



Sensory aspects of whole grain products

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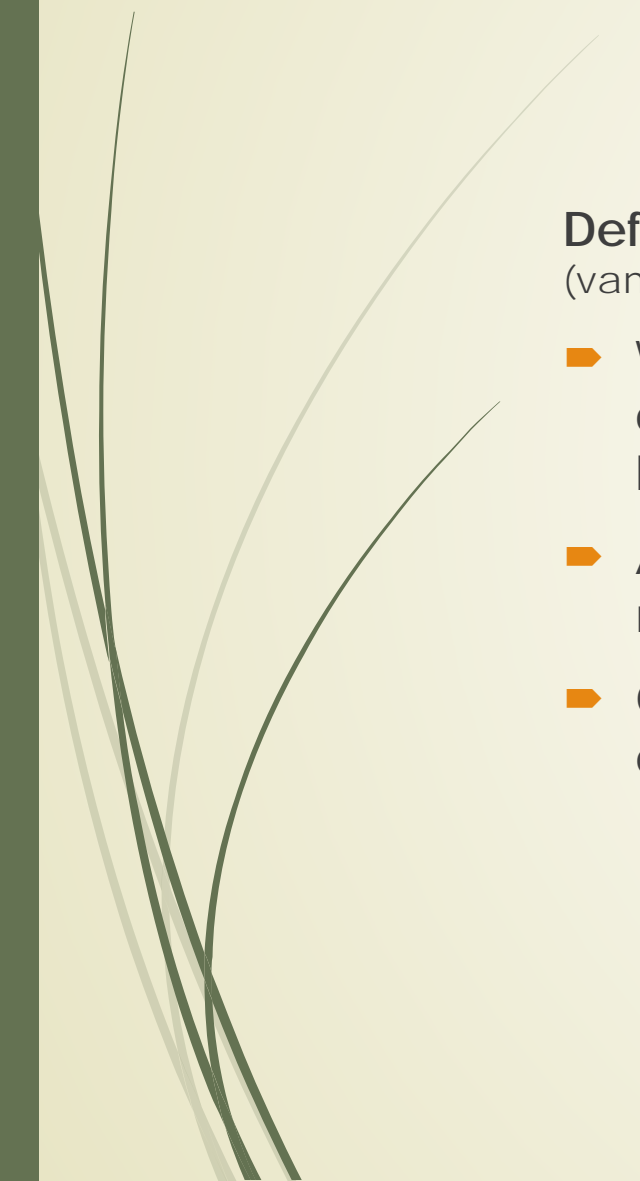
Ljubljana, 29.3.2022



Whole grain ingredient - definition

Definition of Whole Grain as a Food Ingredient – Whole Grain Initiative

(van der Kamp et al. Nutrients. 2022)

- ▶ Whole grains shall consist of the intact, ground, cracked, flaked or otherwise processed kernel after the removal of inedible parts such as the hull and husk.
 - ▶ All anatomical components, including the endosperm, germ, and bran must be present in the same relative proportions as in the intact kernel.
 - ▶ Oilseeds, pulses and legumes are not included in any definitions nor in dietary recommendations for whole grains (Seal et al. Br. J. Nutr. 2016).
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Whole grain food - definition

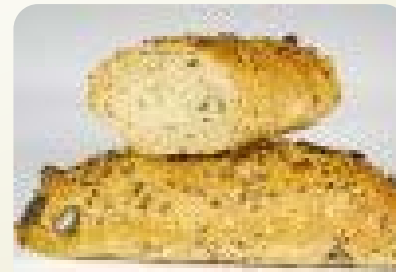
Definition of a Whole-Grain Food – Whole Grain Initiative

(van der Kamp et al. Nutrients. 2022)

- ▶ A whole-grain food shall contain at least 50% whole-grain ingredients based on dry weight.

Requirements for designating the **presence of 'whole grain' front-of-pack**

- ▶ Foods containing a minimum of 25% whole-grain ingredients based on dry weight, may make a front-of-pack claim on the presence of whole grain but cannot be designated 'whole grain' in the product name.

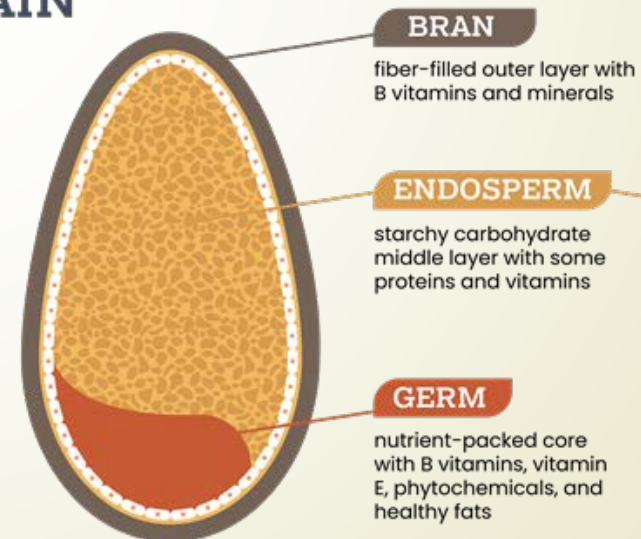


- Grains are staple foods and constitute a major source of carbohydrate, protein and fiber for the world's population (BNF 2004).

