Human Nutrition
Results and Perspectives

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Biomass and human nutrition

- Agro-food biomass:
  - Crop residues
  - Food industry residues
- Cereals:
  - Crop residues
  - Flour milling residues (bran)
- Exploitation of biomass “waste” for the recovery of nutrients: a double benefit
- “Circular” process

Milling industry by-products

- seed coat retains a considerable portion of macro- and micronutrients
- wheat milling by-products are almost exclusively intended for livestock and carry most of the nutrients present in the caryopsis:
  - proteins of high biological value
  - over 70% of vitamin B6
  - over 50% of vitamin B5
  - over 33% of vitamin B1
  - most of the Fe, Zn, Mg, K

Bioavailability of nutrients

- Today, it is only through repeated grinding that part of these substances can be extracted from bran, carrying with it, however, a high portion of fiber as well as subjecting the molecules of the nutrients to stress.

- The structure of the caryopsis protects nutrients and proteins from enzymatic degradation, thus ensuring optimized utilization during germination (D.I. Rhodes et al., Journal of Cereal Science, 2002).

- The availability and digestibility of nutrients are associated with quantity of fiber and particle size (T.M. Amrein et al., Lebensm.-Wiss. U.-Technol. 2003).

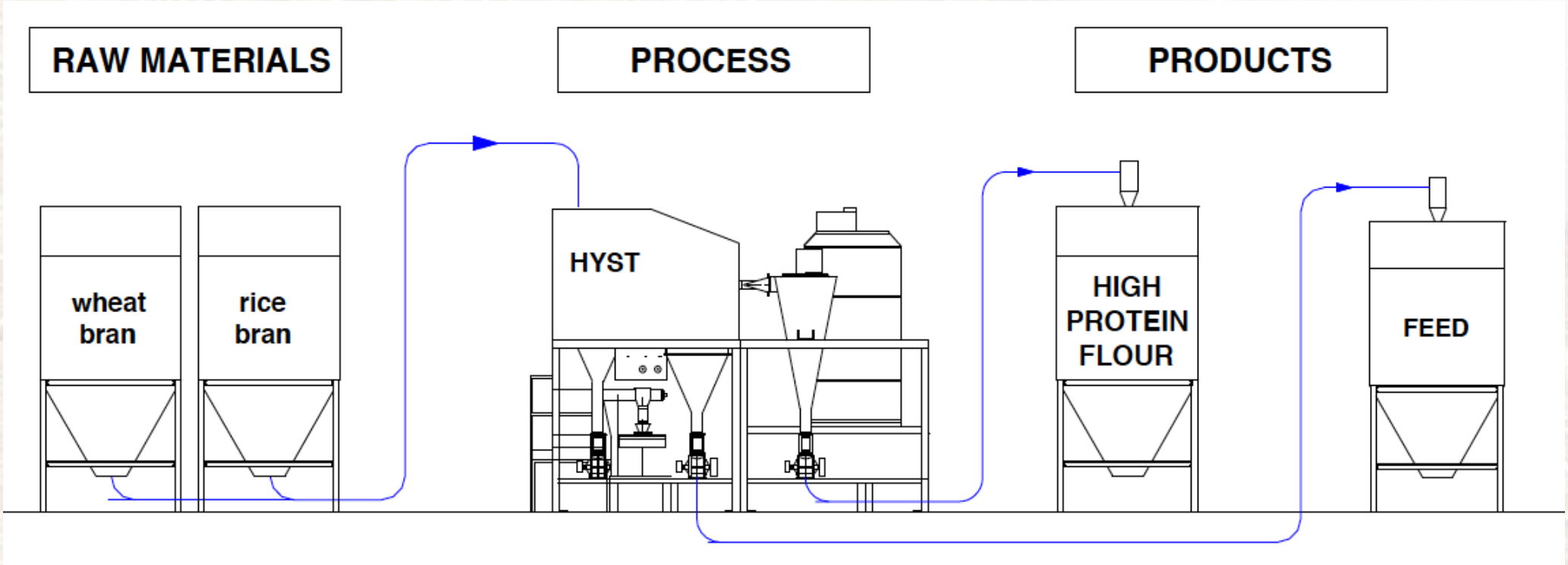
What are our options?

