



Overview of Fibersym® RW, a Resistant Wheat Starch

Creating Better Solutions...Naturally



Fibersym® RW and Dietary Fiber

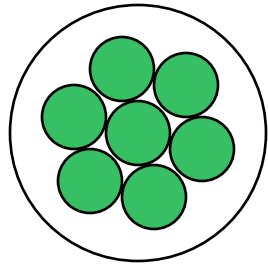
- Definition of Resistant Starch
 - Resistant Starch is the sum of starch and products of starch degradation not absorbed in the small intestine of healthy individuals
- Resistant Starch is recognized as dietary **fiber**
 - American Association of Cereal Chemists International (AACCI, 2000)
 - Institute of Medicine (IOM, 2001)
 - Codex (2009)
 - European Food Safety Authority (2007)



Fibersym[®] RW as a Dietary Fiber

- Measures as dietary fiber by both AOAC 991.43 and AOAC 985.29
 - Fibersym RW = 85% (minimum, dry basis) insoluble fiber
 - FiberRite RW = 75% (minimum, dry basis) insoluble fiber
- Labeled as “Modified Wheat Starch” and no use level limitations
 - Code of Federal Regulations Title 21, Part 172.892

Four Types of Resistant Starches in Diet

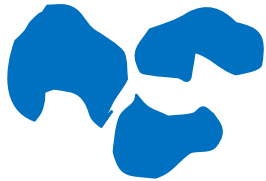


Types of RS

RS1 - Physically inaccessible starch

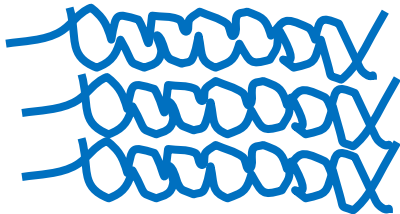
