# Effects of wheat bran on quality of cereal products and potential application in fried cereal snacks

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# Presentation outline

- Introduction
  - Wheat bran (WB) composition
    - Health benefits of wheat bran
      - WB for oil reduction
        - Effect of WB on food quality
          - Future direction
          - Conclusion

# Wheat (*Triticum aestivum*)

- Wheat - a leading cereal crop is mainly utilized for human consumption and livestock feed.

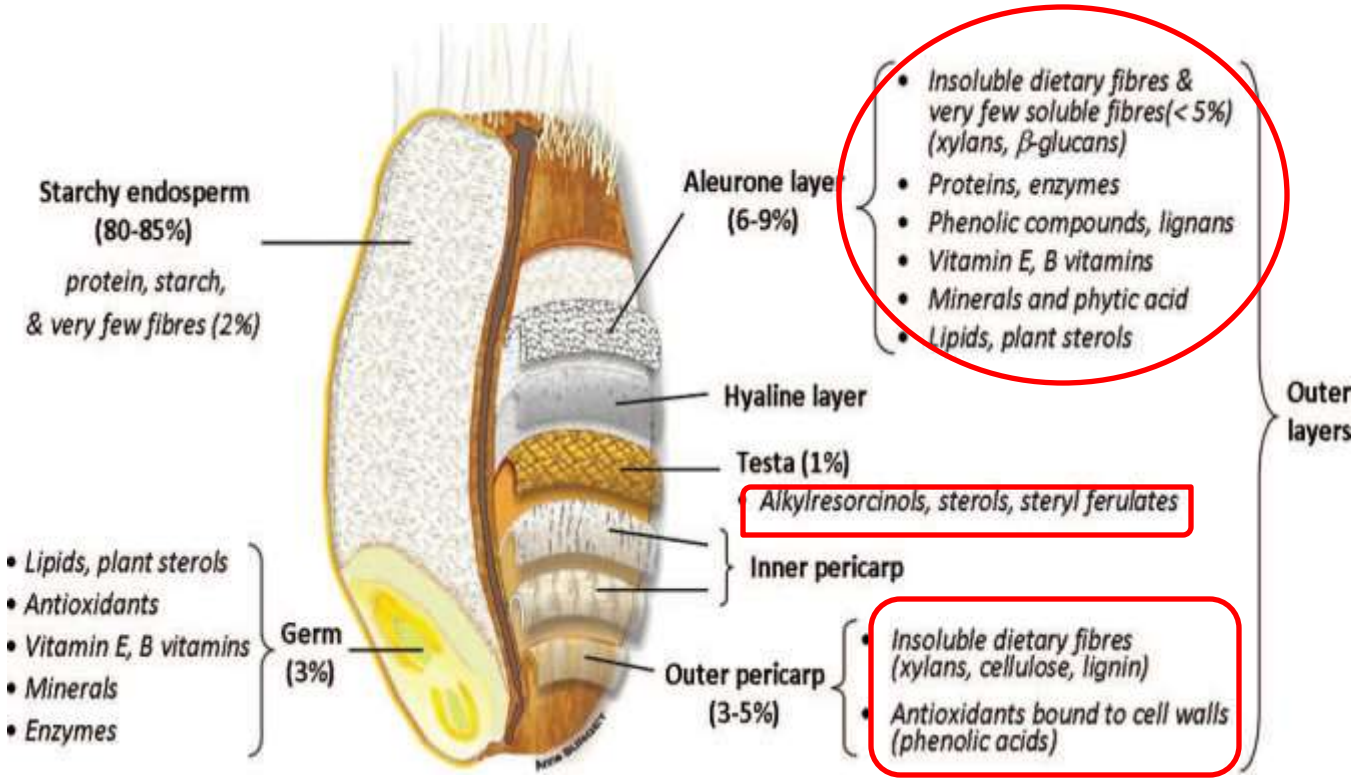
- Wheat bran-enriched products include bread, muffin, bran flakes, yoghurt, *tarhana* soup, doughnuts, pasta, noodles and biscuits.

- The use of wheat bran (WB) for human consumption has increased gradually over the years. Globally, the number of WB-incorporated food products increased from 52 in 2001 to approximately 800 in 2011.