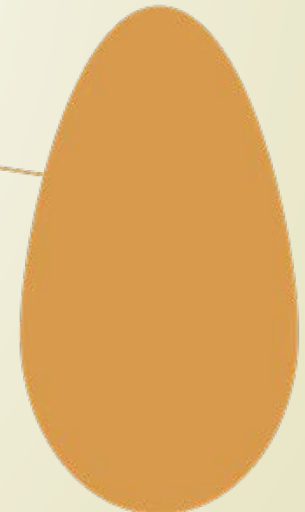
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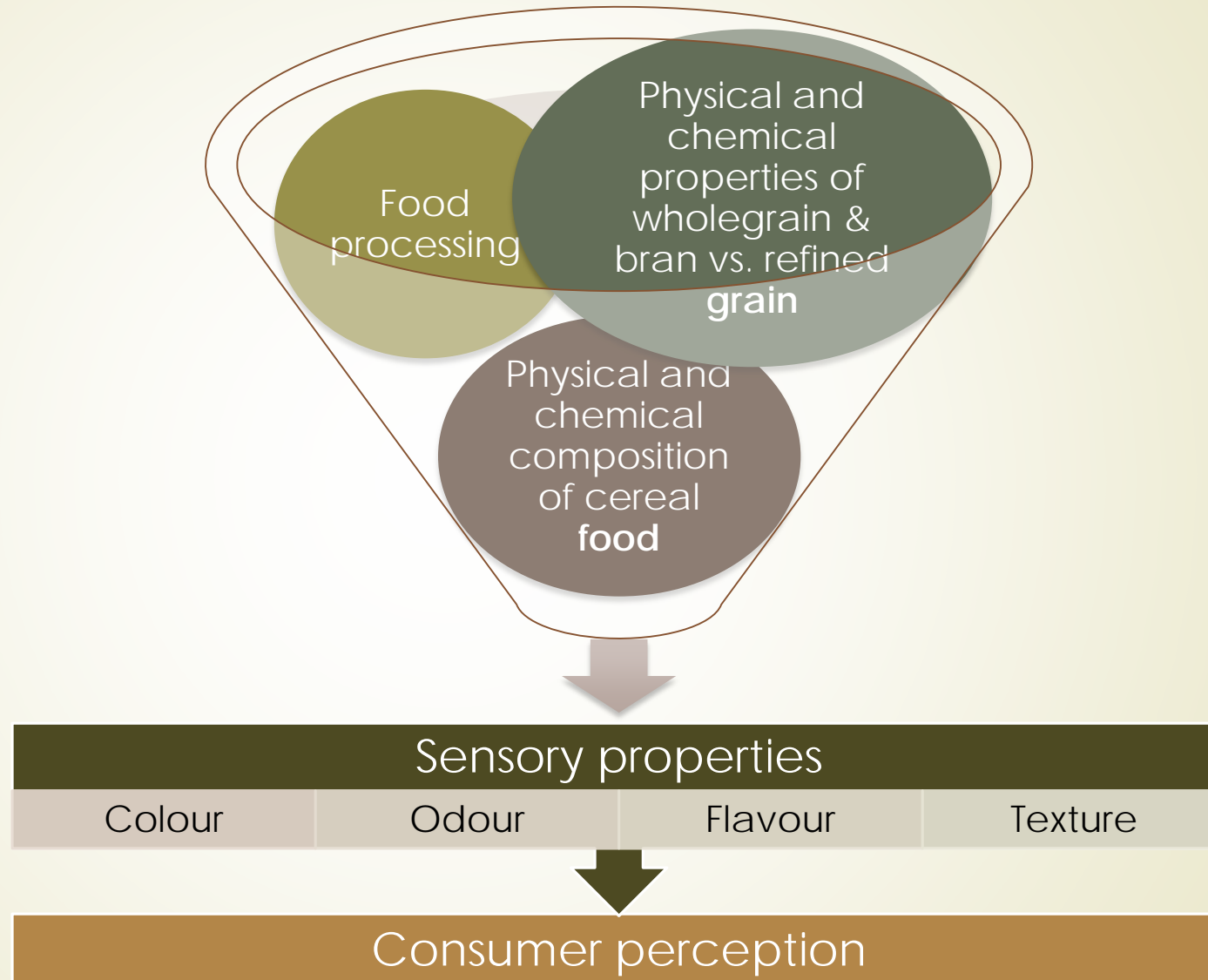
- vitamins (B, E vitamins),
- minerals (zinc, phosphorus, magnesium, and iron),
- bioactive compounds (antioxidants, polyphenols).

