Fibersym Fiber Retention

CONFIDENTIAL

RESISTANT STARCH

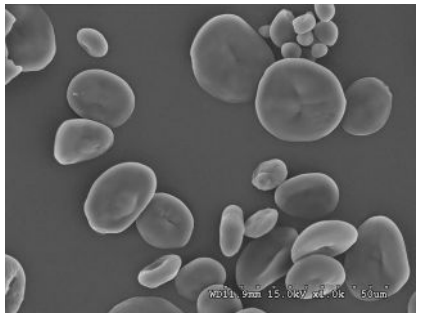
- The term refers to the starch that resist digestion as they pass through the gastrointestinal tract.
- Five types of RS exists, but only RS2 and RS4 are approved by the FDA as a source of dietary fiber
- Five types of RS exist

	Types of RS	Occurrence	
RS1	Physically inaccessible starch	Partially milled, grains, seeds	
RS2	Granular starch	Native, uncooked green banana starch, potato starch, amylose starch	high
RS3	Retrograded amylose	Cooked and cooled starch	
RS4	Chemically modified starch	Cross-linked starch	
RS5	Starch-lipid complex (not commercially available)		

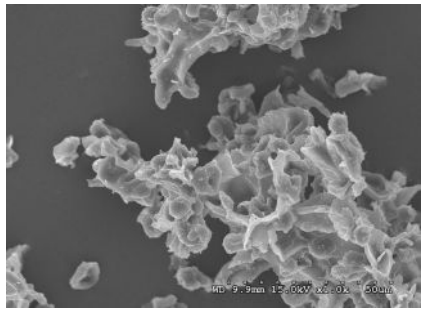
- *RS2 lose significant fiber after baking, while RS4 is the most heat tolerant.