Occurrence

Partially milled grains, seeds and legumes



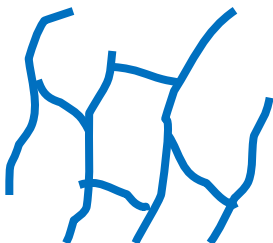
RS2 - Granular starch

Native, uncooked banana starch and potato starch



RS3 - Nongranular, retrograded amylose

Cooked and cooled potato



RS4 - Chemically modified starch

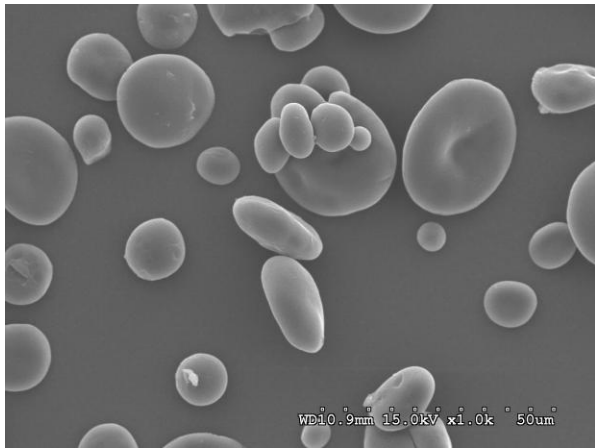
Cross-linked or hydroxypropylated

Slide Courtesy of Dr. Paul A. Seib



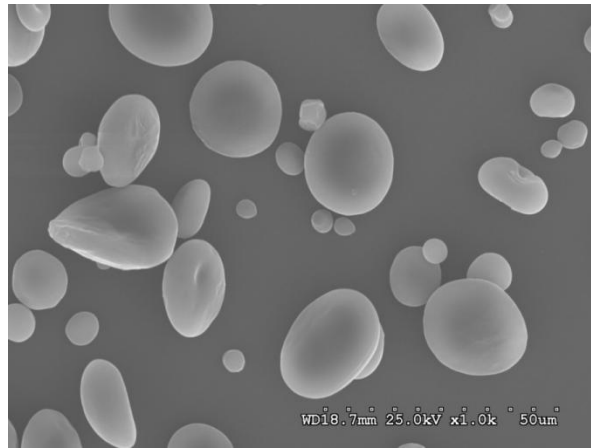
Native Wheat vs. Resistant Wheat Starch

Native Wheat
Starch



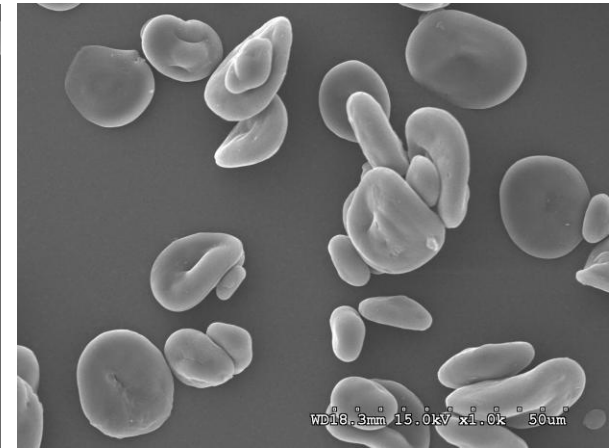
x1,000

Resistant Wheat
Starch Fibersym[®]
RW



x1,000

Pregelatinized RS
Wheat FiberRite[®]
RW



x1,000



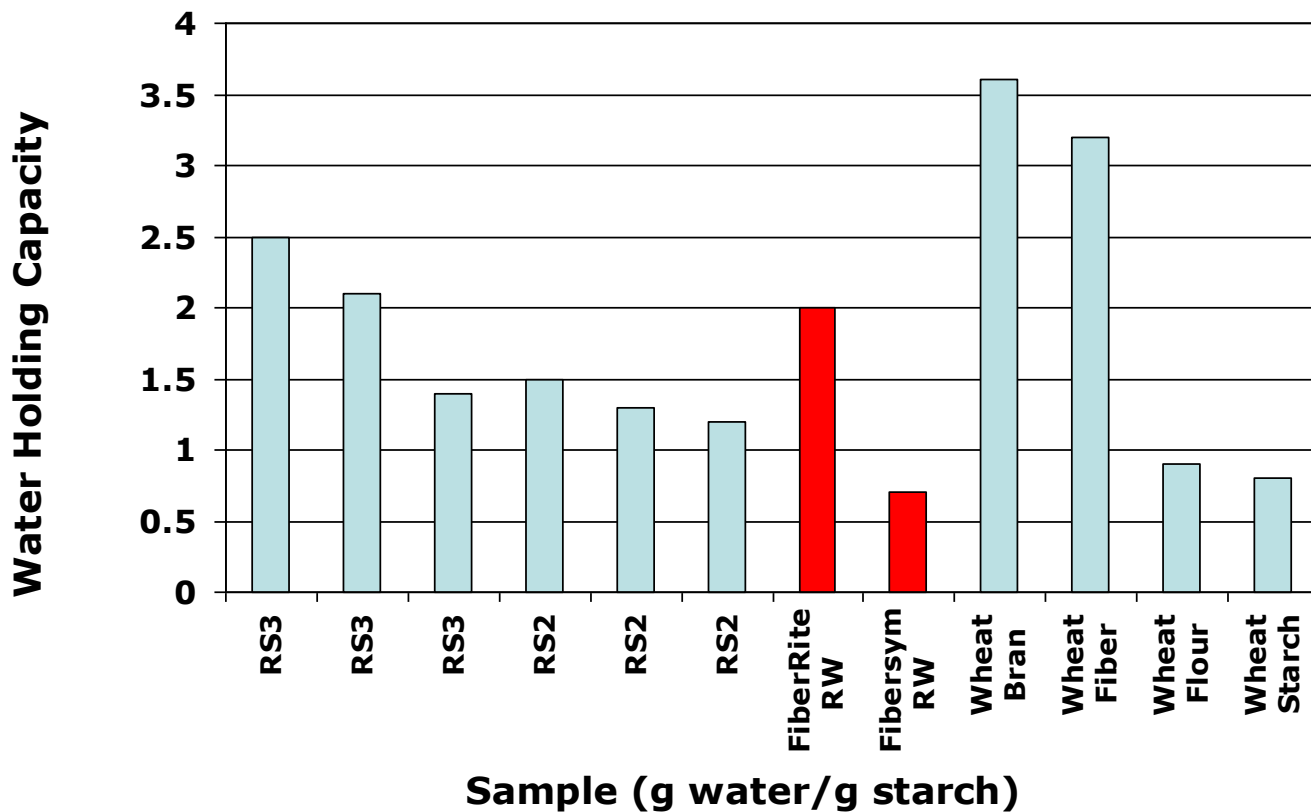
Benefits of Fibersym[®] RW in flour-containing products

- Low water-binding capacity
- Compatibility with wheat flour
- Bland/Neutral flavor profile
- Fine particle size with smooth texture
- White and “invisible” appearance



Key Function of Fibersym® RW in Bakery Products

- Low water holding capacity compared to conventional fiber sources. (0.7g water/g)





