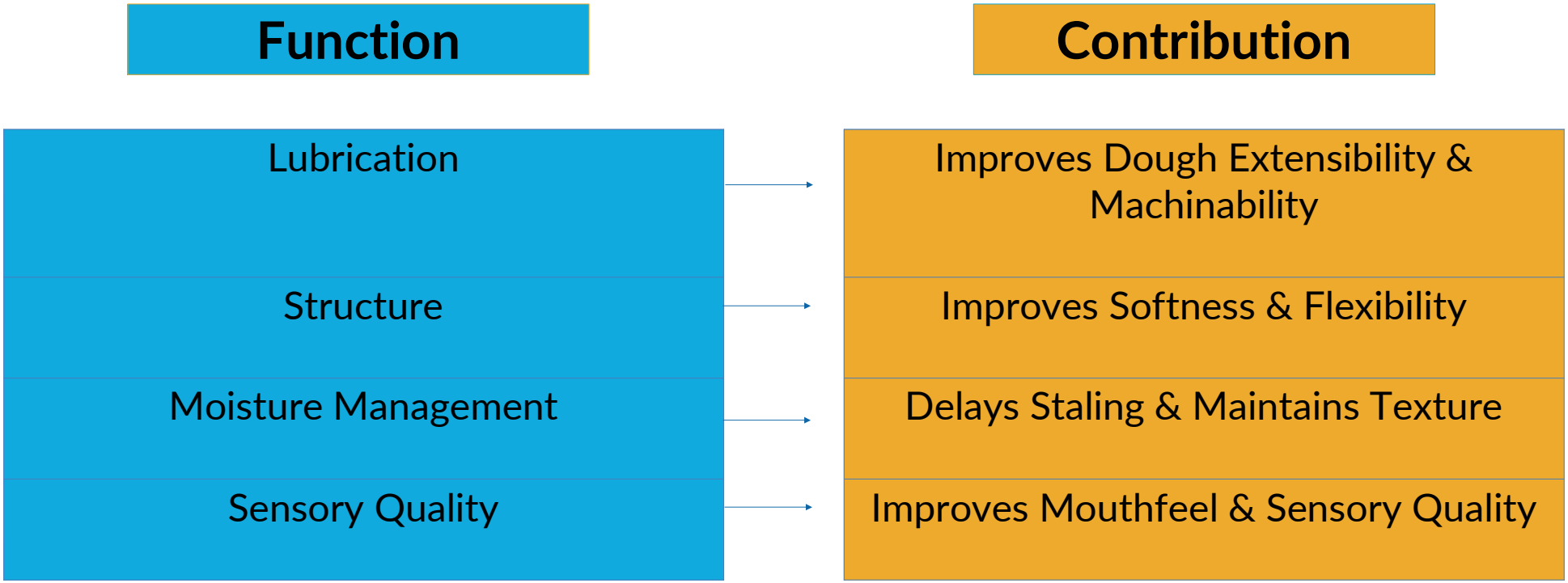
Finished Tortilla Quality

- Higher Firmness
- Reduced Flexibility
- Edge Cracking
- Poor Rollability
- Shorter Shelf Life

Increasing fiber affects both dough processing and finished tortilla quality.

Different fiber types create different challenges, but all require formulation strategies that preserve dough functionality.

Why Is Fat Important in Tortillas?



Demand for Reduced-Fat Tortillas

Consumer Demand

- Customer demand for clean-label products
- Interest in lower-fat bakery products

Food Regulations

- Retailers want healthier nutrition profiles
- Pressure to reduce fat in products

Cost & Supply Challenges

- Fat & shortening prices are unstable
- Need for cost-stable solutions

Technical Challenges

- Shortening supports machinability, softness & shelf life
- Fat reduction must maintain quality & processability

Reducing fat improves nutrition, but removing its functionality presents significant formulation challenges.

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What Happens When Fat Is Reduced in Tortillas?

Processing Challenges

- Dough becomes stickier & harder to process
- Reduced machinability during sheeting & pressing

Texture Changes

- Tortillas become firmer & less extensible
- Higher risk of cracking during rolling & folding

Diminished Quality & Shelf Life

SH2

- Faster Staling
- Reduced Softness & Eating Quality

Fat reduction impacts dough handling, texture & shelf life.