Some wheat bran brands in South Africa

# Wheat grain structure

- The outer layers of the wheat kernel make up the bran. Wheat bran is rich in minerals, fibre, B vitamins and bioactive compounds which are known to possess health-promoting properties (Onipe *et al*., 2015).




Surget & Barron (2005) & Brouns *et al*. (2012).

# Wheat bran-enriched products

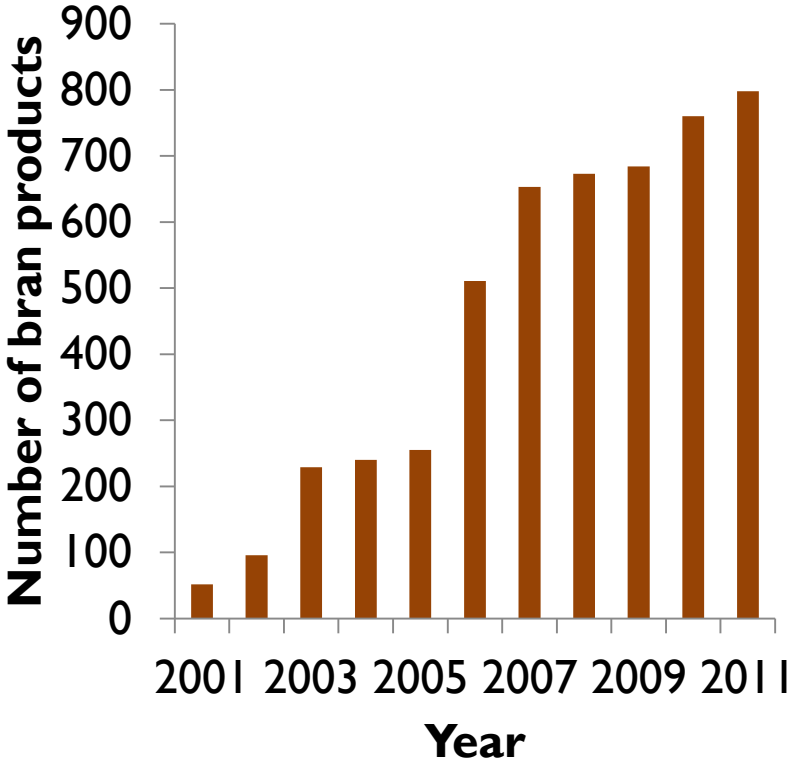
Bran flakes

Brown bread

Bran muffins

Bran yoghurt

Bran *vetkoek*




Number of wheat bran containing products, launched between 2001 – 2011.

http://db2.datamonitor.com/product-launch-analytics
Accessed: 2015-04-03

# Proximate composition of wheat bran

| Proximate composition | Range (% dm) | Reference |
|---|---|---|
| **Dietary fibre** | 33.4 – 63.0 | Elleuch *et al.* (2011); Curti *et al.* (2013) |
| **Moisture** | 8.1 - 12.7 | Noort *et al.* (2010); Curti *et al.* (2013) |
| **Ash** | 3.9 - 8.10 | Hemery *et al.* (2007); Curti *et al.* (2013) |
| **Protein** | 9.60 -18.6 | Curti *et al.* (2013); Yan *et al.* (2015) |
| **Total carbohydrates** | 60.0 – 75.0 | Javed *et al.* (2012) |
| **Starch** | 9.10 - 38.9 | Curti *et al.* (2013); Yan *et al.* (2015) |

# Some phytochemicals in wheat bran

| Phytochemicals | Range (µg/ g) | Reference |
|---|---|---|
| **Alkylresorcinol** | 489 – 1429 | Luthria *et al.* (2015) |
| **Phytosterols** | 344 – 2050 | Fardet (2010) |
| **Ferulic acid** | 1376 – 1918 | Kim *et al.* (2006); Brouns *et al.* (2012) |
| **Bound phenolic compound** | 4.73 – 2020 | Kim *et al.* (2006); Brewer *et al.* (2014) |
| **Flavonoids** | 3000 – 4300 | Fardet (2010); Brewer *et al.* (2014) |