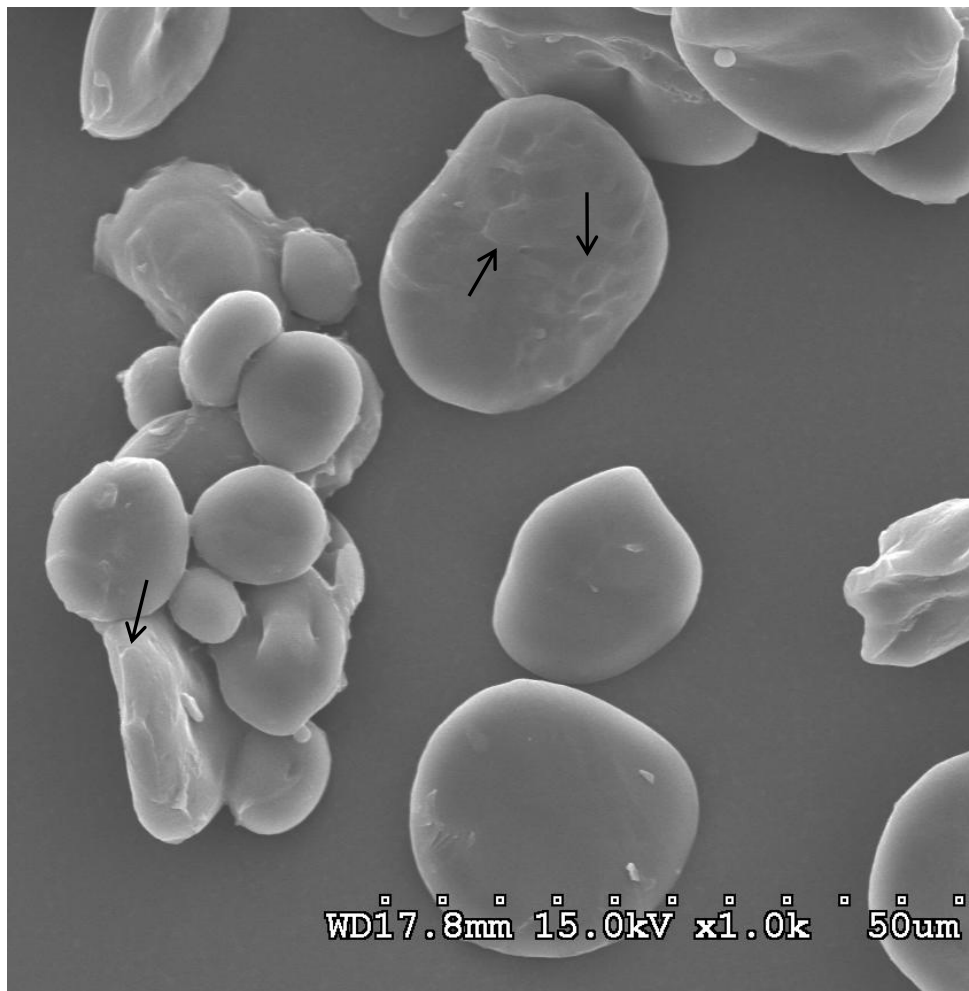
Physiological Benefits of Fibersym[®] RW

- Acts as a prebiotic
- Lower gas production than many other sources of fiber
- Beneficial short chain fatty acid production
- Glycemic response control
- Limited caloric contribution

Aim: To study the fermentation characteristics of Fibersym[®] RW

- Cooked Fibersym[®] RW was digested with pepsin and pancreatin-bile
- Indigestible residue was fermented using fresh human fecal microbiota as inoculum

Indigestible Residue from Fibersym[®] RW (after *in vitro* digestion)



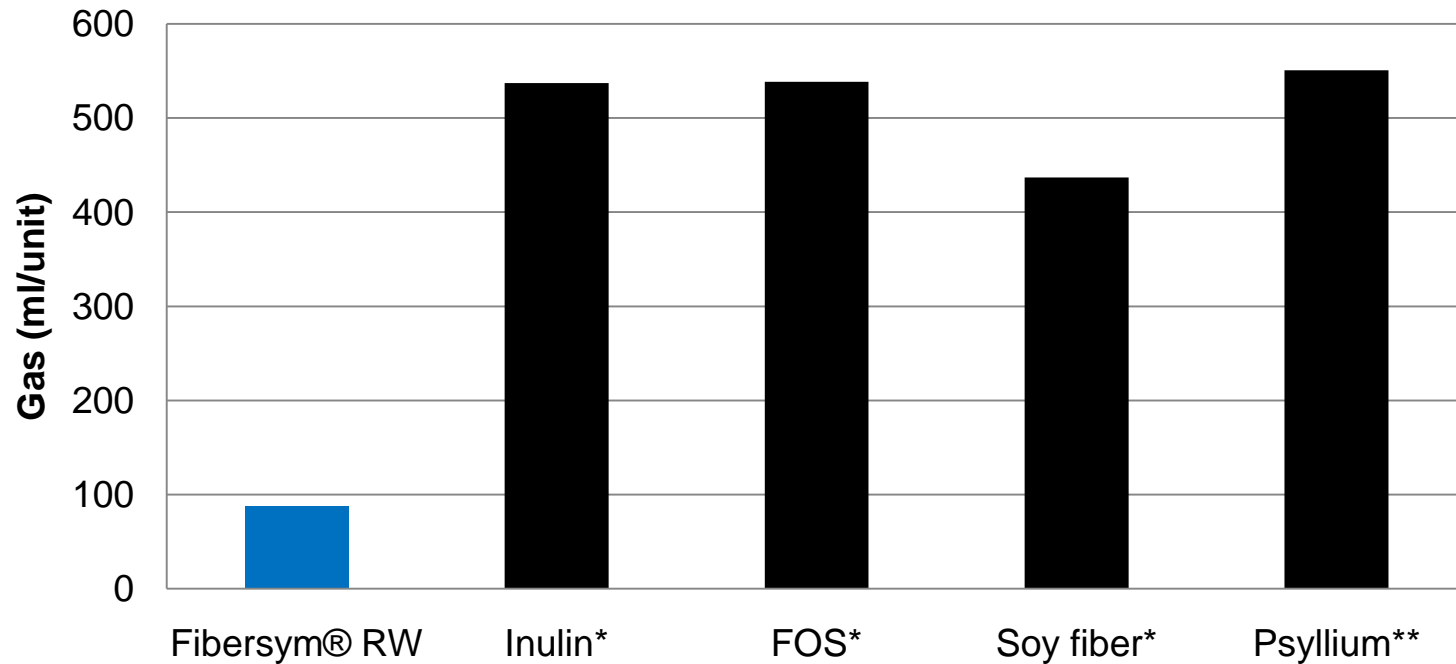
Boiling water bath
30 min.