RESISTANT STARCH

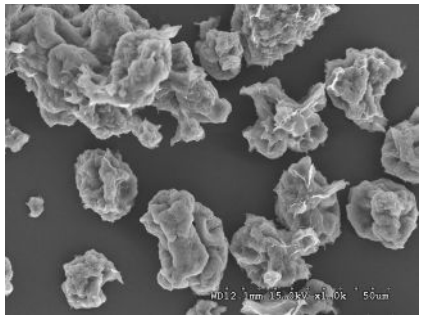
Pressure cooking at 120°C for 30 min



RS4-Fibersym®

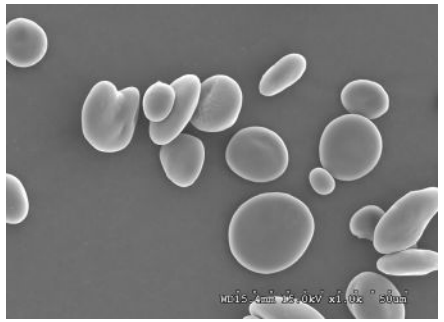


RS2-High-AM corn

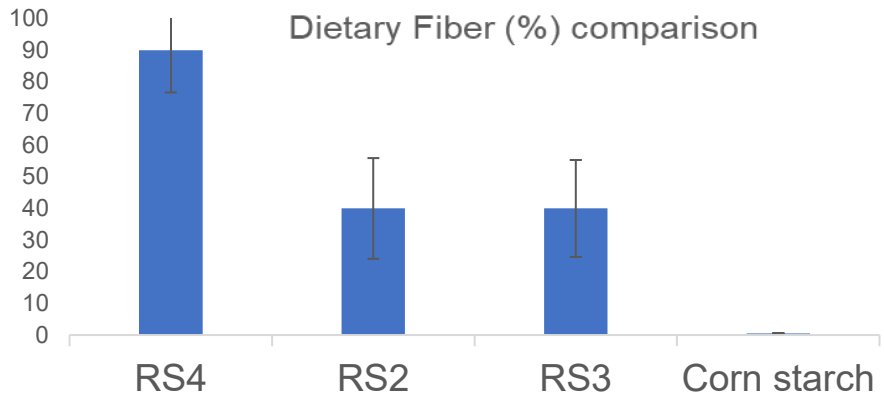


RS3-High-AM corn

Frying with oil at 180°C for 1 min



RS4-Fibersym®



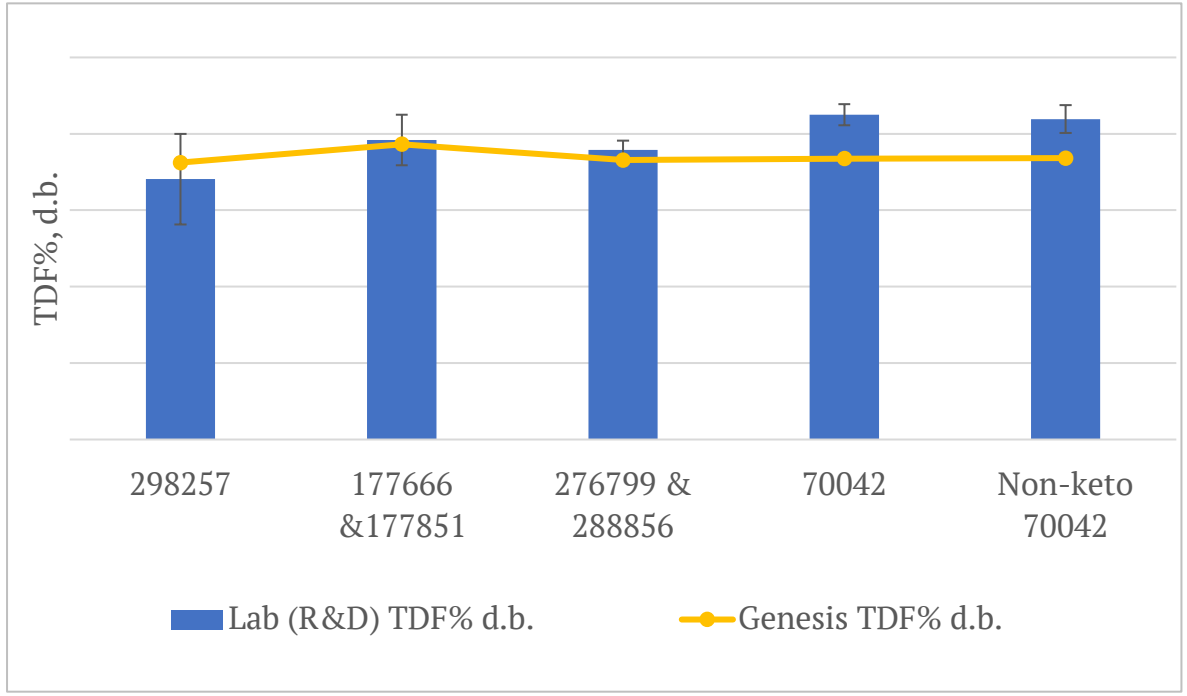
FIBERSYM QUALITY OVER THE YEAR

			TDF% as is
Lots	Fibersym Lot #	Production	2021 Analysis Medallion lab
Old	68276	2013	92
	70042	2013	89
	177666	2017	90
New	276799	2019	90
	288856	2020	88
	298257	2020	89

- No significant change in Fibersym modification procedure during 2013-2017 compared to 2019-2020.
- They all meet spec of >90% dry basis