- wheat bran: the seed coat retains a considerable portion of macro- and micronutrients
  - conventional milling processes are not able to extract them
  - there are more “aggressive” processes but they extract these nutrients altering their organoleptic properties
    - Repeated stages of milling
    - Physical/chemical methods

Bran flour obtained from HYST

- quick and dry processing
- room-temperature processing
- high yield: up to 20%
- no alteration of organoleptic properties
- no waste to dispose of

Example of a process



Test results: macronutrients

Chemical composition (% d.m.)		
		Labelling according to Regulation (EC)1924/2006
Protein	21 - 24%	High protein content
Starch	48 - 55%	
Fats	3.3 - 3.5%	
Fibers	4.8 - 15%	
Minerals	3.5 - 4%	

A comparison of flours

Protein content of Hyst flour from wheat bran is:

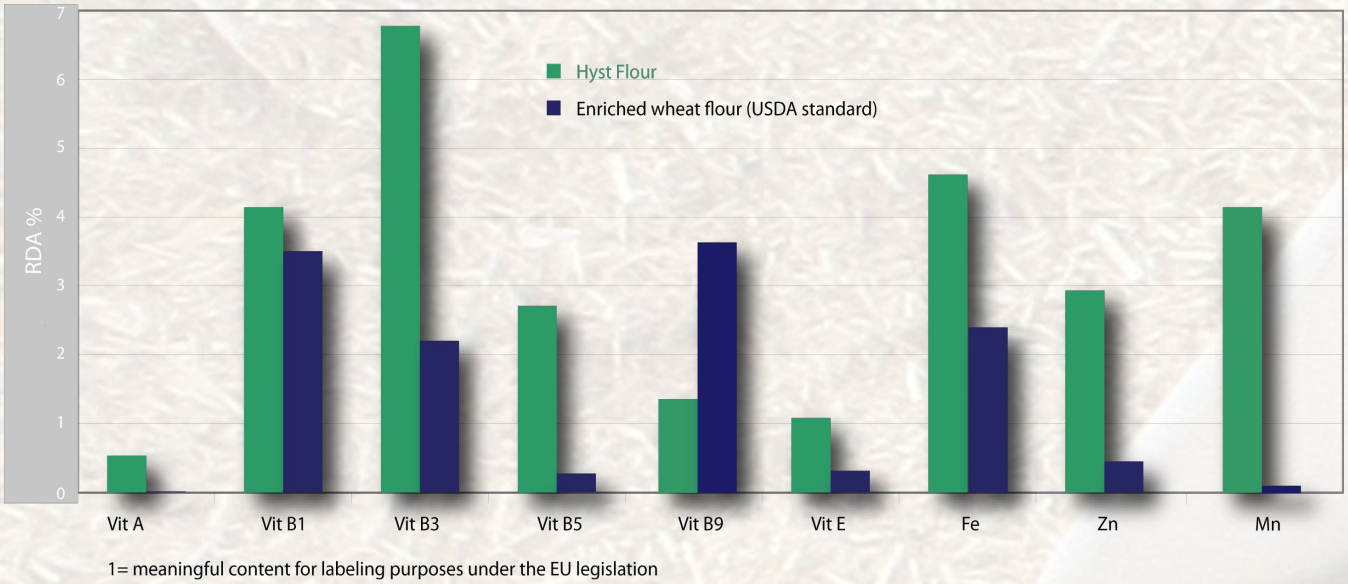
- twice that of regular “0” flour
- 1.6 times that of whole wheat flour
- 1.2 times that of protein mixes used in WFP food programs

Test results: Micronutrients

Vitamin and mineral content		
		Labelling according to Regulation (EC) 1924/2006
Vitamin E	1.39 mg/100 g	Source of Vit. E
Thiamine (Vit. B1)	0.93 mg/100 g	Source of Vit. B1
Niacin (Vit. B3)	18.3 mg/100 g	High in Vit. B3
Pantothenic acid (Vit. B5)	2.1 mg/100 g	Source of Vit. B5
Folic acid (Vit. B9)	77 ug/100 g	Source of Vit. B9
Iron	9.2 mg/100 g	High in Fe
Zinc	3.08 mg/100 g	High in Zn
Magnesium	271 mg/100 g	Source of Mg

“Natural fortification”

The totaly natural Hyst flours have a higher content of vitamins and minerals than that of artificially fortified products as can be seen by comparing Hyst flour with a fortified flour according to USDA standard



1= meaningful content for labeling purposes under the EU legislation

100 g of Hyst flour contains the recommended daily dose of vitamin B3 and over 60% of the daily dose of Vitamina B1 established by the European Food Safety Authority (EFSA) as promoter of brain function in children

Hyst Flours: Functional foods or supplements?