Pepsin-HCl
37 °C
pH 2.0
3 hrs.

Pancreatin-Bile
37 °C
pH 7.5
12 hrs.

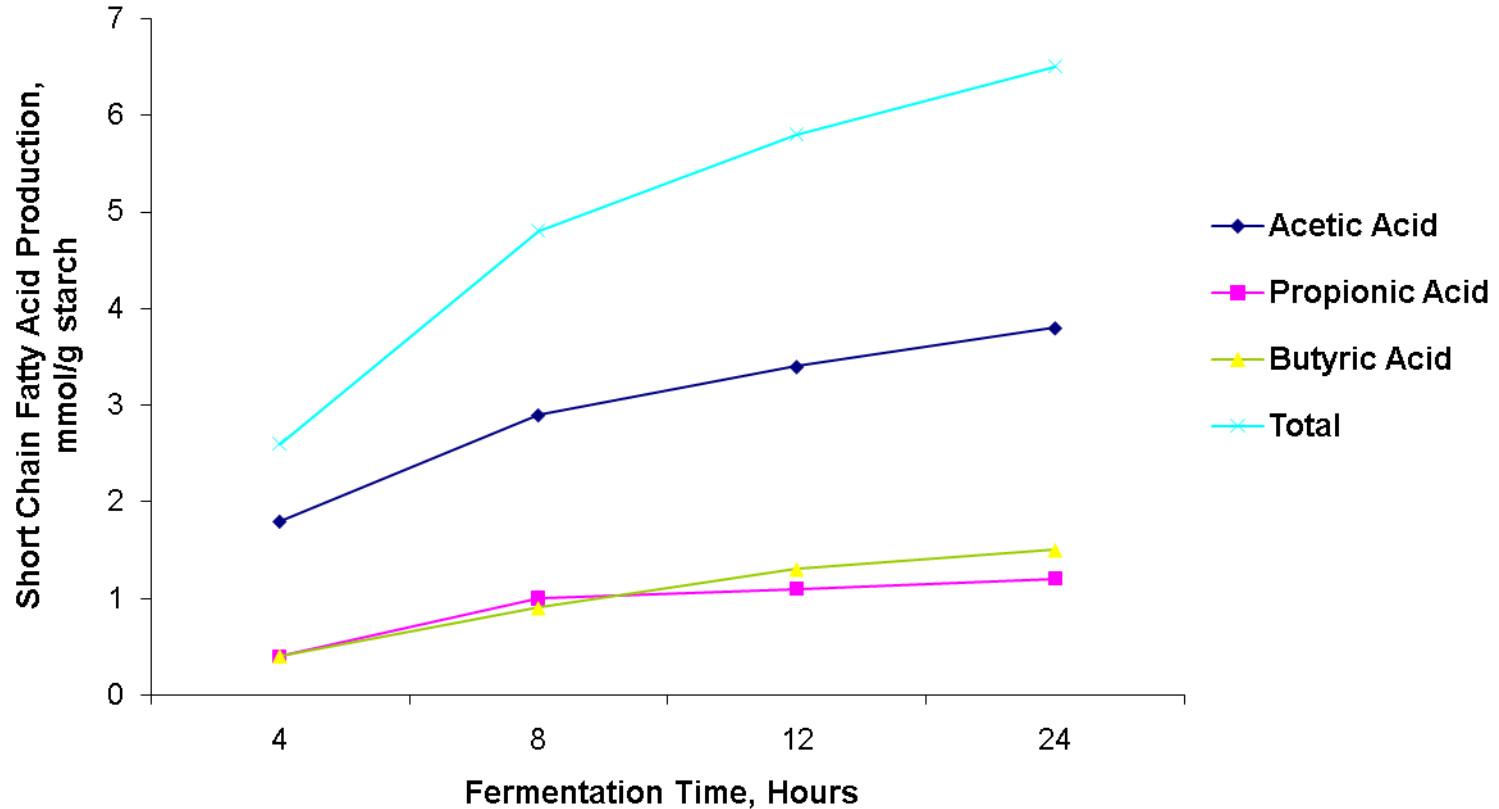
Digestion method by
Trinidad et al 1996

In Vitro Fermentation with Human Fecal Microbiota for 24 Hours



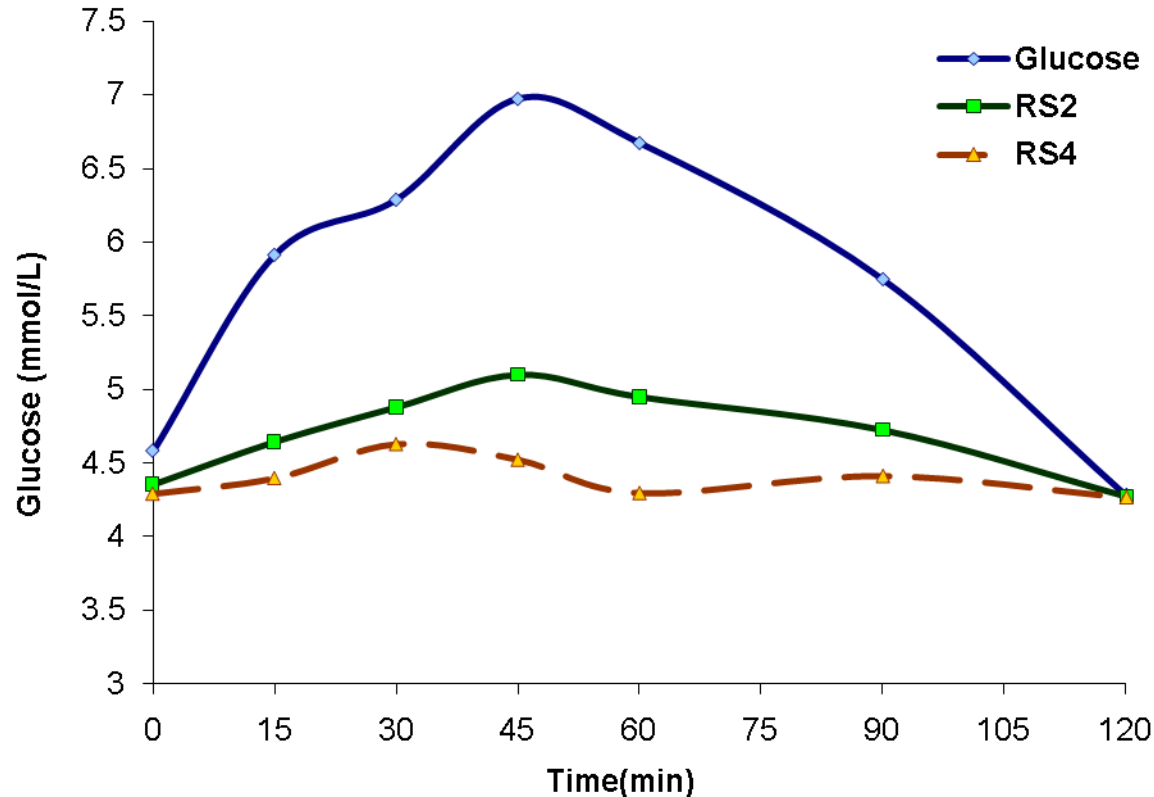
**Adapted from Van Hoeij et al 1997; **Adapted from McBurney et al 1989.*

Cumulative Short-Chain Fatty Acid Production After Fermentation of Dietary Fiber Residue from Fibersym® RW



- The high level of dietary fiber residue in resistant wheat starch was fermented by human feces (colonic bacteria) to short-chain fatty acids for 24 hours (Fermentation by the method of *McBurney et al 1987*).

Resistant Starch on Glycemia Comparison of RS4 Wheat (Fibersym[®] RW) vs. RS2 High-Am Corn



- 20g of RS2 and RS4 were mixed in equal amounts of water and capillary glucose were measured over 2 hours with standard GI method

Al-Tamimi et al. Unpublished data 2007

- Three groups
 - Glucose beverage (control)
 - Fibersym[®] RW (RS4 bar)
 - Puffed wheat bar (PWB bar)
 - Bars had identical ingredients except for RS or puffed wheat

