Soy Protein Applications in Nutrition & Food Technology

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National Soybean Research Laboratory (NSRL) Vision



- University of Illinois
- Research Facility for the Industry
- Public and Private Partnerships
 - Managed Research Areas (MRAs)
 - Education and Training
- International Outreach
 - Fulfilling the service mission of the University

National Soybean Research Laborator

- Research-based outreach when international is the unit of analysis
- Malnutrition, economic development,
 and sustainable value chains



Training and Education

Soy Processing

Soy Dairy

Entrepreneurship

Nutrition Education

Soy in Meat Applications

Soy in Baking Applications

Biodiesel

Soy in Local Cuisine











Soybean Processing and Utilization Training



- University of Illinois
- Soybean Processing
- Soy in Meat, Dairy,
- Baking Applications
- Extrusion Technology
- Consumer Marketing



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WISHH and NSRL



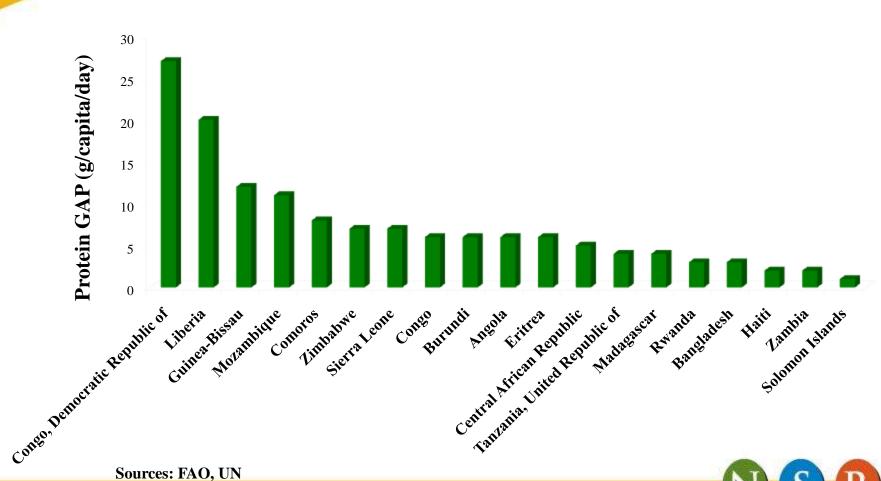
- Technical Resource for WISHH
- Provide training in processing, nutrition education, and develop culturally-appropriate soy applications for human nutrition
- Support for sustainable solutions
- Support for microenterprise development





Protein GAP Across Countries

The Largest "Protein GAP" Countries in 2003

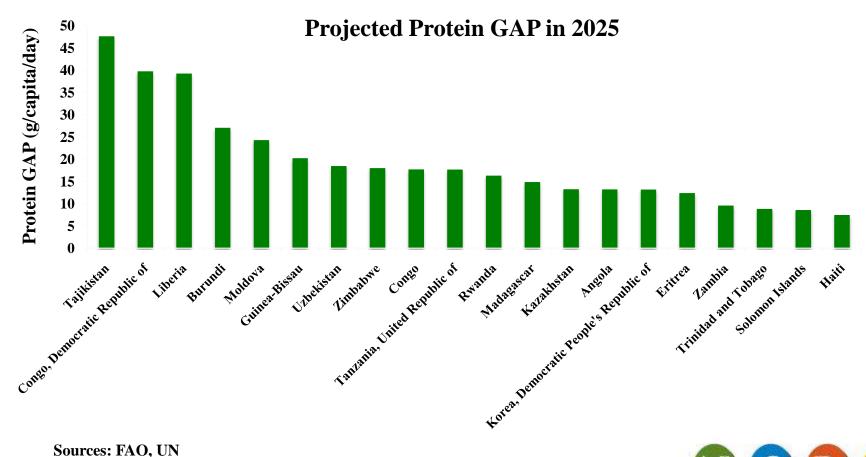


Sources: FAO, UN





What Is the Forecast for 2025?







The Importance of Protein

- Maintenance of Body Functions
- Growth, Development at Crucial Points (Pregnancy and Lactation and the First Year of Life)
- Source of Essential Amino Acids
 - Change in Amino Acid Profile Affects Effectiveness of Dietary Protein Intake to Maintain Nitrogen Balance
- Health Maintenance and Disease Management
- RDI is Established Using Highly Digestible and High Quality Protein
 - Lower Quality Protein Means Higher Protein Requirements



Health Benefits of Soy Protein Chronic Disease Prevention

- Cholesterol Heart Disease
- Hypertension
- Certain cancer
- Diabetes
- Menopause
- Osteoporosis
- Weight Loss







