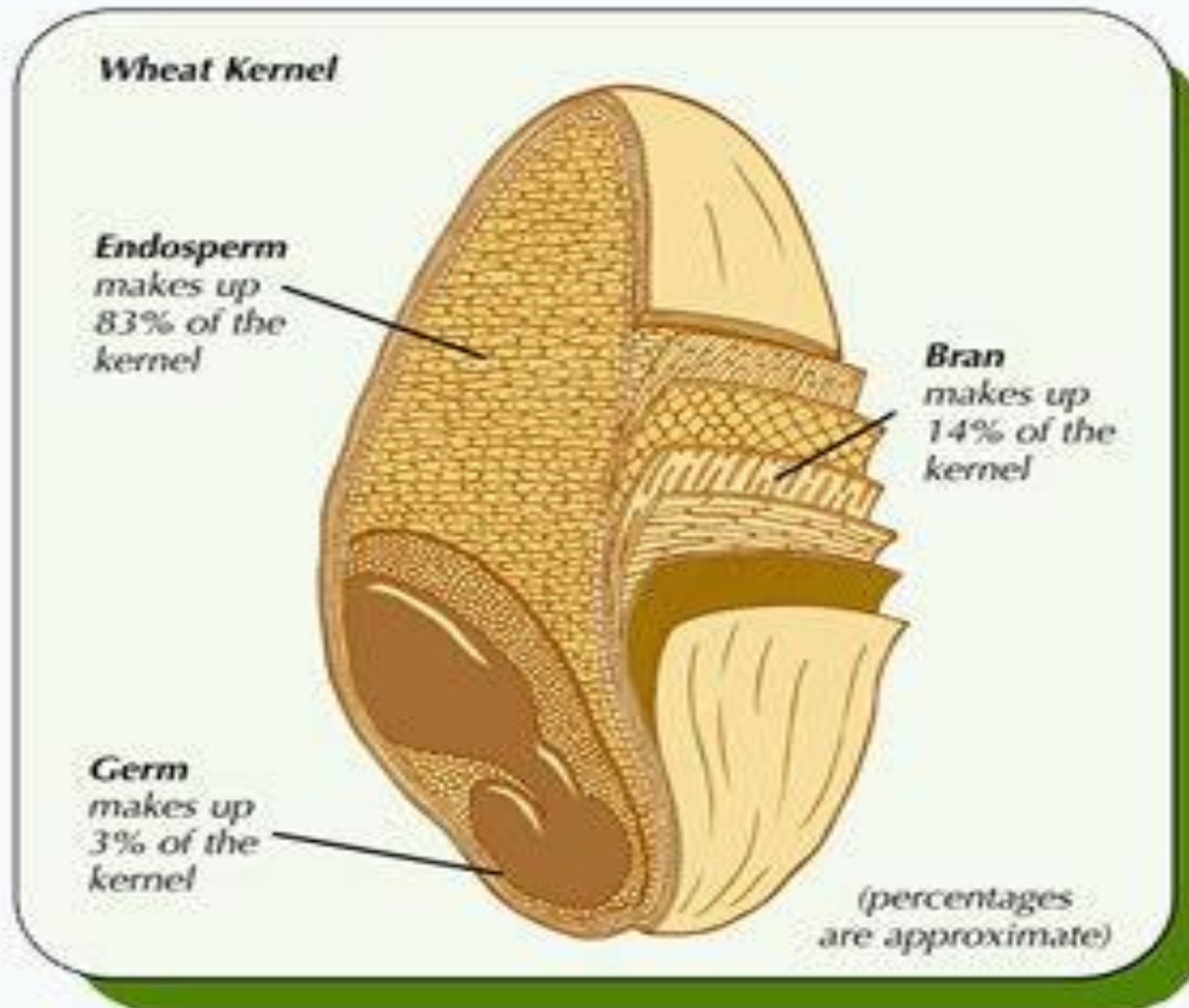


ESU 009– Cereals as functional foods (Wheat bran and rice bran)

Lecture 27



Structure of wheat



- Bran also known as miller's bran is the hard outer layers of cereal grain. It consists of the combined aleurone and pericarp.
- Contains proteins, omega 3 and omega 6 fatty acids and antioxidants
- Cereal bran is an excellent source of dietary fiber; for addition to food, it offers all the nutritional and nutraceutical benefits of whole grain