Source: Haub 2009



Nutrient Composition of Each Meal Per Dose

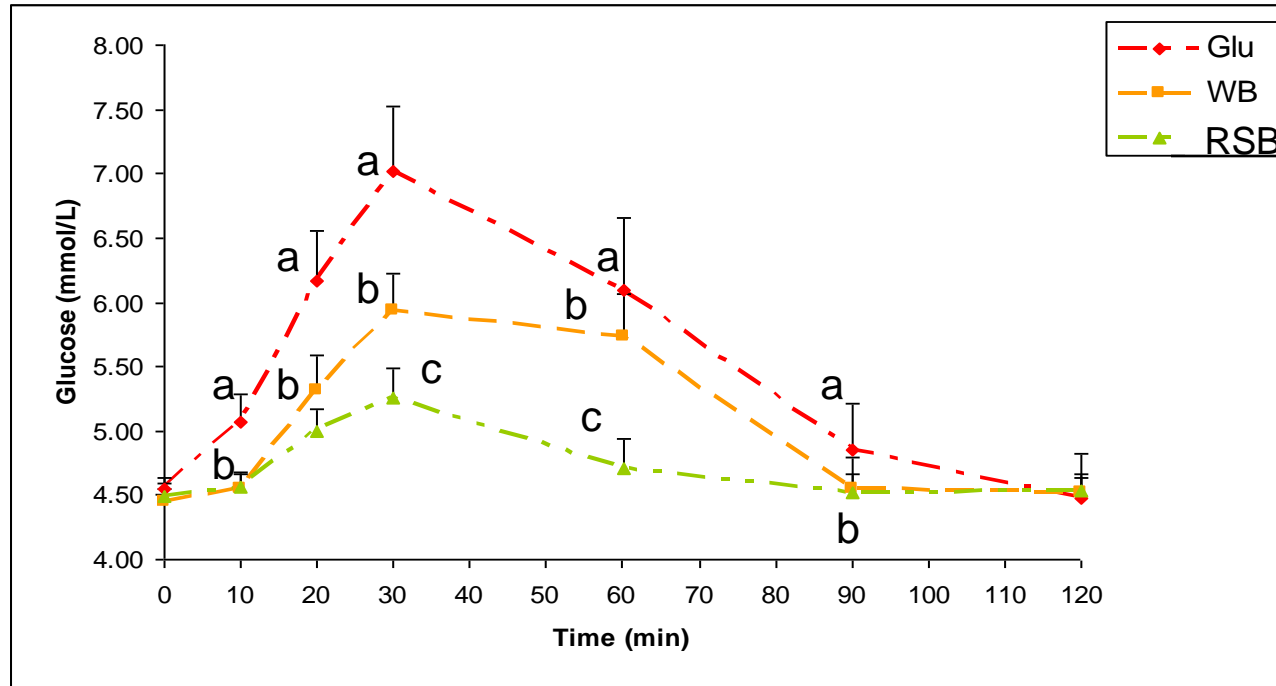
(GLU = 198ml; PWB = 65g; RS4 = 80g)

	<u>GLU</u>	<u>WB</u>	<u>RS4</u>
Total Energy (kcal)	200	261	326
Carbohydrate (g)			
Total	50	56	71
Available	50	51	51
Total Dietary Fiber (g)	--	5	20
Fat (g)	--	1	2
Protein (g)	--	7	6

Source: Haub 2009



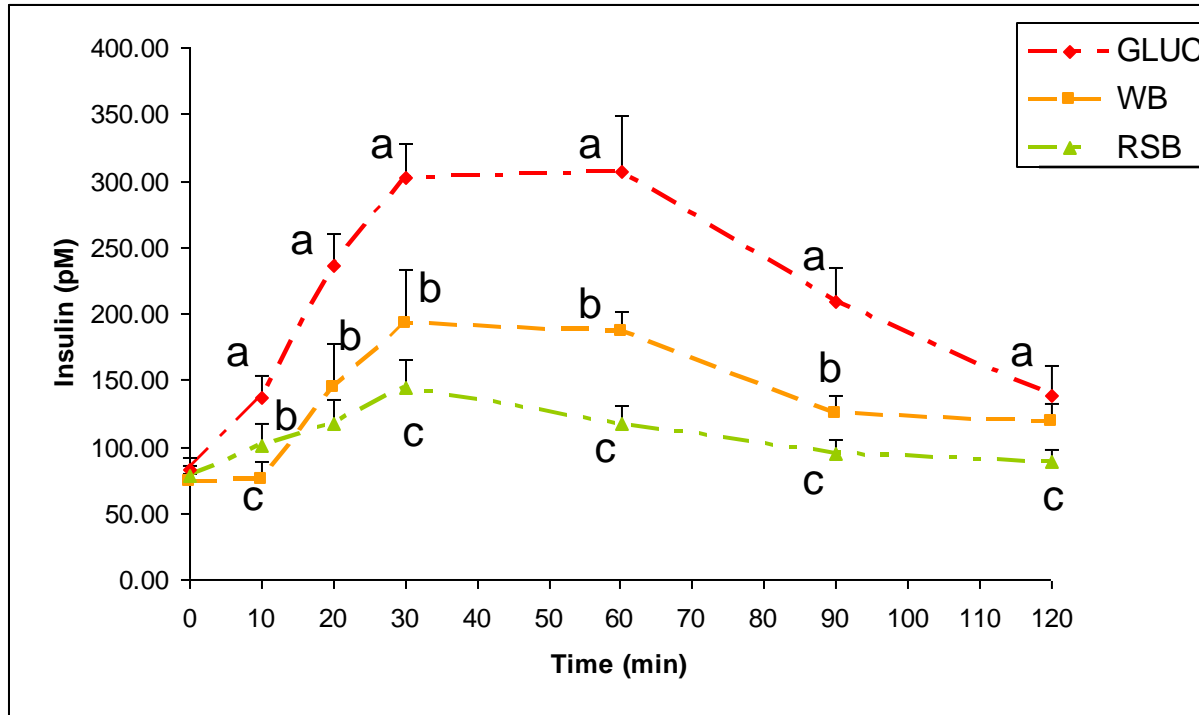
Glycemic Response of Fibersym[®] RW in Healthy Younger Adults