Note:
Assuming 8% moisture on Fibersym
88% (8%m.b.) = 95.7% dry basis

FIBER RETENTION: KETO-FRIENDLY BREADS



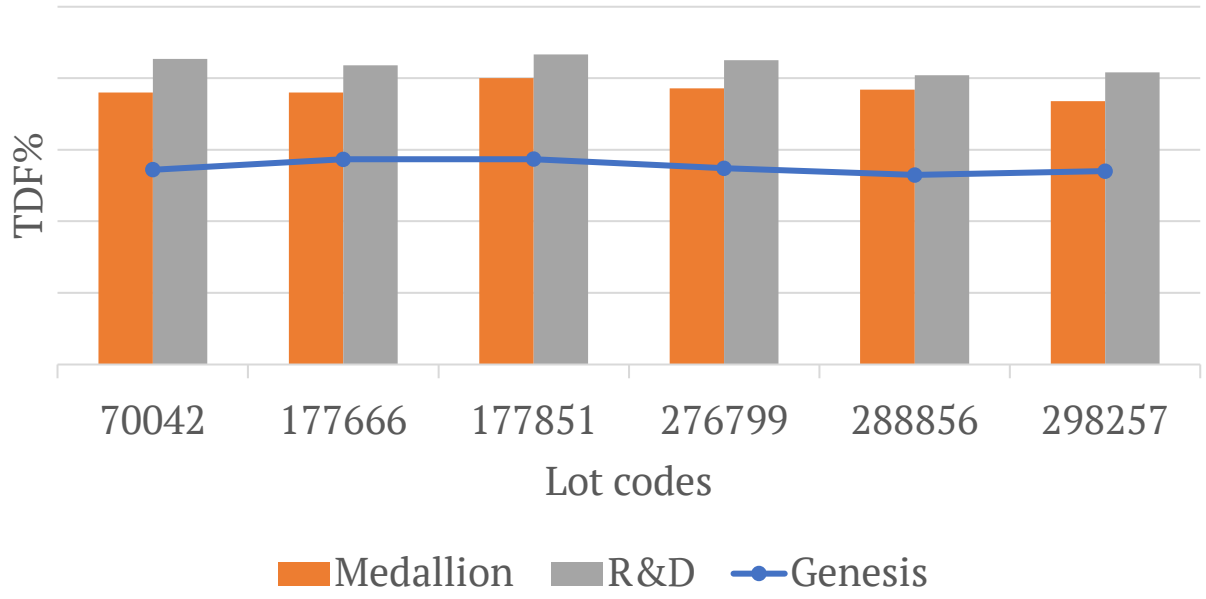
AACC Pup loaf method

	"Keto"
Ingredient	***True %***
Flour	-
Yeast	1.8
Shortening/Oil	3.7
Sugar	0.0
Salt	1.8
Fibersym	59.1
Protein Isolates	33.6
	100

- Minimal fiber loss was observed in keto-friendly breads.

FIBER RETENTION: HIGH FIBER BREADS

Lab vs Calculated; Old vs New lots



AACCI pup loaf method

Ingredient	Gram	True%
Flour	84	61.8
Yeast	4.8	3.5
Shortening	4.8	3.5
Sugar	4.2	3.1
Salt	2.04	1.5
Fibersym	36	26.5
	135.84	100.0

- Both R&D and Medallion have fiber gains when compared to the calculated value from Genesis (Expected 10% loss; the gain was unexpected.
  - We repeated the bake on lot 70042 and got the same results.

Low net-carb crackers results

- Enzyme cracker
  - 12% fiber gained from the calculated nutritional
- Saltine cracker, 16-hour fermentation
  - 11% fiber loss from the calculated nutritional

Duplicate analysis, AOAC 991.43 method, as is moisture basis (~5-6% moisture)

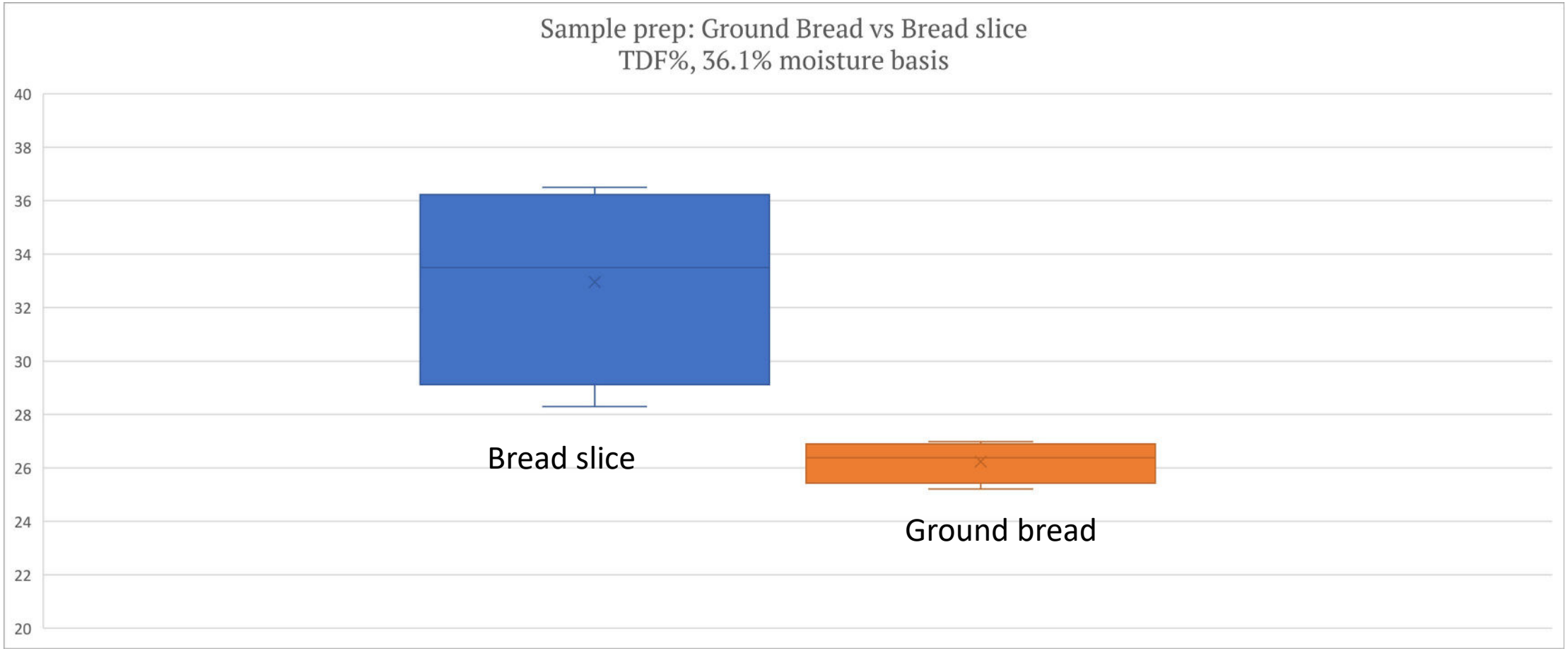
TOTAL DIETARY FIBER OF BREAKFAST CEREALS