Bioactive compounds in wheat

Bioactive compound	Wholegrain wheat	Wheat bran	Wheat germ
α -Linoleic acid (18:3 $n-3$)	—*	0.16	0.53
Sulphur compounds	0.5	0.7	1.2
Total free glutathione	0.007	0.038	0.27
Fibre (as AOAC)	13.2	44.6	17.7
Lignins	1.9	5.6	1.5
Oligosaccharides	1.9	3.7	10.1
Phytic acid	0.9	4.2	1.8
Minerals and trace elements	1.12	3.39	2.51

B vitamins	0.0091	0.0303	0.0123
Vitamin E (tocopherols and tocotrienols)	0.0047	0.0095	0.0271
Carotenoids	0.00034	0.00072	—*
Polyphenols	0.15	1.10	>0.37
Phenolic acids	0.11	1.07	>0.07
Flavonoids	0.037	0.028	0.300
Lignans	0.0004	0.0050	0.0005
Alkylresorcinol	0.07	0.27	—*
Phytosterols	0.08	0.16	0.43

- The majority of beneficial antioxidant phytochemicals (including phenolic acid and alkylresorcinols) in wholewheat grain are present in the germ/bran fractions.
- In wholegrain wheat flour, the bran/germ fractions contained 83% of total phenolic content.
- Arabinoxylan is an important source of antioxidant phenolic compounds, including alkylresorcinols and phenolic acids (including ferulic acid).
- When delivered to the colon complexed with arabinoxylan, these phenolic compounds may be released by fermentation to have potentially beneficial effects

- Ferulic acid like most of the phenolic compounds in wholegrain wheat fractions exists in bound form (approximately 76%), usually bound to arabinoxylans and other indigestible polysaccharides.
- Although processing (such as thermal treatments and fermentation) may improve the release of ferulic acid and other bound phenolics.
- Other biologically important components in wholegrain fractions include sulphur containing amino acids (methionine and cystine). These two amino acids are found in higher levels in the wheat bran (0.6%)
- Methionine and cysteine are precursors of glutathione (an intracellular antioxidant) and contribute to the control of cell oxidative status

- Wheat bran and wheat germ fractions also contain almost all of the B-group vitamins: thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin and folates, with wheat bran and wheat germ fractions containing about 30.3 mg and 12.3 mg B vitamins/100 g respectively.
- They are also a source of vitamin E and the carotenoids.
- Other bioactives found in wholegrain fractions (such as ferulic acid, magnesium, zinc, copper, inositols, policosanol and melatonin) have also been suggested to have a role in promoting mental health

Wheat bran and health benefits

- Wheat bran may have a beneficial effect on the prevention of diseases, including some cancers (in particular colorectal cancer), CVD, obesity and some gastrointestinal diseases, including constipation and irritable bowel syndrome (IBS)

- **Wheat bran and cancer**
- **Wheat bran and CVD**
- **Wheat bran and obesity**
- **Wheat bran and digestive health**
- **Wheat bran and IBS**
- **Wheat bran as a prebiotic**

- The rice bran obtained from different varieties of colored rice are rich in antioxidant compounds viz polyphenols, carotenoids, vitamin-E and tocotrienol which help in preventing the damage of body tissue and oxidative damage of DNA.