MEAN \pm SEM blood glucose response for 13 healthy younger adults after consumption of Glucose Drink (\blacklozenge Glu), Puffed Wheat Bar (\blacksquare WB), and Resistant Wheat Starch (\blacktriangle RSB). Means of blood glucose at the same time with different letters differ significantly ($p < 0.05$).



Insulin Response of Fibersym[®] RW in Healthy Younger Adults



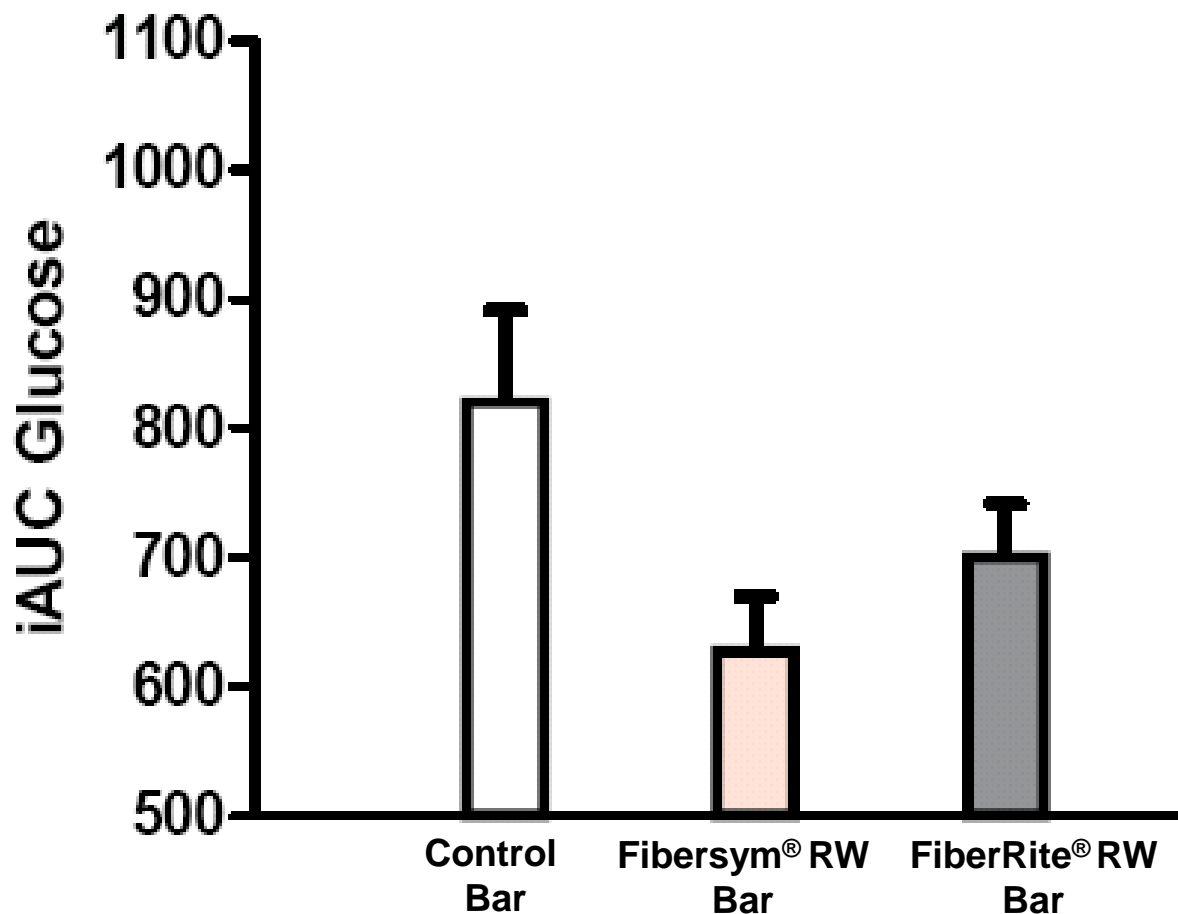
MEAN \pm SEM blood insulin response for 13 healthy younger adults after consumption of Glucose Drink (\blacklozenge GLUC), Puffed Wheat Bar (\blacksquare WB), and Resistant Wheat Starch (\blacktriangle RSB). Means of blood insulin at the same time with different letters differ significantly ($p < 0.05$).