Slide 17

SH1 and now we only have color outlines instead of color boxes...
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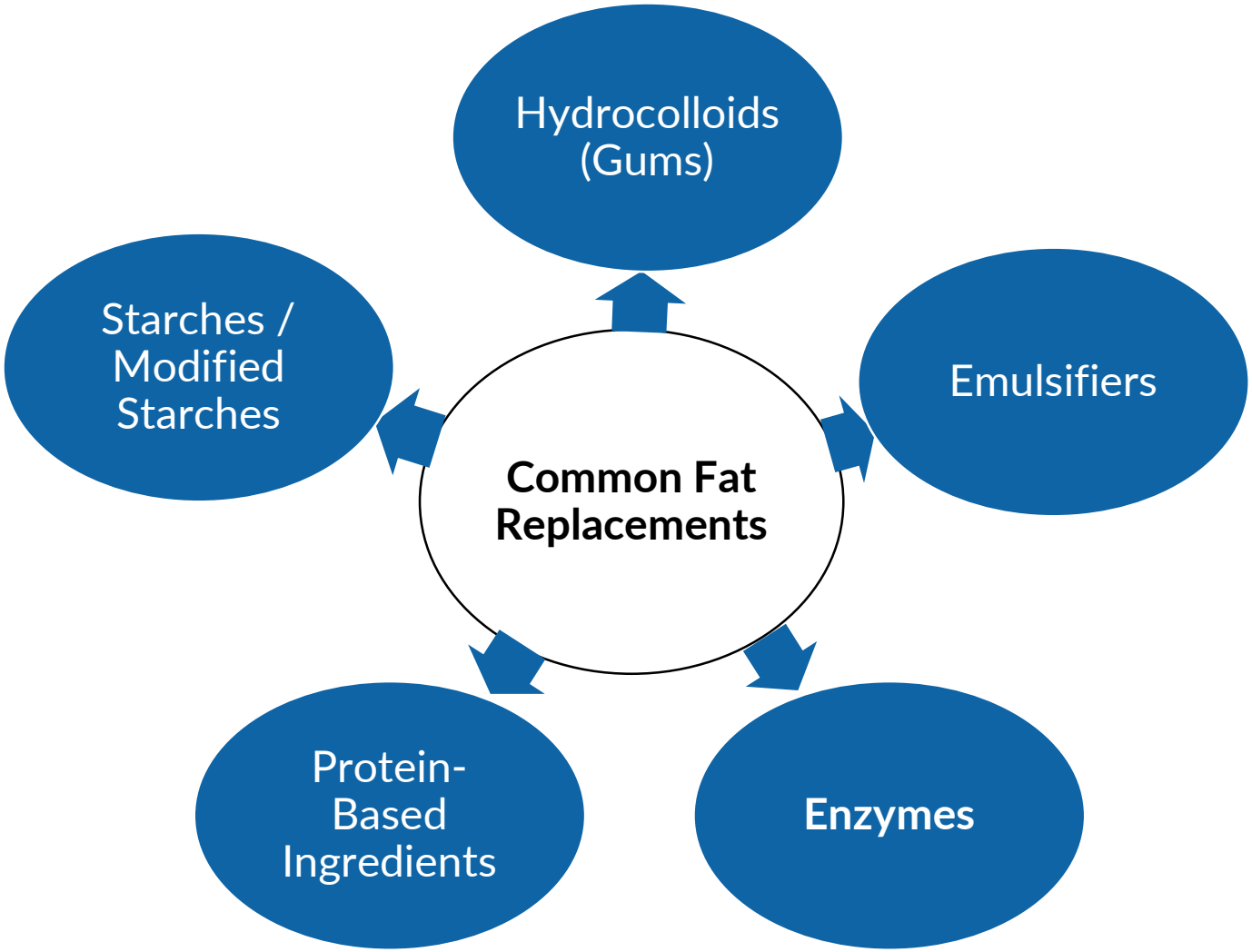
SH2 added Diminished
Stephanie Harmatz, 2026-08-18T16:51:36.426


Hydrocolloids (Gums)
Starches / Modified Starches
Emulsifiers
Common Fat Replacements
Protein-Based Ingredients
Enzymes

Fat Replacement Comparison

Approach	Main Benefit	Key Limitation
Hydrocolloids	Improve water retention	Can create gummy texture
Starches	Improve structure	Reduce flexibility
Emulsifiers	Improve dough handling & machinability	Limited long-term softness
Proteins	Improve nutrition & structure	Impact flavor
Enzymes	Support dough handling, softness & shelf life	Require dose optimization

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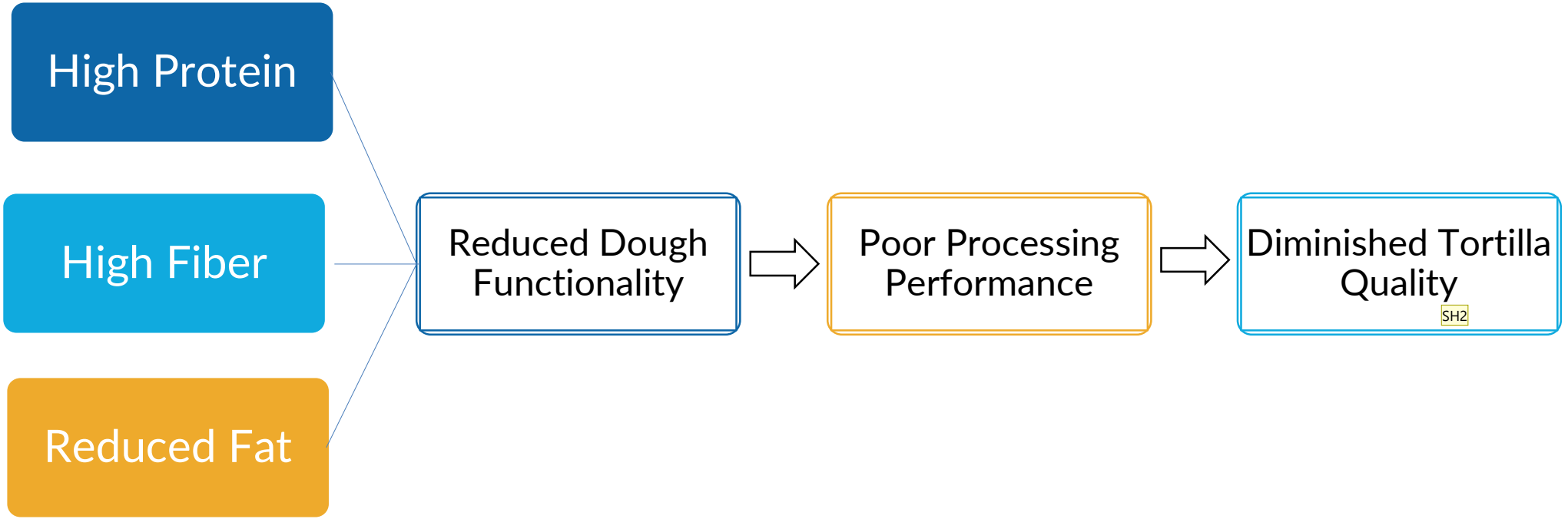
Three Different Challenges... One Common Problem



SH2

Although these formulation strategies serve different nutritional goals, they all share one common challenge: preserving dough functionality.

Slide 20

SH1 all white font in the color boxes...
Stephanie Harmatz, 2026-08-10T18:26:08.915

SH2 changed reduced to diminished
Stephanie Harmatz, 2026-08-18T16:51:25.600

How Can Enzymes Restore Dough Functionality?

Enzymes do not replace protein, fiber or fat. They help restore dough functionality.