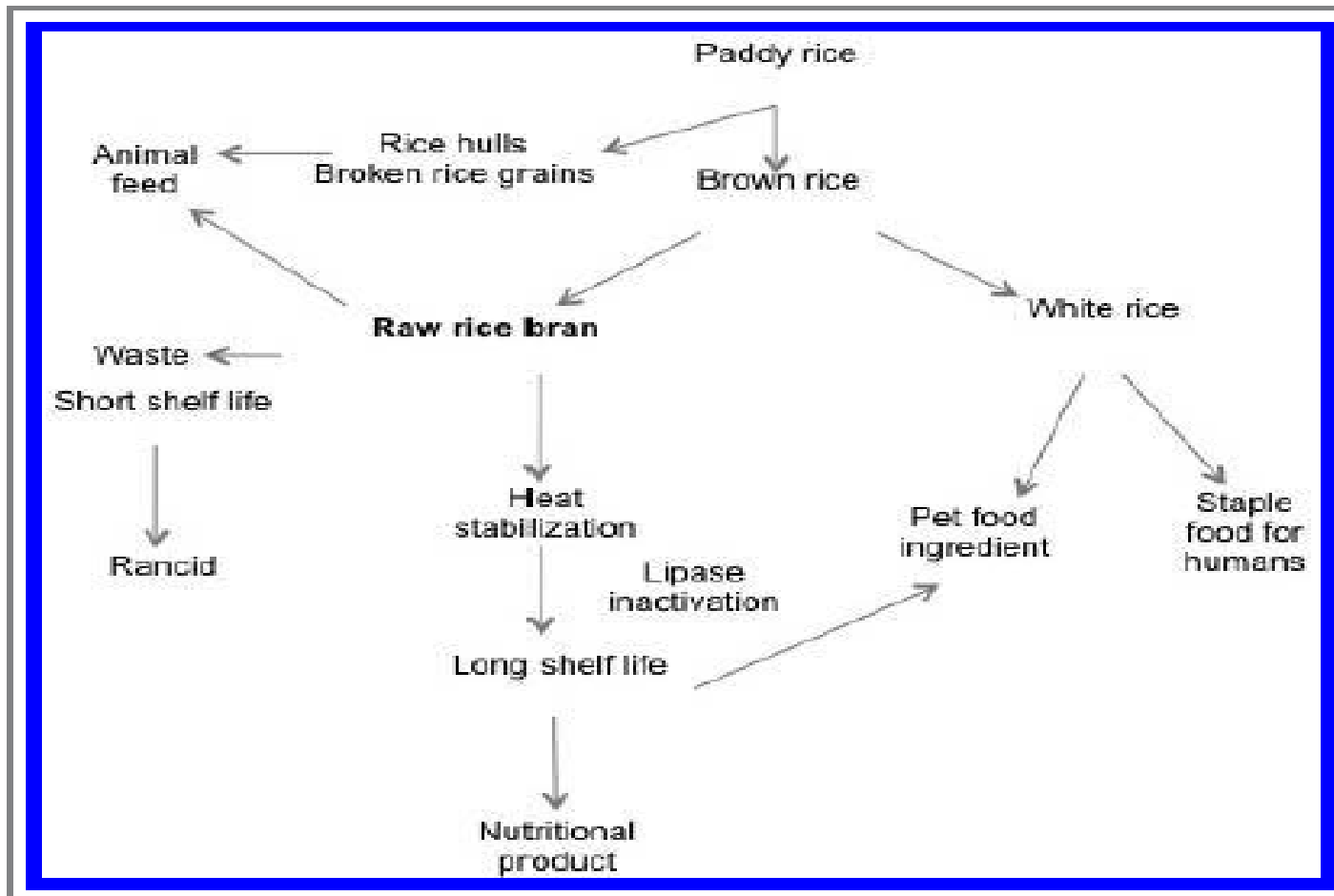


Figure 1—Schematic depiction of rice production and processing for bran.



- Bioactive food components in rice bran include oryzanol, tocopherols, tocotrienols, polyphenols (ferulic acid and α -lipoic acid), phytosterols (β -sitosterol, campesterol, and stigmasterol), and carotenoids (α -carotene, β -carotene, lycopene, lutein, and zeaxanthin).
- Rice bran also contains essential amino acids (tryptophan, histidine, methionine, cysteine, and arginine) and micronutrients (eg, magnesium, calcium, phosphorous, manganese, and B-vitamins)

Health benefits of rice bran

Lowering cholesterol:

- RBO have hypocholesterolemic influence resulting from selective decrease of Low Density Lipoprotein (LDL) Cholesterol (C) fraction.
- This discrepancy could be attributed to the presence of high concentration of unsaponifiables including phytosterols, oryzanols, and tocotrienols.
- Gamma-oryzanol was also found to have similar hypocholesterolemic effects.

Coronary heart disease (CHD)

- The consumption of dietary fiber that is present in cereals have shown to reduce the risk of coronary heart disease (CHD) mortality by reducing blood pressure, lowering blood cholesterol levels and improving insulin sensitivity.

Colorectal cancer

Anti - Ageing / Cosmetics and Personal Care

- The oryzanol component acts as a protective agent against UV light induced lipid peroxidation and hence can be used as a potent sunscreen agent
- The ferulic acid and its esters present in gamma oryzanol stimulate hair growth and prevent skin ageing
- Tocotrienols when applied to the skin penetrate and get absorbed rapidly

- Rice bran oil is rich in phytosterols, sterolins and gamma-oryzanol, a compound with antioxidant properties which may modulate the immune system.
- The gamma oryzanol of rice bran reduced a prominent amount of elevated serum levels in hypothyroid patients
- It is used as an ergogenic supplement by body builders and athletes

- The nutraceuticals developed from the soluble and fiber fractions of rice bran control both type I and type II Diabetes Mellitus
- Many colored rice cultivars have a range of micronutrients including a rich reserve of β -carotene which can be converted to vitamin-A

Thank you

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