# Micronutrients in wheat bran

| Micronutrients | Range (mg/ 100 g) | Reference |
|---|---|---|
| Phosphorus | 900 – 1500 | Fardet (2010); Brouns *et al.* (2012) |
| Magnesium | 530 – 1030 | Brouns *et al.* (2012) |
| Zinc | 8.3 – 14.0 | Brouns *et al.* (2012) |
| Iron | 1.9 – 34.0 | Fardet (2010); Brouns *et al.* (2012) |
| Manganese | 0.9 – 10.1 | Fardet (2010); Brouns *et al.* (2012) |
| Vitamin E | 0.13 – 9.5 | Fardet (2010) |
| B Vitamins | | |
| Thiamin (B1) | 0.51 – 1.6 | Fardet (2010) |
| Riboflavin (B2) | 0.20 – 0.80 | Fardet (2010); Brouns *et al.* (2012) |
| Pyridoxine (B6) | 0.30 – 1.30 | Brouns *et al.* (2012) |
| Folate (B9) | 0.088 – 0.80 | Fardet (2010) |

# Potential health benefits of wheat bran

**Wheat bran**

Dietary fibre

- Laxative effect
- Colon cancer prevention

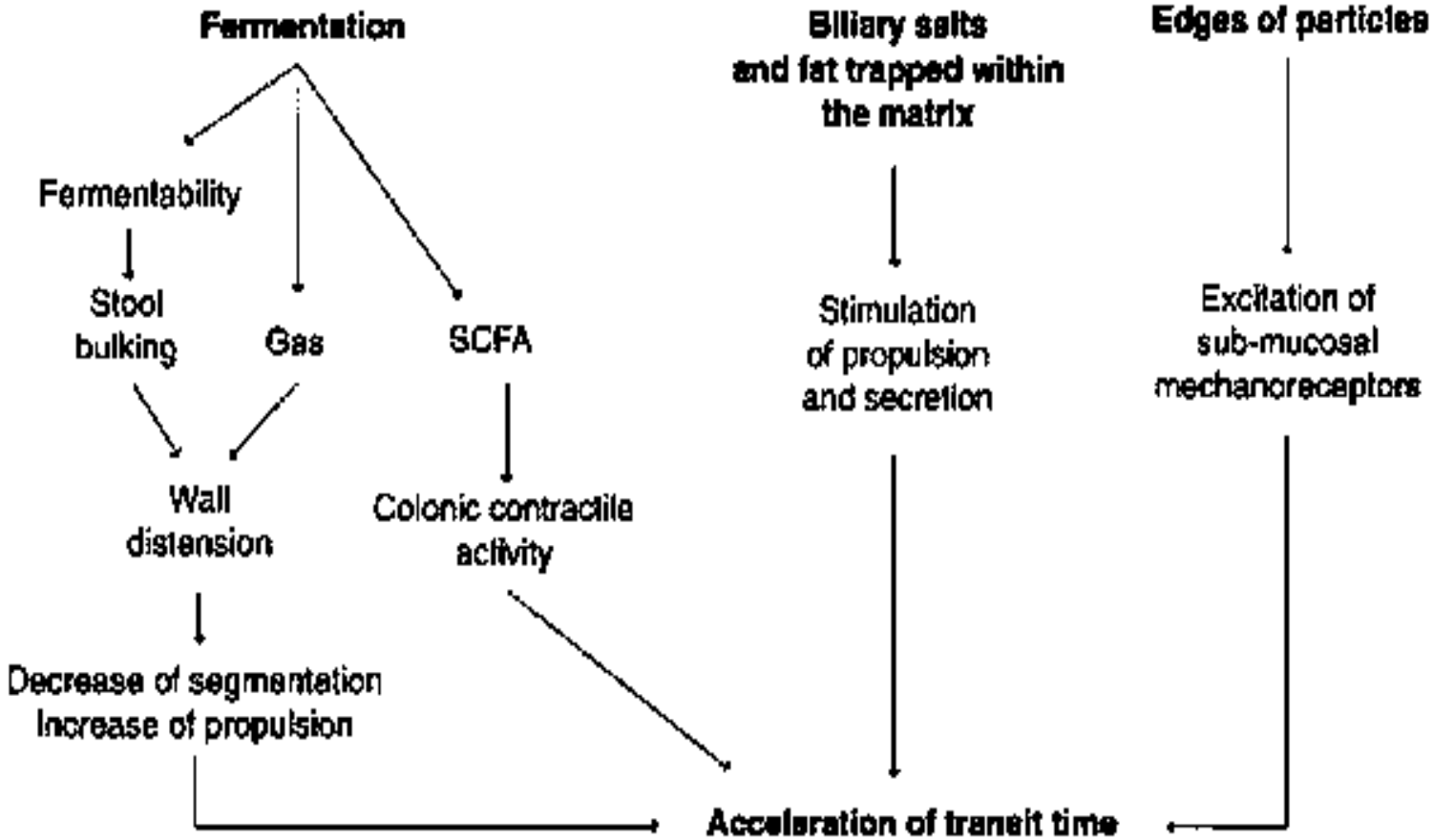
Phenolic compounds

- Antioxidant properties
- Inhibition of low density lipoprotein oxidation

Phytosterols

- Plasma cholesterol reduction

# Potential mechanism of wheat bran fibre on colon transit time



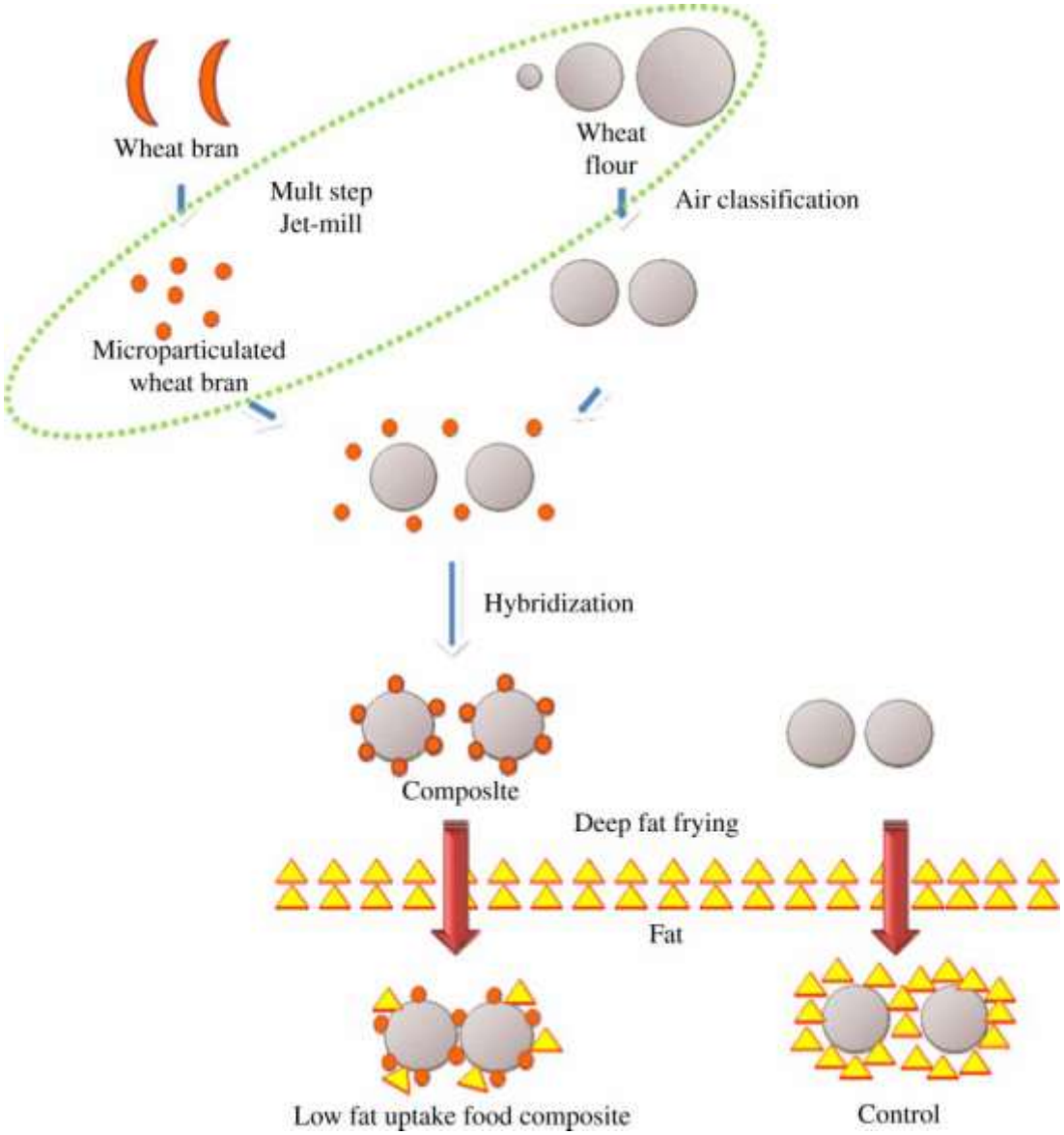

http://www.fao.org/docrep/w8079e/w8079e0l.html Accessed: 2014-10-15.

# Wheat bran application in fried cereal snacks

| Authors | Food | Wheat bran (%) | Oil reduction (%) |
|---|---|---|---|
| **Yadav & Rajan 2012** | *Poori* | 6 – 12 | 20 |
| **Kim *et al.*, 2012** | Doughnut | 1 – 10 | 9.4 |

- Frying is a dehydration process which involves heat & mass transfer.