Enzymes target starch–protein–lipid interactions & improve internal structure

Dough & Processing
- Improve dough handling & machinability
- Support gluten extensibility

Texture & Structure
- Help maintain softness & flexibility
- Improve rollability & foldability

Moisture & Shelf Life
- Improve water distribution & retention
- Help delay firming during storage

Traditional approaches = single function

Enzymes = multi-functional support

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Choosing the Right Enzyme Strategy

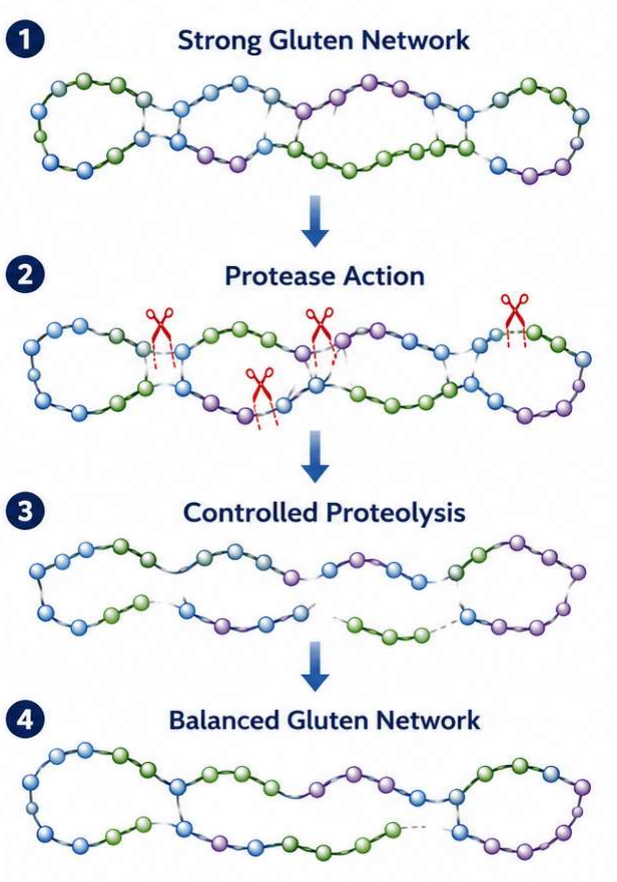
Challenge	Target	Enzyme	Outcome
High Protein	Break down gluten protein	Proteases	Improve dough handling & extensibility
High Fiber	Break down hemicellulose	Xylanase	Improve dough handling & machinability
Reduced Fat	Break down fats (lipids)	Phospholipase	Improve stability & flexibility SH2
Shelf Life	Break down starch into simple sugar	Amylase	Soft tortillas & longer freshness

Slide 22

SH1 my version - the table is really tight with 36 pt font...
Stephanie Harmatz, 2026-08-10T18:36:05.399

SH2 removed 2nd improved
Stephanie Harmatz, 2026-08-18T16:52:33.115

Proteases: Restore Dough Extensibility



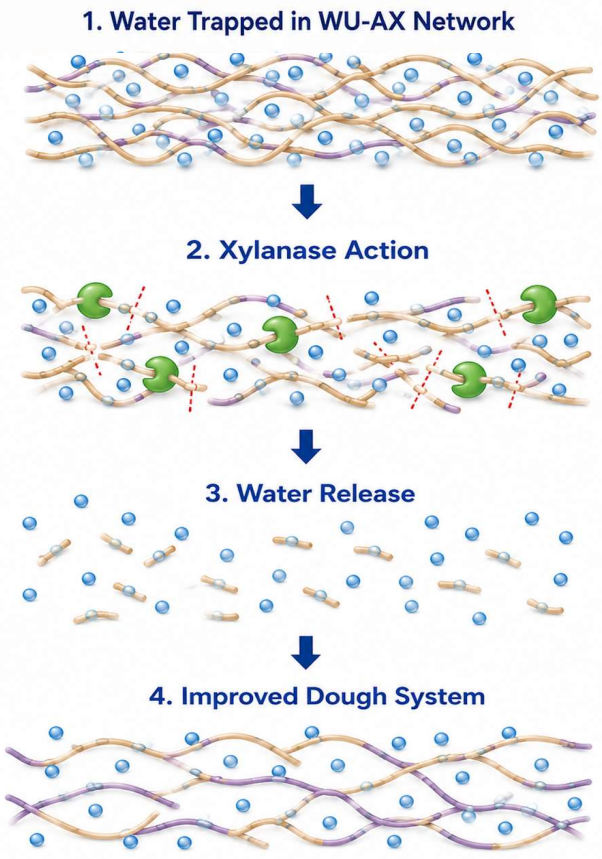
- Strong gluten network
- Low extensibility
- Difficult sheeting

- Control hydrolysis of gluten proteins
- Selective cleavage of peptide bonds

- Reduce excessive strength
- Maintain gluten network integrity

- Balanced dough strength
- Improved dough extensibility
- Easier sheeting
- Improved dough handling

Xylanase: Improve Dough Handling



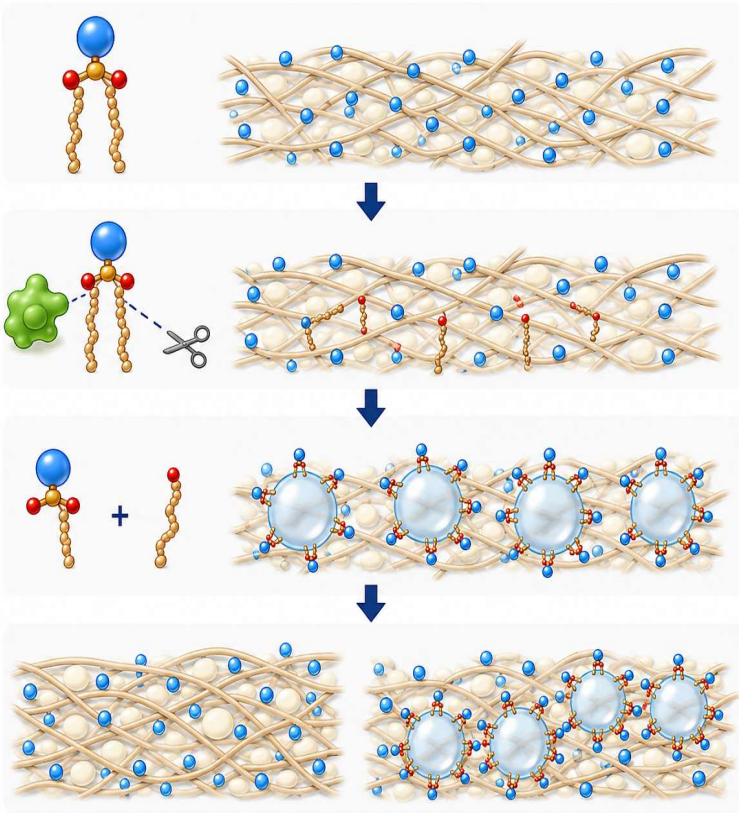
- Less water for gluten
- Stiffer dough

- Hydrolyzes water-unextractable arabinoxylans (WU-AX)
- Shortens arabinoxylan chains