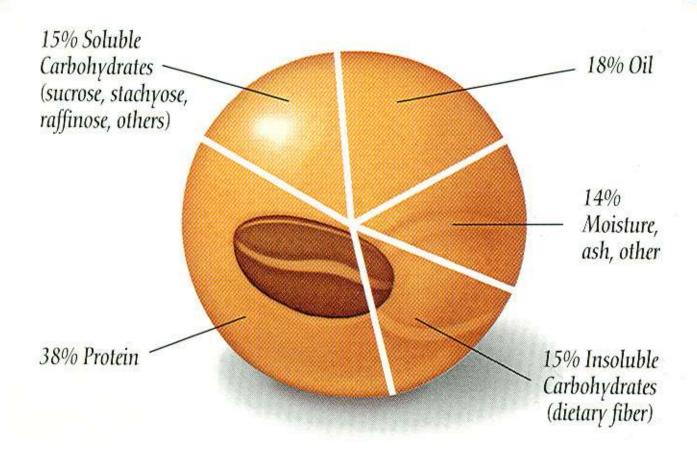
Soy Health Claims

- Heart Health (October 1999)
 - Diets low in saturated fat and cholesterol that include 25 grams of soy protein a day may reduce the risk of heart disease.
 - A serving of soy milk has 7 grams of soy protein
 - A serving of textured soy protein has 12 grams of protein
 - A serving of soy flour in a muffin has 15 grams of protein





Soybean Composition

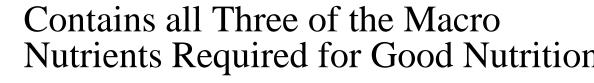






Why Soy





Adaptable and Economical

Multiple Product Options

Soy Flour

Textured Soy Protein

Soy Milk

Whole Soy

Soy Protein Concentrate

Soy Protein Isolate







Why Consume Soy Foods

- Health
 - Nutrition and growth
 - Diseaseprevention

- Functional properties
 - Water absorption
 - Emulsification
 - Texture







Soy Improves Functional Properties of Foods

- Bland
- Absorbs Flavor
- Conditions Dough
- Emulsifies
- Increases Whiteness
- Improves Texture
- Retains Moisture
- Absorbs Fat
- Keeps Product Fresh for a Longer Time







Soy Protein Products

- Soy Flour
- Textured Soy Protein
- Soy Protein Concentrate
- Soy Protein Isolate
- Soy Milk

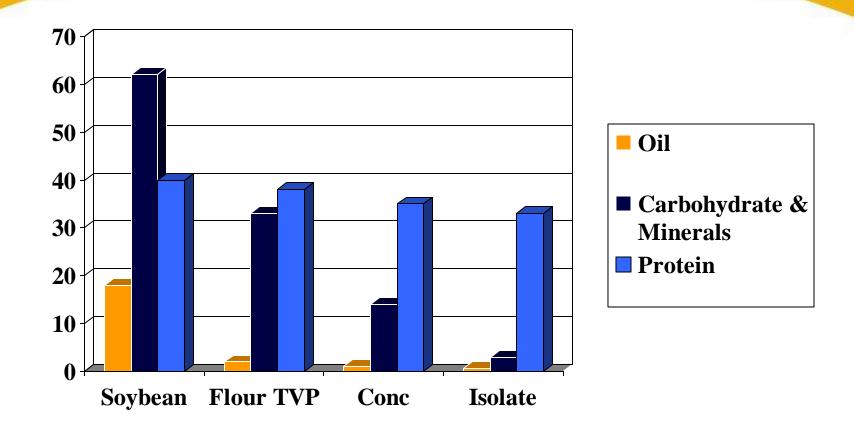








Soy Protein Products







Soy Protein Products

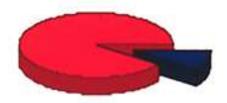
Soy Flour

Soy Protein Concentrate

Isolated Soy Protein







50% Protein

70% Protein

90% Protein

Protein (moisture free basis)

Carbohydrate, lipid, vitamins, minerals





American Baked Products



Soy Protein Ingredient:

• Soy flour

Functional Properties:

- Improves whiteness
- Dough conditioner





Defatted Soy Flour

Applications:

- Weaning Foods
- Cookies
- Muffins
- Cereals
- Doughnuts
- Dry mixes
- Nan and Flat Breads
- Ground Meat

- Porridge and Gruel
- Crackers
- Breads
- Cakes
- Pastas
- Tortillas
- Soups and Sauces









Textured Soy Protein

- Applications as an ingredient with:
 - Ground meat for patties
 - Sausage
 - Meat Loaf
 - in Vegetarian Foods
 - in Stews and Soups









Soy Protein Concentrate

- Applications in:
 - a Variety of Meat Systems
 - Baked Goods
 - and Specialty Items

Shelf Life of One Year







Soy Protein Isolate

- Applications as an Ingredient in High Protein Foods Including:
 - Dairy Foods
 - as a Milk Replacer
 - Nutritional Supplements
 - Meat Systems
 - Infant Formulas
 - Nutritional Beverages
 - Cream Soups and Sauces
 - Snacks
- Shelf Life of One Year







Soy Milk

• Applications:

- Beverage
- to Produce Yogurt
- to Produce Ice Cream
- to Produce Tofu
- in Soups and Sauces