- Use of wheat bran in fried cereal snacks for oil reduction is not so common.
- Wheat bran serves as a barrier that prevents the migration of oil in the fried food.
- Factors to also be considered is the particle size of wheat bran: Kim *et al.* (2012) used a 6.87 μm wheat bran particle size while Yadav & Rajan (2012) used the common wheat bran with >1000 μm.

# Dry particle coating system schematics.




Kim *et al.*, 2012

# Effects of wheat bran (WB) addition on quality of cereal products

| Food | WB supplementation (%) | Effect of WB on food quality | Reference |
|---|---|---|---|
| **Biscuit** | 5 – 30 | Dough pasting viscosity reduced with bran addition. DF and protein level increased with increasing bran addition. Low gluten network led to crumbliness of biscuit. Content of digestible starch reduced with increased bran addition | Sozer *et al.* (2014) |
| **Bread** | 0 – 20 | Reduced crumb luminosity and specific volume. Increased crumb moisture content. Good sensory attributes with increase in WB addition | Almeida *et al.* (2013) |
| | 8.9 – 9 | Increase in total dietary fibre of all breads. Lower a* and b* values in crusts of composite* bread compared to control. Reduced specific volume loaf volume with increase in WB addition | Pavlovich-Abril *et al.* (2014) |
| | 7 – 25 | Hardness and springiness increased; loaf volume reduced with bran addition | Kim *et al.* (2013) |