- Bound water released
- Improved water distribution

- Improved dough handling
- Improved gluten hydration
- Higher dough extensibility

Phospholipase: Replace Emulsifiers, Improve Dough Stability & Flexibility



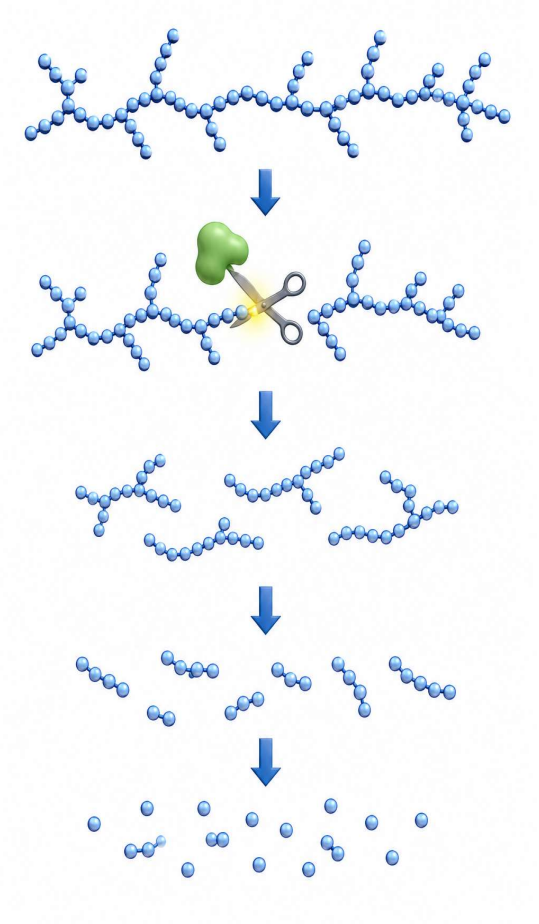
- Native phospholipids
- Limited emulsifying activity

- Hydrolyzes phospholipid
- More surface-active molecules

- Natural emulsifiers formed
- Gluten network stabilizes

- Improved dough stability
- Better gas retention
- Improved dough handling & machinability
- Increased flexibility

Amylase: Prolong Softness & Extend Shelf Life



- Native starch (amylose/amylopectin)
- Hydrolyzes starch chains
- Formation of shorter starch fragments (dextrins)
- Delayed retrogradation
- Reduced starch reassociation during storage

- Softer tortillas
- Longer freshness & softness
- Extended shelf life

High Protein Tortilla Study

SEBake PP™ – Smoother Dough

- Improves dough extensibility
- Can reduce mix times
- Increases gas cell diameter
- Improves dough handling

- Breaks down gluten in a lower molecular weight polypeptides & amino acids

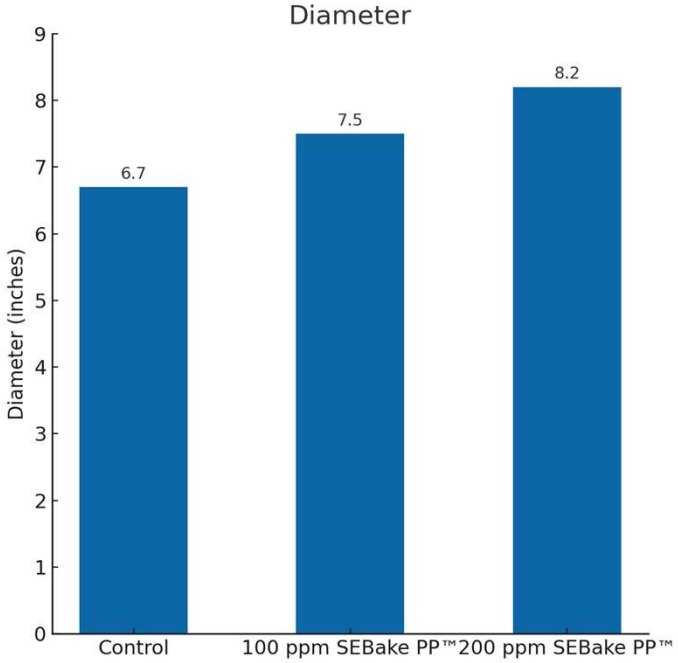
Dough w/17% added protein

Dough w/17% added protein + SEBake PP™

SEBake PP™ - Increased Diameter

Whole Wheat Tortillas

Control | 100 ppm SEBake PP™ | 200 ppm SEBake PP™



High Fiber Tortillas

SEBake PF ™

- Phospholipase-based enzyme
- Replaces emulsifiers
- Improves crumb whiteness
- Enhances dough functionality
- Supports overall product quality

SEBake PF™ + HealthSense Flour Tortillas

Control	50% HealthSense Flour*	50% HealthSense Flour* + 100ppm SEBake Fresh Ultra™	50% HealthSense Flour* + 100ppm SEBake Fresh Ultra™ + 20ppm SEBake PF™

