

# Soy Nutrition & Small Scale Processing



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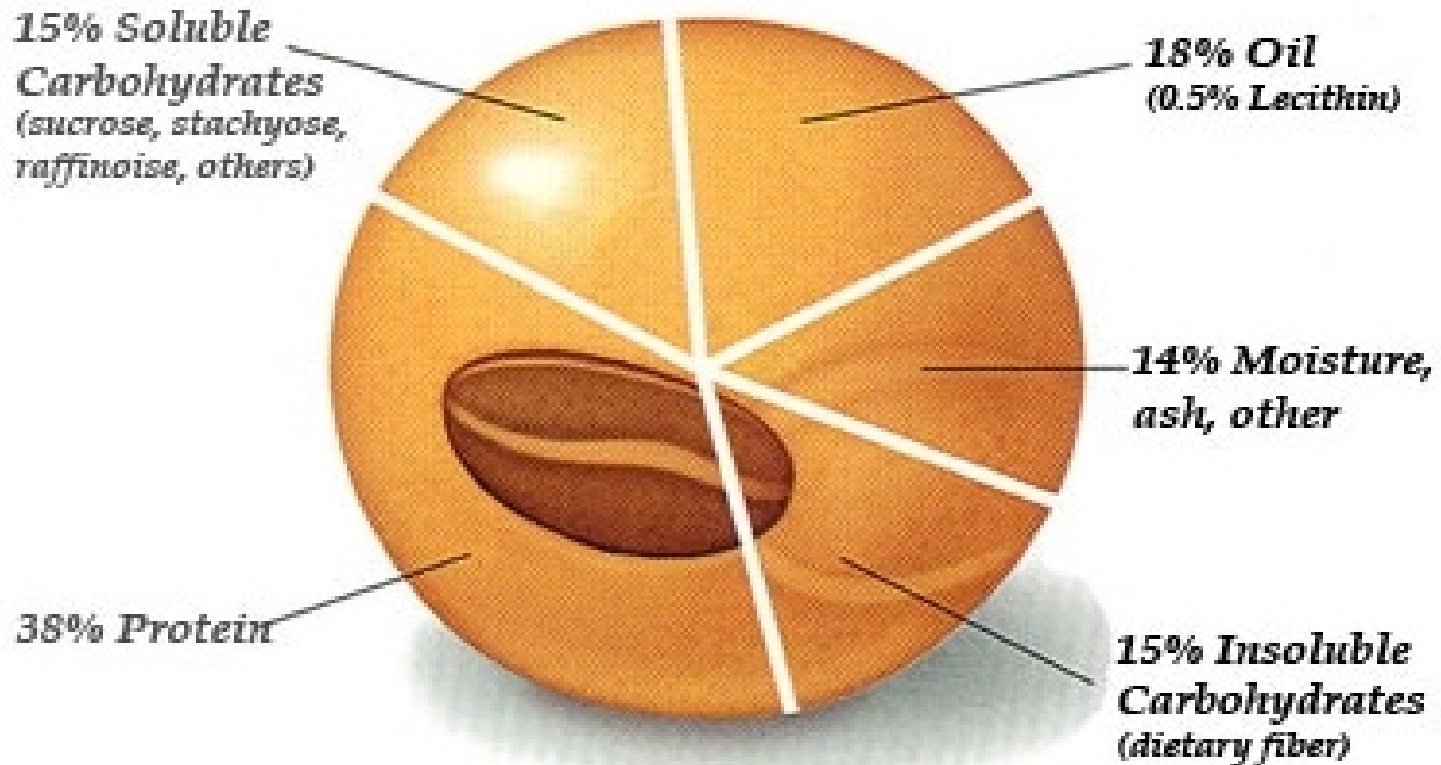
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# Soybeans – The Miracle Crop



# Protein Satiety



- Protein can make you feel full longer
- Stave off hunger pangs
- PEM: Protein-Energy Malnutrition
- Protein malnutrition usually comes with energy deficiencies, lacking other nutrients