Fibersym (%)	TDF in ingredient blend (%)	TDF in extruded cereal (%)	TDF loss during Extrusion (%)	TDF retention (%)
0	6.4 e	**5.6 d**	0.8 b	88.1 a
5	10.6 d	**9.4 c**	1.2 b	88.4 a
10	14.2 c	**11.6 bc**	2.6 ab	82.5 a
15	18.0 b	**14.8 ab**	3.2 ab	82.5 a
20	21.3 a	**16.6 a**	4.7 a	78.1 a

Source: Miller et al 2011

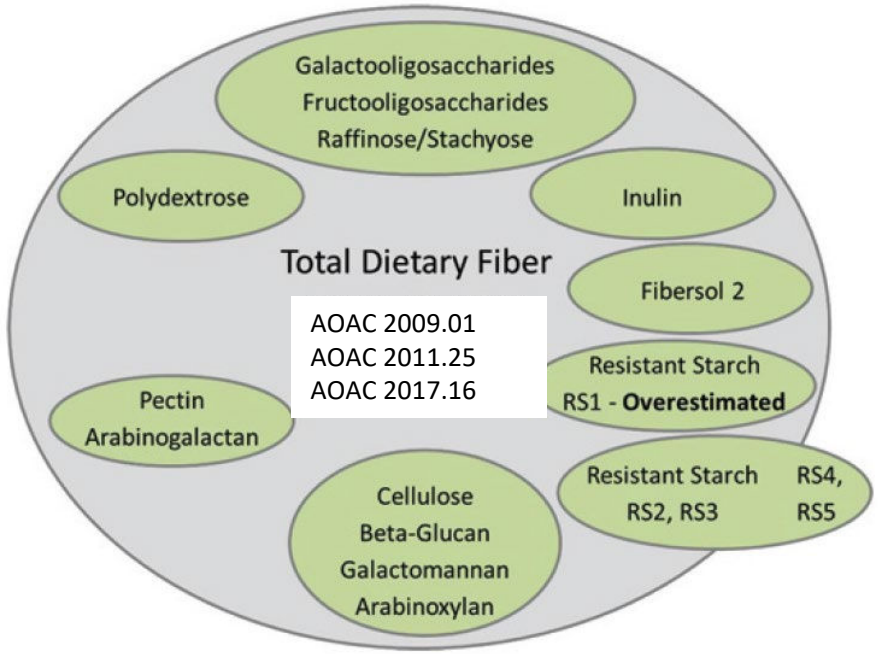
BENEFICIAL PHYSIOLOGICAL EFFECTS OF FIBERSYM® IN HUMANS (CLINICAL STUDIES)

Lowers postprandial blood glucose level	4 human studies Kansas State University; Inquis Clinical Research
Lowers postprandial blood insulin level	3 human studies Kansas State University; Inquis Clinical Research
Lowers blood cholesterol level	2 human studies and 1 hamster study South Dakota State University
Reduces waist circumference and body fat percentage	2 human studies South Dakota State University
Reduces risk factors associated with chronic diseases	1 human study South Dakota State University
Increases fermentation and short-chain fatty acid production	1 human study and 1*in vitro* study South Dakota State University; University of Toronto
Positive modulation of gut microbiota	2 human studies University of Nebraska; South Dakota State University
Bowel movement, stool consistency, and abdominal symptoms	1 human study University of Nebraska



CAUTIONS ON FIBER TESTING

- Dietary Fiber Testing is challenging
- Many methods are available, and large variations between labs.
- The methods are Codex Type 1, meaning that they are empirical, and results are dependent the method.



Recommended methods

RS4	AOAC 991.43, AOAC 2001.03 (based on *in vivo* human study)
Other Fibers	AOAC 991.43, AOAC 2001.03, AOAC 2009.01, AOAC 2011.25, AOAC 2017.16