*HealthSense Flour contains 32% fiber

Foldability

Foldability – Day 24

Control

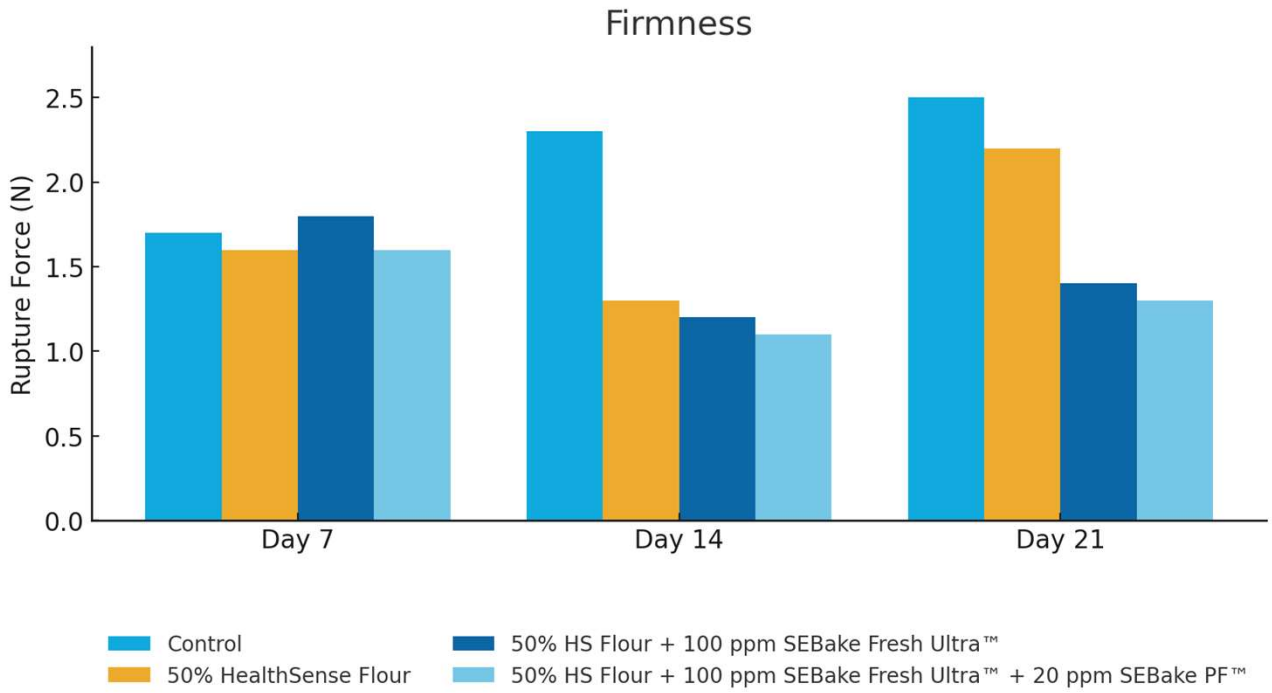
50% HealthSense Flour*

50% HealthSense Flour* +
100 ppm SEBake Fresh Ultra ™

50% HealthSense Flour* +
100 ppm SEBake Fresh Ultra ™ + 20ppm SEBake PF ™

*HealthSense Flour contains 32% fiber

Improved Softness Retention



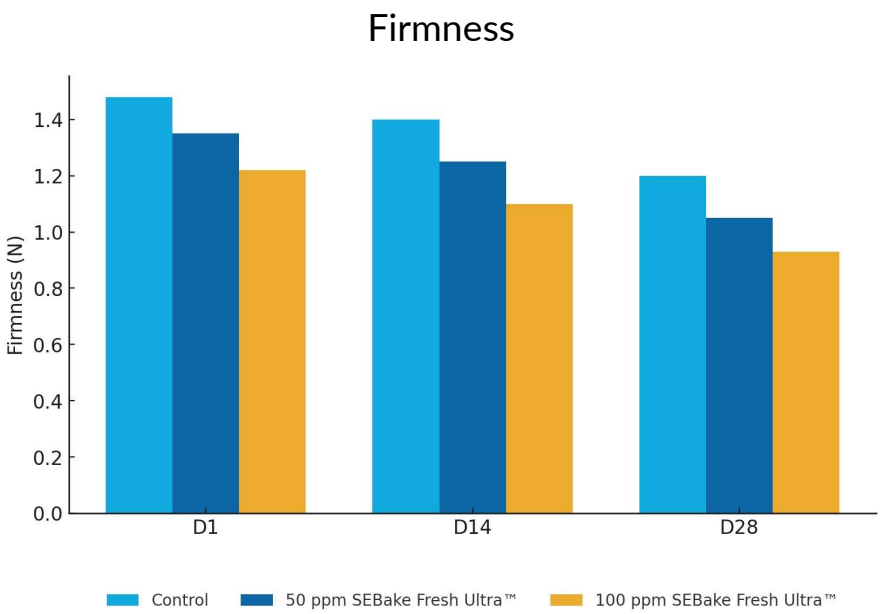
- HealthSense Flour* firms faster
- Added enzymes (SEBake Fresh Ultra™ + SEBake PF ™) keep products soft & delay staling
- Best softness = HS + SEBake Fresh Ultra™ (+ SEBake PF ™)

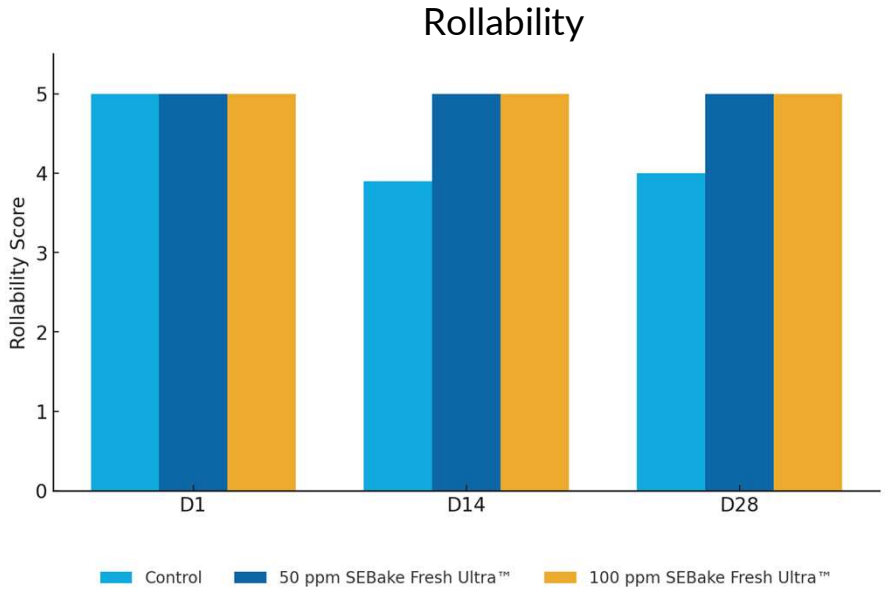
SEBake Fresh Ultra™ in High Fiber Tortillas