# Protein



- Throughout the body—in muscle, bone, skin, hair, and virtually every other body part or tissue
- Over 10,000 different proteins make you what you are and keep you that way
- Especially critical for pregnant and lactating women, growing children

# Protein – Amino Acids



- Twenty basic building blocks
- Amino acids provide the raw material for all proteins
- Body does not store amino acids, as it does fats or carbohydrates
  - We need a daily supply of amino acids to make new protein

# Essential vs. Non-Essential AA

- Non-Essential
  - Body can make from proteins consumed
  - Break down amino acids to molecules and then reassembled into new amino acids
- Essential
  - Cannot be made in the body
  - Must be consumed regularly
  - Nine AA are essential
  - All are present in soy protein
    - “High quality” or “Complete”

# Complementary Proteins

- Two or more proteins together that provide adequate amounts of all amino acids
- Best if consumed in the same day
- Whole grain with a legume
  - Rice plus soybeans



# Daily Protein Requirements

Age (years)	Protein (g)
4-8	19
9-13	34
14-18 (girls)	46
14-18 (boys)	52
19-70+	46
19-70+	56
Pregnant and lactating women	60-71
HIV/AIDS	80-100



# Protein Sources

- One cup milk: 8g
- 3.5 oz fish: 22g
- 1 oz cheese: 7-8g
- 4 oz. hamburger: 28g
- 1 egg: 6g
- 3.5 oz chicken: 30g
- 1 cup beans: 16g
- One cup soymilk: 11g
- ½ cup tofu: 10g
- 1 cup dry soybeans: 12g
- ½ cup edamame: 11g
- ½ cup cooked soybeans: 14g
- ½ cup soy flour: 15g
- ¼ cup uncooked soy grits: 16g

# Why Soy?

- Soy products are an excellent source of the three macronutrients
- “Complete” protein
- Protein quality high
- Place within multiple food groups
- Adaptable, versatile, acceptable
- Affordable protein choice



# Adaptable Soy: Acceptable Soy

- Food is important in culture and traditions
- Consumers like what they know
- Compliment with other ingredients
- Flavor chameleon
- Do not sacrifice
  - Original flavor
  - Mouthfeel
  - Appearance

# Small Scale Processing Soybeans

- Whole soybeans
- Roasted soy nuts
- Soymilk
- Soy flour and soy grits
- Green soybeans or 'edamame'



# General Processing Guidelines

- Soybean cleaning is required
- Cooking is required
  - Heat improves soybeans
  - Deactivates trypsin inhibitors (TI) in soybeans naturally
  - Improves flavors, reduces beany taste
- Practice good hygiene and food safety

# Home Processing

- Cooking. Drop clean whole or dehulled soybean into rapidly boiling water. soybean: water ratio is 1:5. Return to boil quickly, simmer for 30 minutes.
- Drying. Use air, sun, or oven. For oven drying, spread soybeans in a single layer on a baking sheet, then oven dry at low heat, about 95 °C (200 °F), until dry, 1 hour.

# Home Processing

- Grinding. Grind the cooked, dried soybeans using hammer mill, kitchen blender or hand crusher.
- Course grinding produces soy grits. Soy grits may be toasted to achieve a nuttier flavor and darker color. Finer grinding produces full-fat soy flour.
- Soymilk can be used as a beverage, or as a cooking ingredient just as dairy milk is used

# Home Processing

- The whole cooked, wet soybeans can be mashed and added to porridges or soups, and blended with ground meats
- The dry soybean flour and grits can be blended with dry powders such as wheat, or millet and this fortified blend would used in usual preparations



# Whole Soybeans - Basic Preparation

1. Sort and remove broken beans and debris. Rinse the beans
2. Blanch the beans. Use 5 parts water to 1 part soybeans. Boil water and add pinch of baking soda.
3. Simmer 5 minutes; drain and rinse in cold water

# Whole Soybeans - Basic Preparation

4. Cook the soybeans. Use 5 parts water to 1 part soybeans. Boil water and add pinch of baking soda.
5. Add blanched soybeans.
6. Return to boil and cook 35 minutes; drain.
7. Use whole or mashed

# Whole Soybeans – Soy Nuts

1. Do steps 1-3 under Whole Soybean preparations
2. Bring water 3 times the original dry bean volume to a boil, and add a pinch of baking soda.
3. Add the blanched soybeans and cook at a low simmer for 15 minutes. Drain and rinse with cool water.