- A food can be regarded as functional if it is shown to have positive effects on one or more specific body functions that go beyond the normal nutritional effects in a manner that is relevant to the improvement of health and well-being and/or to the reduction of disease risk

- Examples of functional foods are foods that contain certain minerals, vitamins, fatty acids or dietary fiber and those that have been fortified with biologically active substances, such as active ingredients of plant origin or other antioxidants

- “Food supplements” are foodstuffs intended to supplement regular diets and which are a concentrated source of nutrients, such as vitamins and minerals, or other substances with a nutritional or physiological effect, in particular but not only aminoacids, essential fatty acids, fibers and plant sourced extracts, alone or in combination, in unit dose form

Market outlook

Italian market. For multivitamin health foods, supplements and functional foods the 2007 turnover was 1.5 billion euro and it almost peaked to 3 billion euro in 2010.

Global market. The pharma food sector is the only growing food sector and by 2020 it will represent 10% of the entire food market.
In Europe functional foods alone move more than 10 billion euro a year, and more than 20 in the USA.
The turnover of the entire pharma food sector will reach 200 billion euro in 2020.

International and EC regulations:
- due to increasing consumption of supplements and for consumer protection
- need to create a new common market.

EU Directive reference: 2002/46/EC

Vitamin B supplements

- Rice and wheat are the main sources of B vitamins for humans
- Refining removes a significant amount
- Widespread subclinical deficiency of B vitamins in industrialized countries
- Clinical deficiency in conditions of malnutrition and undernourishment

B-complex vitamins: deficiency symptoms

Vitamin	Deficiency symptoms
Thiamine (B1)	Beri-beri, polyneuritis, Wernicke-Korsakoff syndrome
Riboflavin (B2)	Growth problems, stomatitis, dermatitis
Niacin (PP, B3)	Pellagra with diarrhea, dermatitis and dementia
Pyridoxine (B6)	Peripheral neuropathy, epileptiform convulsions in infants, glossitis
Pantothenic Acid (B5)	Nausea, sleep disorders, coordination problems, fatigue
Biotin (B8)	Nausea, depression, dermatitis, muscle aches, fatigue

Source: Vitamin and mineral requirements in human nutrition: report of a joint FAO/WHO expert consultation, Bangkok, Thailand, 1998

Cereals in Africa

- Main contribution to nutriton in Africa
- Over 50% of calories and proteins are obtained from cereals (FAO), in a proportion much higher than that of indutrialized countries
- Rice husk:
  - contains up to 5 times more vitamin B1 than wheat bran
  - contains up to 3 times more vitamin B3 and B5 than wheat bran

Malnutrition and undernutrition

- Malnutrition is as serious a problem as hunger
- Improved access to vitamins and zinc would save more than 680,000 children every year (WFP Annual Report 2007)
- HYST flour from cereal by-products can alleviate deficiency related problems of:
  - B vitamins
  - A vitamins
  - Protein
  - Zinc
- 6,500,000 children under the age of 5 die of hunger and malnutrition every year. From 12-15 million tons of global production more than two tons of flour could reach each single child

Certifications

- The production of Hyst wheat flour is permitted in accordance with Chapter III, Paragraph 1, Article 12 of Presidential Decree 187/2001
- Hyst wheat flour is considered as a concentrated source of nutrients and therefore having the requirements for food supplements according to law

Ministry of Agriculture, Food and Forestry

Ministry of Health – Directorate-General for hygiene and food safety and nutrition – Offices I and IV

Collaboration perspectives

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Universities and scientific organizations of the countries involved in the project

Bits of Future: Food for All