Ingredients	Product	Benefits
Whole Wheat Flour Flaxseed Cellulose	SEBake Fresh Ultra™	Prolongs Softness Extends Shelf Life

Control 50ppm SEBake Fresh Ultra™ 100ppm SEBake Fresh Ultra™

SEBake Fresh Ultra™ - Improved Firmness & Rollability



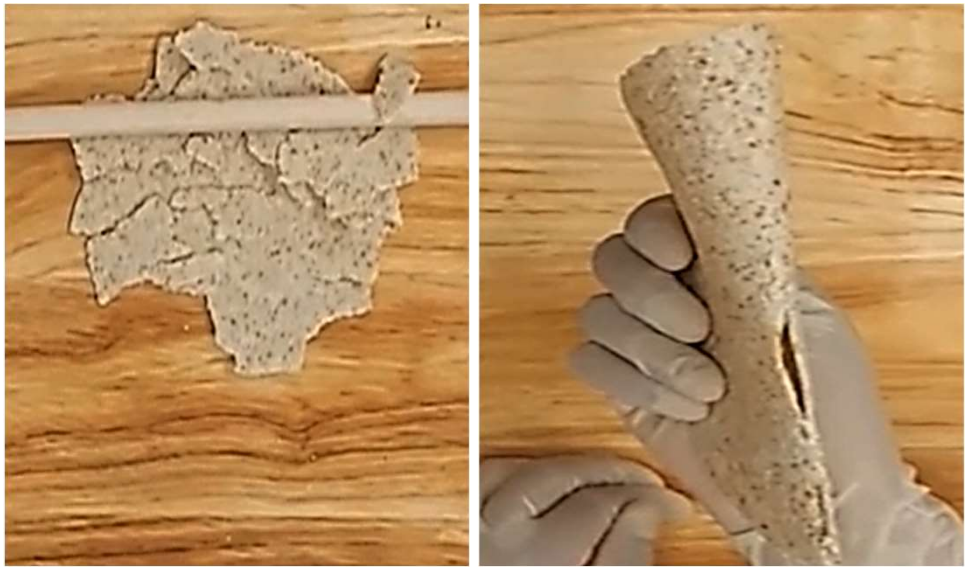


- Tortillas remain softer longer
- Delays staling by enhancing softness & moisture retention
- 100ppm extends freshness & flexibility

- Tortillas remain flexible for 28 days
- Prevents staling & preserves rollability
- 50–100ppm maintains Day 1 flexibility throughout storage

SEBake Fresh Ultra™ - Improved Rollability

SEBake Fresh Ultra™



Control

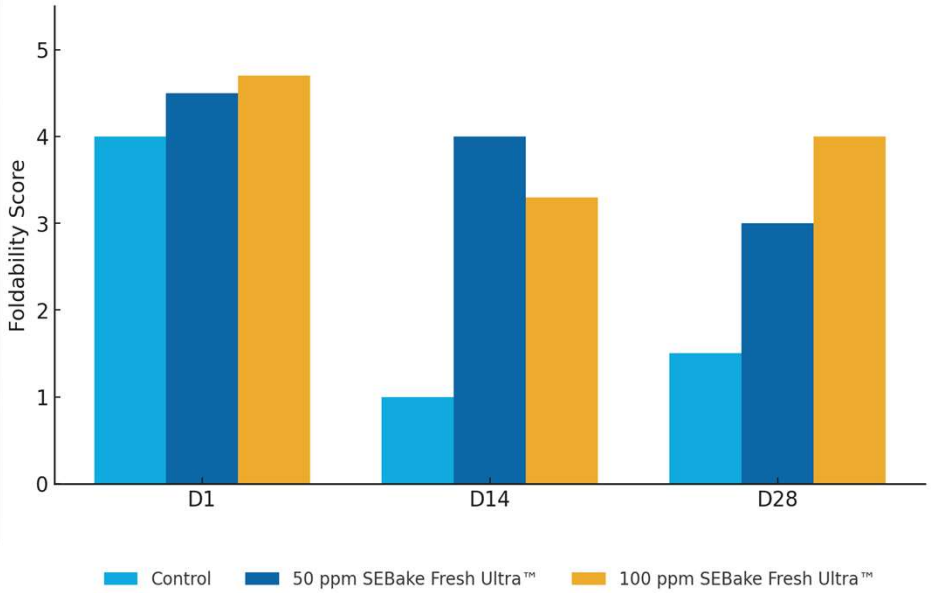
High-fiber tortillas on day 35 (8.6g fiber per 45g tortilla)

SEBake Fresh Ultra™ - Improved Foldability

Day 0

Day 14

Day 28



- After 28 days, tortillas are foldable & flexible with 100ppm SEBake Fresh Ultra™
- No cracks or brittleness

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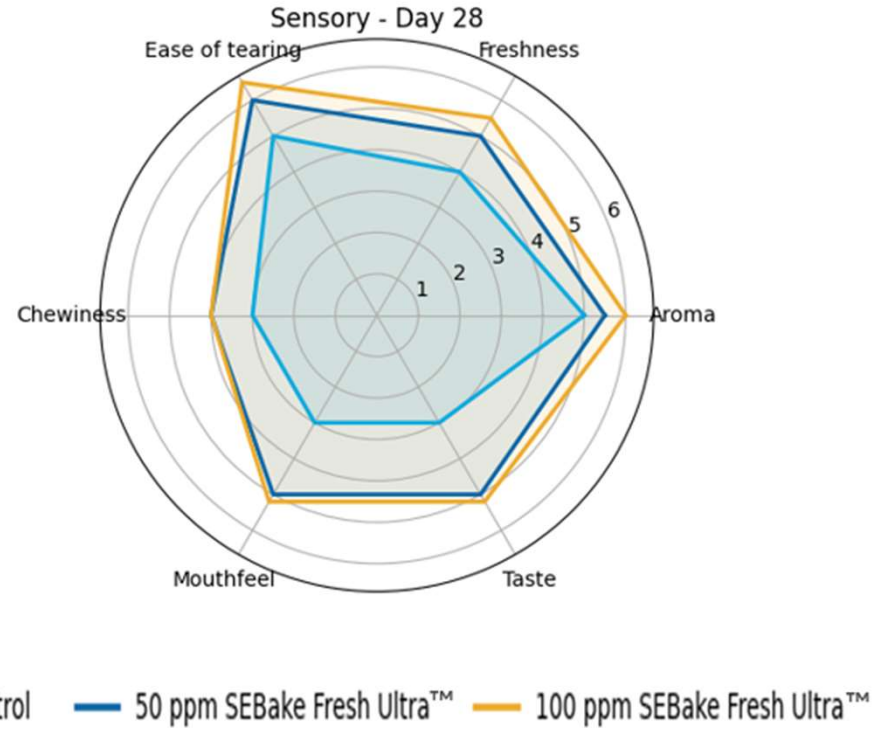
SEBake Fresh Ultra™ - Sensory Evaluation