# Whole Soybeans – Soy Nuts

4. Dry as thoroughly as possible.
5. Roast the soybeans at 175 °C (350 °F) in a single layer on a cookie sheet. Bake, stirring occasionally but more often as the beans dry out. This takes between 45 minutes to 2 hours. Bake until the crunchy texture is achieved.
6. Seasoning such as salt or red pepper should be done while the beans are hot.

# Soy milk



## *Ingredients*

- 4 liters (16 cups) water
- 200 grams (7 oz., about 1 ½ cups) whole, mature soybeans, sorted and cleaned
- 2 pinches baking soda (divided)
- 45 ml (3 tablespoons) sugar, or as desired
- 2 ml salt (scant ½ teaspoon), or as desired
- Other flavorings, such as vanilla, as desired

# Soymilk

1. Blanch the beans twice: Bring 1 liter (4 cups) of water to a boil on the stove. Add 1 pinch of baking soda. Drop the whole soybeans directly into the boiling water and blanch for 5 minutes. Drain and rinse the beans with hot water. Repeat this process so that the beans are blanched twice.
2. Grind the beans: Grind the blanched beans with 2 liters of hot water for 3 minutes using a blender on high speed. Work in batches and work carefully as this is hot.

# Soymilk

3. Strain the mixture: Cool the mixture until it is just warm to the touch and squeeze it through a cheesecloth to filter. Reserve the solids (the okara) for another use.
4. Simmer: Simmer the filtered liquid on the stove for 20 minutes. Stir occasionally. If desired, add sugar and/or salt plus other flavorings to taste.
5. To fortify with calcium, stir in about 1 ½ teaspoons calcium carbonate powder per liter of soymilk. Stir well before each use.

# Okara

- The okara is the solid material left behind after making soymilk or tofu
- Okara is a high-fiber food with many uses
- 1 cup of okara has 94 calories, 4g protein, and 5g fiber
- Okara can be worked into breads, soups, mashed potatoes, hot cereals, and stews
- Okara can even extend ground meats such as sausages and hamburger



# Soy Flour - *Wet heat method*

1. Blanch the beans: Bring 5 cups water to a boil for each cup of soybeans. Add a pinch of baking soda to the boiling water and then add the soybeans. Cook at a low boil for 20 to 25 minutes. Drain and rinse the soybeans in cool water.



# Soy Flour or Grits - *Wet heat method*

2. Dry the beans: Spread the beans in a single layer on a baking sheet and heat them in a low oven at 95 C ° (200 °F) until dry, which can be several hours. stirring occasionally. The beans may also be placed in the sun to dry for 2 or 3 days. Be sure the beans are clean before proceeding with the recipe.

# Soy Flour or Grits - *Wet heat method*

3. Grind to grits or flour: Use a grain mill, blender, or hand crusher to grind the beans coarsely into grits or more finely into flour. If desired, toast the grits or flour lightly in a dry skillet over moderate heat, stirring occasionally, to enhance the nutty flavor.



# Soy Flour or Grits – *Dry heat method*

1. Soak the beans: Cover the soybeans with several times their volume of water and soak for 8 hours. Drain the beans.
2. Bake the beans: Spread the beans in a single layer on a baking sheet and bake them in an oven at 350 °F (175 °C) for 15 minutes. Stir the beans and bake for 10 minutes longer, stirring after 5 minutes. The beans may also be baked in a covered pan over a campfire or cooking stove.
3. Grind as in the wet heat method.