| **Pasta** | 20 – 40 | WB addition increased ash, total dietary fibre, protein content, chewiness and adhesiveness of pasta. Pasta had harder structure beyond 20% WB content as well as a lingering after taste in the mouth which resulted in lower sensory scores. | Sobota *et al.* (2015) |
| **Noodles** | 2 – 6 | With increase in WB addition, dough sheet had reduced L values while a* and b* values increased. Increase in tensile strength and water absorption of cooked noodles. | Song *et al.* (2013) |
| **Doughnut** | 1 – 10 | Fat content of doughnuts reduced at 5 and 10% bran addition. Doughnut had increased volume and darker colour with increase in bran content. | Kim *et al.* (2012) |

# Future direction

- Intentional use of wheat bran (WB) in other fried foods aside cereal products.
- Comparison of oil reduction using WB and other cereal brans.
- Effect of frying on bio-accessibility of bioactive compounds in WB.
- Estimation of consumer acceptability of wheat bran-enriched fried foods.
- Dissemination of information regarding oil reduction potential of WB.

# Conclusion

- Wheat bran can be regarded as a functional food ingredient.
- Consumption of wheat bran coupled with other lifestyle changes can help reduce risk of obesity- a risk factor for other non-communicable diseases.
- Wheat bran has potential in oil reduction of fried products- serving as a barrier for oil migration into the food.
- Healthier food option from fried foods with reduced oil content.

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