- Enzymes enhance tortilla freshness, taste & mouthfeel over 28 days
- Best sensory experience with 100ppm

Improved sensory quality after 28 days of storage



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Stephanie Harmatz, 2026-08-10T19:48:39.835

Fat Reduction in Tortillas

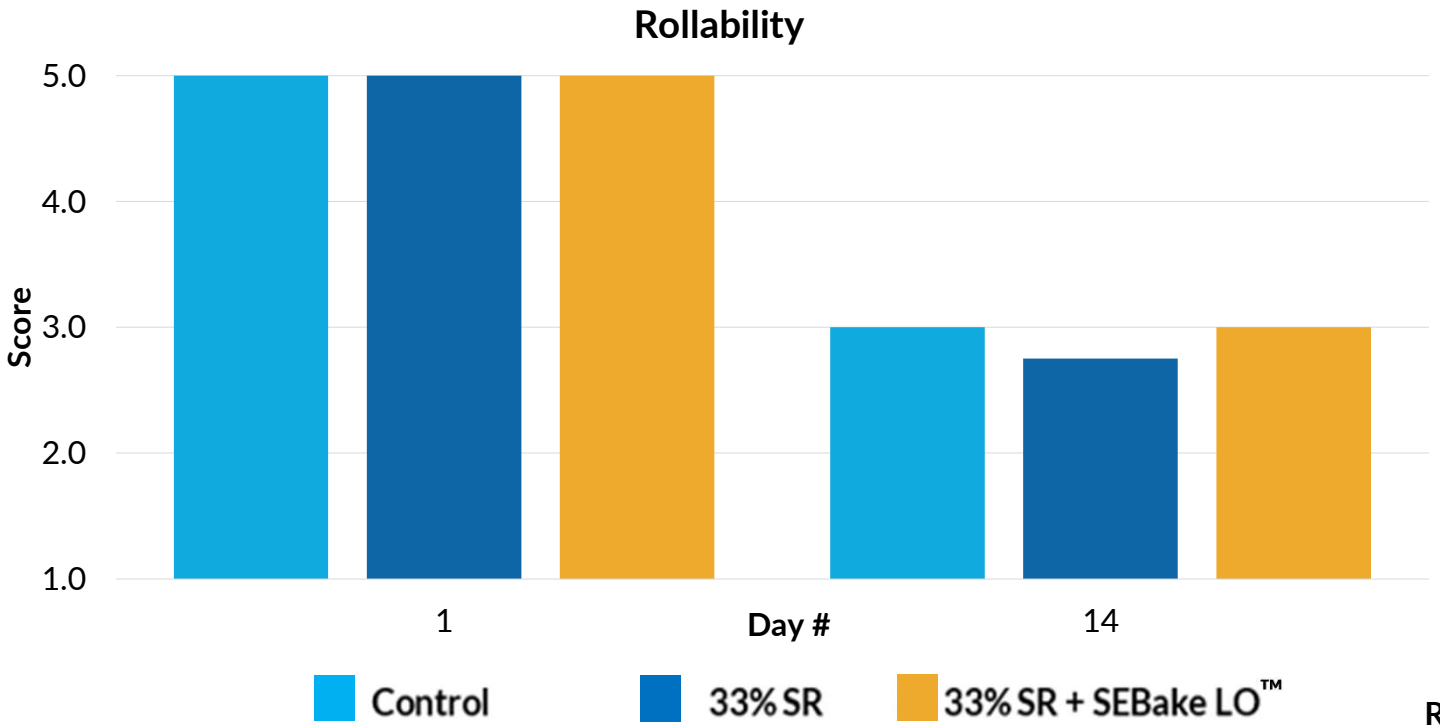
SEBake LO™

Control	33% Shortening Reduction	33% SR + SEBake LO™

Control	33% Shortening Reduction	33% SR + SEBake LO™

- Improved dough smoothness & extensibility
- Maintained tortilla diameter in reduced-fat formulations

SEBake LO™ - Improved Rollability



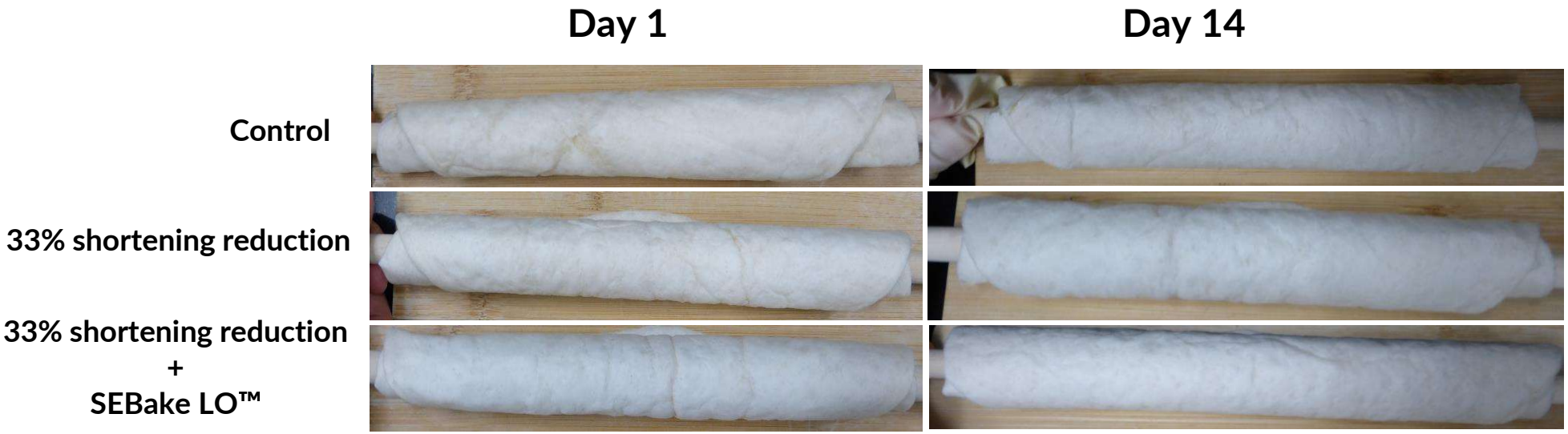
Rollability Score (1–5)
5 = no cracks, easy roll
3 = some cracks
1 = breaks, not rollable