# Green Soybeans or Edamame



- Fresh green soybeans
- Harvest the beans when pods have reached full size, bright green, and not yet begun to yellow
- They reach their maximum sweetness about 30 days after flowering
- The pods are fibrous and not eaten
- The seeds inside are easily and best removed after cooking

# Green Soybeans or Edamame

1. Bring a pot of water to a boil. Add the pods and boil for 4 to 5 minutes.
2. Drain the beans and cool them under running water.
3. *To serve in the pod* –Lightly salt and serve as an snack. To eat the beans from the pod, apply gentle pressure to the pod and pop the beans directly into the mouth. Do not eat the pod.



# Green Soybeans or Edamame

4. *To serve without the pod* – It is extremely difficult to remove the beans from the pod prior to cooking, but they slip out easily once cooked. Shell the cooked edamame by gently squeezing the pod to release the beans.



# Product Uses – Snacks

- Roasted soy nuts
  - Store in airtight containers in dry space
  - Room temperature
  - 3-8 weeks; heat and air causes rancidity
- Green soybeans or ‘edamame’
  - Refrigerate uncooked 2-3 days
  - Blanch and freeze
  - Blanch, chill up to 2-3 days or eat immediately



# Product Uses – Whole Soybeans



- Harvest when pods are fully yellow and soybeans are hard
- Pods should not yet have begun to break open
- Store uncooked, dry soybeans in cool, dry place
- Once cooked, store in refrigerator or freeze

# Product Uses – Whole Soybeans

- Cooked and whole: add to soups, stews, on fresh or cooked greens
- Cooked and mashed: add to soups, porridge, weaning foods
- Cook with flavorful ingredients such as onions or peppers
- Add to ground meats
- Substitute where other beans are used

# Product Uses - Soymilk

- Soymilk should be refrigerated
- Use refrigerated soymilk within 2-10 days
- Use in cooking cream sauces or soups
- Use as liquid in baking
- Make non-dairy versions of ice cream and yogurt
- DO NOT use as infant formula



# Product Uses-Soy Flour

- Store 3-6 months in dry, cool space
- Keep in closed container
- Refrigerate or freeze for longer shelf life
- Soy flour is just a finer grind than grits
- Use grits as you use whole soybeans-the need 20-40 cooking minutes to soften
- Add soy flour to baked goods, porridge, weaning foods

# Soy Flour for Function

- Crust
- Dough conditioning
- Emulsification
- Shortening
- Water binding



# Soy Flour for Function

- Water absorption increase
- Decrease fat absorption
- Emulsification
- Texture improvement
- Crust color improved
- Bleaching (dough whitening)
- Shelf life extended



# Function vs. Nutrition

- Include at 3-6% replacing wheat flour for function
- Include up to 20% for quick breads to affect protein and nutrition
- Add to yeast breads at 10-15% to increase protein about 40%
- Soy flour does not have gluten. Complete wheat flour replacement will not work

# Product Uses - Weaning Foods

- Complementary Foods or Weaning Foods can come in many forms:
  - Baked products
  - Beverages
  - Spreads
  - Most Common are dry powders that can be prepared as beverages, porridges, paps, ujis, etc. in the home by the caregiver
  - Micronutrient fortified is best



# Weaning Food Examples

Food	Energy (kcal)	Protein (g/100 g dry weight)	Carbohydrate (g/100 g dry weight)
<b>Traditional Weaning Foods From Africa</b>			
Corn pap	415	4	92
Maize pap	417	6	91
Millet pap	419	7	88
Millet pap + soymilk	420	19	74
Corn porridge	412	5	91
Millet porridge + soymilk	413	23	70
<b>Commercial Products</b>			
Lactogen	463	22	52
Similac	517	11	56
Cerelac	412	16	67

Onofiok; et al. 2006

# Summary

- Soy overview
- Nutrients in soy
- Soy ingredients
  - How to process soy
  - How to store and use the ingredients



# THANK YOU