Al-Tamimi, Ph.D. Dissertation 2007, Kansas State University

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Glycemic Response of Fibersym[®] RW and FiberRite[®] RW in Type 2 Diabetics



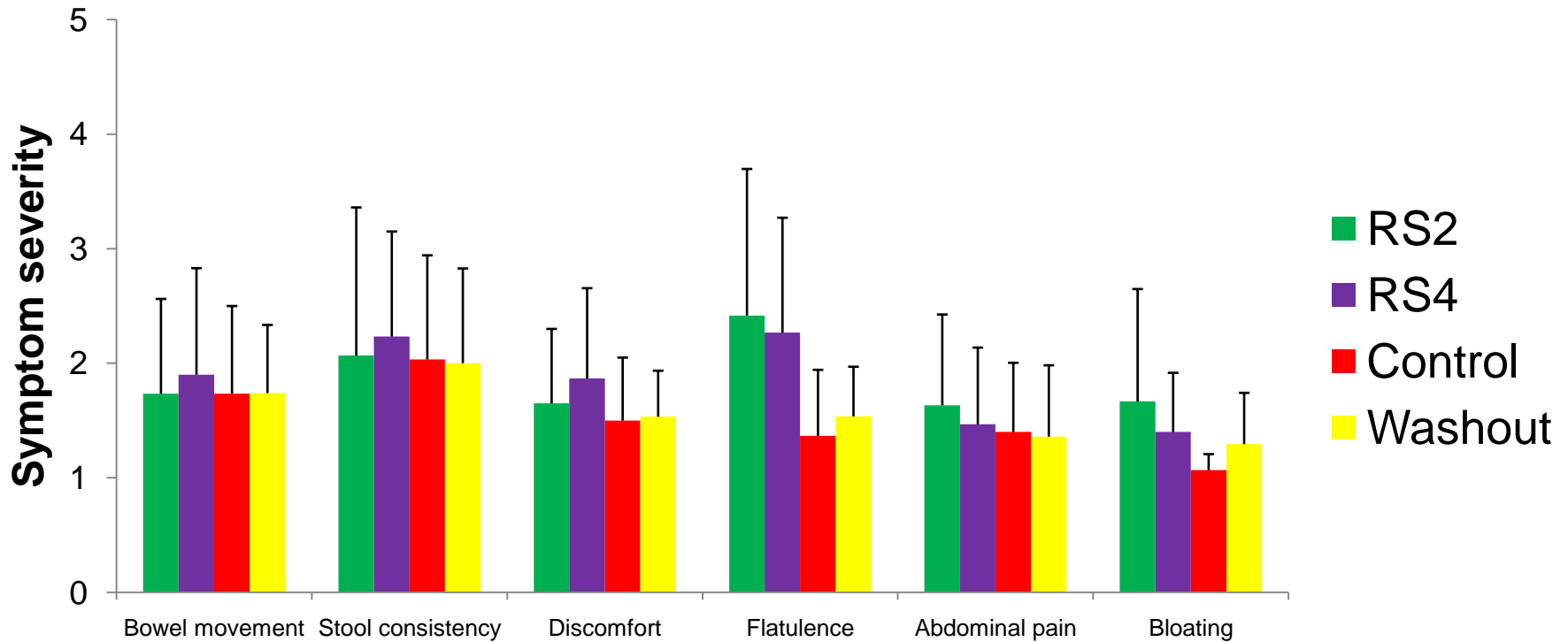
Source: Haub 2008



Gut Microbiota Study Conclusions

- ✓ Fibersym[®] RW has great potential as a functional ingredient to improve digestive health; can be classified as a prebiotic fiber
- ✓ Fibersym[®] RW creates no significant differences in appearance, texture, flavor and overall sensory properties of snack crackers
- ✓ In total, snack crackers formulated with Fibersym[®] RW were more bifidogenic than crackers formulated with a high-amylose resistant corn starch
- ✓ 30 grams of dietary fiber from Fibersym[®] RW are well tolerated by human subjects based on results related to bowel movement, stool consistency, discomfort, flatulence, abdominal pain and bloating
- ✓ Gut microbiota was modified by Fibersym[®] RW in 5 out of 10 subjects
- ✓ On average, Fibersym[®] RW increased Bifidobacteria by 350% in 10 human subjects tested

Results: Symptoms



No statistically significant differences.