Slide 42

SH1 are the squares in the legend different sizes?
Stephanie Harmatz, 2026-08-10T19:52:45.830

NT1 0 yeah lol
Norman Teguh, 2026-08-19T15:36:30.890

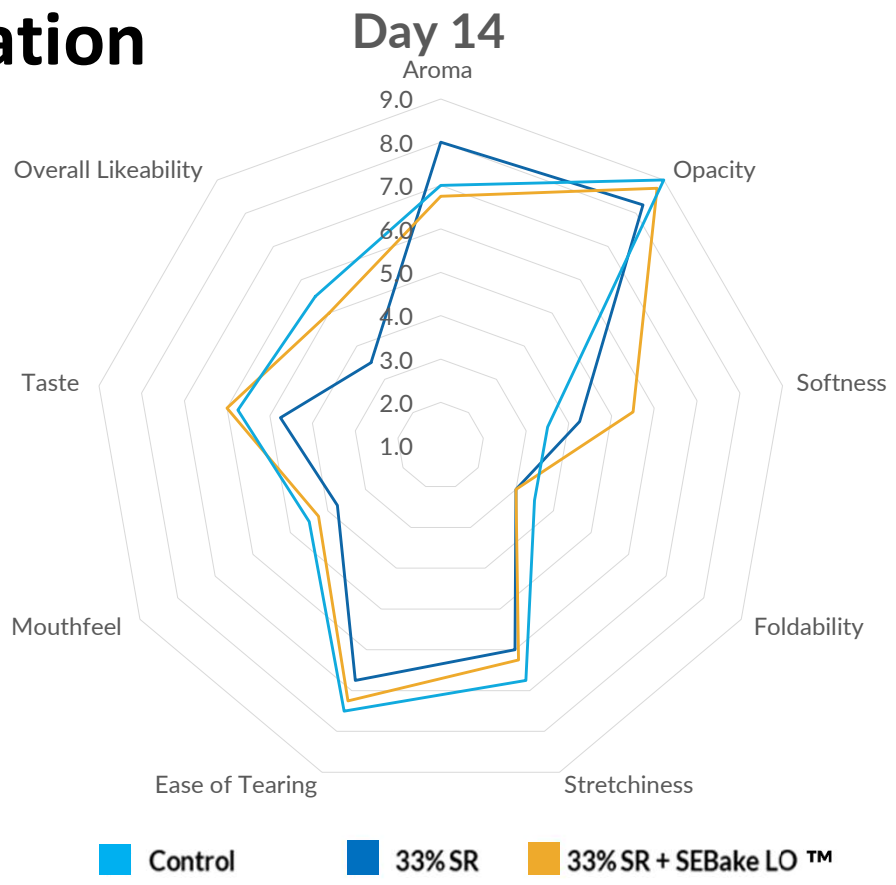
SEBake LO™ - Rollability



SEBake LO™ improved softness, enabling a 33% reduction in shortening while maintaining control-like diameter, firmness, rollability & foldability.

SEBake LO™ - Sensory Evaluation

- Improved sensory stability under reduced-fat conditions
- Helped maintain texture & overall likeability during storage



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Common Enzyme Mistakes in Healthy Tortilla Development

Wrong Enzyme Selection

- Using the wrong enzyme for the formulation
- Poor dough performance

Incorrect Enzyme Dosage

- Too little or too much enzyme
- Weak, sticky or over-relaxed dough

Ignoring Flour Variability

- Using the same dosage for every flour
- Inconsistent dough quality

Poor Process Control

- Inconsistent mixing, dough temperature or proofing
- Variable enzyme performance

Poor Water Management

- Not adjusting water for protein or fiber
- Dry, stiff or sticky dough

Evaluating Only the Dough

- Ignoring tortilla quality after baking
- Loss of flexibility & shelf-life

Slide 45

SH1 my version
Stephanie Harmatz, 2026-08-10T20:31:38.577

The right enzyme system:

- Maintains current production line
- No new equipment needed
- No major process changes needed

Reduces shortening 20–50%

Maintains softness & flexibility in high fiber & high protein tortillas

Improves rollability & rupture resistance

Supports shelf life

Preserves machinability

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Enzyme Strategies for Healthier Tortillas

High Protein

Manage Gluten Strength
& Water Competition

High Fiber

Improve Water Distribution
& Dough Handling

Reduced Fat

Restore Lubrication
Flexibility & Stability

Slide 47

SH1 my version -consistent font colors?
Stephanie Harmatz, 2026-08-10T20:42:13.378

Enzyme Strategies for Healthier Tortillas

Healthy Tortillas	Enzyme Innovation Solution	Benefits
High Protein	SEBake PP™ / SEBake NP™	Increases extensibility & relaxes dough
High Fiber	SEBake CLX™ / SEBake FX Ultra™ / SEBake PF™	Improves dough handling & fiber functionality
Reduced Fat	SEBake LO™	Supports up to 33% shortening reduction
Softness & Shelf Life	SEBake Fresh Ultra™	Prolongs softness & freshness, improves rollability

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