WHOLE GRAIN



REFINED GRAIN








Sensory active compounds

- ▶ Wholegrain and bran contain flavour-active compounds, flavour precursors and resistant cell wall structures causing changes in flavour and texture during processing.
 - ▶ Volatile: aldehydes, ketons, alcohols
 - ▶ Non-volatile: amino acids, fatty acids, sugars, peptides, **phenolic compounds**
- ▶ Bitter taste, astringency, pungency
 - ▶ Phenolic compounds are located unevenly in the outer layers of grain – differently flavor-active milling fractions.
 - ▶ Increased knowledge on flavor formation has led to the possibility to not only measure but actually also design the flavour.
- ▶ Processing defines the structure and texture of cereal foods - important determinants of sensory quality and product stability.

Sensory properties

- ▶ Descriptors of sensory properties
 - ▶ Colour: dark brown, greyish
 - ▶ Odour: sweet dairy, wheaty, bitter, sour, phenolic-like, browned, yeasty
 - ▶ Flavour: bitter, sweet, grainy, astringent, pungent, malty
 - ▶ Texture: hard, firm, tender, gritty, coarse, crispy

Wholegrain	Product	Examples of typical sensory attributes
Wholegrain wheat	Bread	Dark colour, 'speckled' appearance Coarse, hard texture Nutty odour Bitter/ sour taste Grain-like, 'seedy' flavour, malted note, musty
	Biscuit, cracker	Astringent High wheat, toasted and earthy notes
White wheat	Bread	Light colour Only slight grain-like flavour or malted note
	Biscuit, cracker	Only slight wheat, toasted and earthy notes; strong dairy note



Sensory properties important to consumers

- ▶ Intrinsic properties
 - ▶ Texture
 - ▶ Odour and flavour = freshness of bread
 - ▶ Colour and flavour = pasta acceptance
- ▶ Extrinsic
 - ▶ Health information induces sensory and hedonic expectations. Important that these expectations are fulfilled during consumption
- ▶ Strategy 1: Whole grain foods with sensory characteristics comparable to refined grain foods.
- ▶ Strategy 2: New appealing product concepts as well as tailored communication strategies focused towards younger consumers.

Sensory properties

Product	Examples of challenges in texture of whole grain foods
Bread	Reduced volume Dense, hard (rye); sticky (oat, barley) texture Increased crumbliness (reduced cohesiveness)
Biscuit	Increased water absorption Harder, coarser texture Increased crumbliness, dry mouthfeel
Extruded snacks	Reduced expansion Reduced crispiness Increased hardness and density
Pasta	Lower firmness Higher adhesiveness Increased surface roughness; harder texture

Adapted after: Heiniö et al. Trends in Food Science & Technology. 2016

Possibilities for improvement of sensory characteristics

Process	Flavour modification	Texture improvement	Shelf life
Bioprocessing	Flavour of bread Decreased staleness (longer freshness)	Higher volume (bread) Increased expansion (extrudates)	Prolonged (bread)
Milling and fractionation	Type of milling technique (roller / stone)		
Particle size		More spread (biscuits), increased expansion and crispiness (extrudates)	
Selection of raw material	Milder flavour (lighter wheat var.)		
Masking agents	Sweeteners (breakfast cereals), salt (pasta, rice)	Addition of gluten, emulsifiers, enzymes	

Product concepts and tailored communication strategies

Self-reported benefits of eating WG	Barriers for sufficient intake
perceived naturalness	taste preferences of the family
high fiber content	cooking skills
improved satiety and increased energy levels	price and availability of WG products
superior taste	

Kuznesof et al. Appetite. 2012

Nutritional concern:

- 50% consumers from the “salt sensitive” cluster chose whole grain bread as their preference, only 10% chose white bread.
- Approximately 20% of the “salt adherent” cluster chose whole grain bread as their preference is for white bread.

Kuhar et al. Foods. 2020

Product concepts and tailored communication strategies

- ▶ Liking and acceptability of whole grains increases with a 6-week exposure but preferences for foods varying in taste and fat content are not altered.
 - ▶ Mere exposure to WG foods represents a feasible and easily applied behavioral strategy for increasing consumption of WGs.
 - ▶ Significantly increased WG consumption.
 - ▶ Exposure to WG products resulted in improved ratings of liking, flavor, texture, and willingness to include WG in the regular diet.



De Leon et al. Current developments in nutrition, 2020



Conclusions

- ▶ Encouraging consumers to focus on enjoyment of the taste may be more effective than emphasizing the health benefits of whole grain consumption.
De Leon et al. Current developments in nutrition, 2020
- ▶ There is a need to take the variation between different cultures, traditions and eating habits into account when introducing healthy cereal based products to the market.
- ▶ Sensory appeal remains a key food choice factor.

Thank you!

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