Benefits of Soy Milk

- No Lactose
- No Cholesterol
- Low in Saturated Fat
- Low in Sodium







Composition of Soy Milk, Cow's Milk and Mother's Milk

Item/100 g	Soymilk	Cow's Milk	Mother's Milk
Calorie	44	59	62
Water (g)	90.8	88.6	88.2
Protein	3.6	2.9	1.4
Fat	2.0	3.3	3.1
Carbohydrates	2.9	4.5	7.1
Ash	0.5	0.7	0.2
Minerals (mg)			
Calcium	15	100	35
Phosphorus	49	90	25
Sodium	2	36	15
Iron	1.2	0.1	0.2
Vitamins (mg)			
Thiamine (B1)	0.03	0.04	0.02
Riboflavin (B2)	0.02	0.15	0.03
Niacin	0.50	0.20	0.20
Saturated Fatty Acids (%)	40-48	60-70	55.3
Unsaturated fatty acid (%)	52-60	30-40	44.7
Cholesterol	0	9.24-9.9	9.3-18.6

Quantity: Higher Protein

Commodity	Protein per 100 gms	Calories per 100 gms
	(in gms)	(in Kcal)
Soy Flour (defatted)	52	290
Textured Soy Protein	52	270
Wheat Flour	10	360
Corn meal	8	370
Rice	7	360
Wheat Soy Blend	22	360
Soy Bulgur	18	340
Corn Soy Blend	17	380
Lentils	28	340
Peas	25	340





Protein Quality – Why Soy

Product	PDCASS Score
Egg White	1.00
Milk (Casein)	1.00
Beef	0.92
Soybean	0.90 - 1.00
Pea	0.73
Kidney Bean	0.68
Chickpea	0.66
Oats	0.57
Peanut Meal	0.52
Lentils	0.52
Rice	0.47
Corn	0.42
Whole Wheat	0.40
Wheat Gluten	0.25



Soy Added to Cereal Grains Improves Growth¹

Protein Efficiency Ratio

Cereal	Without Soy	With Soy ¹	
Maize	1.0	2.2	
Rice	1.9	2.9	
Wheat Flour	0.7	2.0	
Whole Wheat	1.3	1.9	

¹Soy flour added to maize, rice, wheat flour, and whole wheat diets at a level of 8%, 8%, 10% and 8%, respectively.





Soy Protein Products: Cost

Product	Price (pound)
Soy Flour (defatted)	\$0.28
Textured soy protein Soy protein concentrate	0.35 0.86
Soy protein isolate	2.00





Price Ratio

Product	Ratio (pound)	Ratio (pound protein)	
Soy Flour (defatted)	1.0	1.0	
Textured Soy Protein)	1.2	1.2	
Soy protein concentrate	3.0	2.4	
Soy protein isolate	7.1	4.3	





Reduced Cost

Product	Price (ton)	Price (pound protein)	Price (1000 Kcals)
Soy Flour (defatted)	\$620	\$0.54	\$0.21
Textured Soy Protein	\$770	\$0.67	\$0.28
Wheat Flour	\$230	\$1.02	\$0.06
Corn Meal	\$173	\$1.97	\$0.11
Rice	\$560	\$3.80	\$0.16
Soy Bulgur	\$360	\$0.90	\$0.11
Wheat Soy Blend	\$360	\$1.42	\$0.13
Peas	\$240	\$0.77	\$0.12
Lentils	\$435	\$1.16	\$0.22





- India
 - Textured Soy Protein in Rice Dishes
 - Soy Flour in Indian Breads and Sambar
- Mozambique
 - Textured Soy Protein as a Microenterprise Product
- Vietnam
 - Soy Milk and Tofu Production
- Tajikistan
 - Soy Flour in Flat Breads





Soy Flour with Micronutrients in FortiSoyTM

Complementary Micronutrient Food for Infants and Children in Central America

Methods:

- Two products were developed containing calcium, iron, zinc, folate, vitamin C, and vitamin A.
- Soy flour was added to one of the products, while the other (the control) contained maltrin at similar caloric content.
- 2 scoops (26 grams) daily per child.
- Children aged 6 to 30 months were randomly assigned to the treatment group (n=136) or control group (n=140).





Soy Flour with Micronutrients in FortiSoyTM

Complementary Micronutrient Food for Infants and Children in Central America

Results:

- Both supplements were easily administered and acceptable to most participants.
- At one month, 87% of children on the control supplement and 88% of those on the soy supplement reported ongoing daily use.
- No allergic reactions were reported.
- Study to be completed this month and repeated in Summer of 2009.





- South Africa
 - Soy Protein Isolates in a Beverage
- Uganda
 - Soy Protein Concentrates in Baked Goods
- Haiti
 - Soy Milk and Mango Juice Beverages
- Ghana
 - Soy Milk in School Lunch Program





Thank You



National Soybean Research Laboratory

Research, Outreach and Education supporting Soybean Production and Nutrition

