

Pasta and Gluten: Facts and Fakes

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How Traditional Pasta are made ?

- Only one raw material: Durum wheat
- Primary processing : Extraction of the starchy endosperm in form of semolina
- Pasta processing :
 - Hydration
 - Mixing
 - Forming: sheeting or cold extrusion (< 55°C)
 - Drying
- Sensorial attributes
 - Yellow color
 - High capacity to hold water during cooking with low amount of solid losses
 - Texture : firm and elastic
 - Surface condition : no stickiness, no disintegration



Physicochemical Basis of Pasta Quality

Pasta processing consists in developping a protein network able to entrap starch granules during cooking

• Starch Swelling and Gelatinisation

 Protein Network forming and denaturation

Disulfid bond (elasticity)

Non Covalent bond (viscosity)





Gluten (wheat) Related Pathogenesis



Prevalence: 0.7-1.5%

Global Social Media Hype : Eating wheat makes you fat and sick





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REASONS FOR PURCHASING 'GLUTEN-FREE' FOODS





GRAIN BRAIN

The Surprising Truth About Wheat, Carbs, and Sugar - Your Brain's Silent Killers



Gluten-Free is healthy !



Source: The Hartman Group's Health & Wellness 2015 and Organic & Natural 2014 reports © 2015 The Hartman Group, Inc. All rights reserved. www.hartman-group.com

How to Prepare Gluten Free Pasta ?

- Gluten Free pasta should have the same sensorial attributes as traditionnal pasta :
 - Color

– Cooking Quality

- Mixing different raw material: Flour and/or starch products without gluten content
- Adding or not additives for color
- Adapting pasta processing
 - Modifying starch properties
 - Additives for cooking quality

How to Replace Gluten Functionality ?

Modifying the starch components in order to :

- 1. Create a new organised structure to give a form to pasta during extrusion (binding properties)
 - Heat-treated flours and starches
 - Extrusion cooking
- 2. Limit starch swelling and solubilisation during cooking
 - High-amylose content (starch)
 - Additives to complex amylose : Emulsifiers (mono and diglycerides)
 - Other texturing ingredients : hydrocolloids (guar, Xanthan, CMC, etc.)

Commercial GF Pasta Ingredients

Starch sources	Protein sources	Additives
Rice (flours and starches) Corn (flours and starches)	Protein isolates from pea or lupin	Hydrocolloids and gums Xanthan Guar
Pseudocereals : (flours) • Buckwheat, • Quinoa •	Egg	Emulsifiers • Mono-glycerides • Di-glycerides
Potato and tubers (starch)	Whey	Inulin
	Legume (flour)	Aroma, cane sugar syrup, salt

Sources:

Mariotti et al. (2011) J. Cereal Sci.53: 319-327 Marti and Pagani (2013) Trends Food Sci. Technol. 31: 63-71 web sites of different French supermarkets and health food stores

Some Examples of GF Pasta



Rice pasta





Lentil Pasta



Durum Pasta



Buckwheat Pasta



Quinoa Pasta

Macronutrients of Traditional and GF Pasta

Pasta	Protein (%)	Total Carbohydrates (%)	Total Lipids (%)	Fiber (%)
GF pasta	11.2	80.8	5.5	2.4
Durum pasta	13.8	78.4	2.6	5.3

Sources: Miranda et al. (2014) Plant Foods Hum. Nutr. 69: 182–187 Means based on 15 GF products and 38 non GF pasta

Micronutrients of Traditional and GF Pasta Minerals

Products	Minerals (mg/100 g)						
	Ca	Fe	Mg	Ρ	К	Na	Zn
GF pasta	19	1.46	77	224	197	326	1.44
Durum pasta	25	2.46	90	266	328	6	2.19

Source: http://ndb.nal.usda.gov/ndb/foods

Micronutrients of Traditional and GF Pasta Vitamins

Products		Folate (µg/100 g)				
	Thiamin	Riboflavin	Niacin	B6	E	
GF pasta	0.25	0.08	1.99	0.16	0.11	30
Durum pasta	0.25	0.14	5.19	0.21	0.28	43

Source: http://ndb.nal.usda.gov/ndb/foods

Sensorial Properties of GF Pasta

Composition	Col	Colour		Cooking Quality		
	Brightness	Yellowness	Losses	Firmness	Stickiness	
Rice Flour	7	תת		\rightarrow		
Yellow Corn Flour	Ы	Z	Z Z	\rightarrow	7	
Corn Starch	Ŕ	\rightarrow	Z Z	\rightarrow	N N	
Rice + Corn flours + additives	\rightarrow	\rightarrow	קק	\rightarrow	7	

Sources: Mariotti et al. (2011) J. Cereal. Sci. 53: 319-327 and Lucisano et al. (2012) J. Cereal. Sci. 56: 667-675

Glycemic Index of Traditional and GF Pasta

Pasta content	GI	Sources
Durum wheat	48	Foster-Powell et al.
Whole wheat	46	Nutr. 76:5-56.
Corn	64	- Bacchetti et al.
Rice	79	(2014) FOOD FUNCT. 5:3014-3017
Rice and corn	76	 Berti et al. Eur J Nutr (2004) 43 : 198–204 Foster-Powell et al.
Corn/rice/other ingredients (pea, millet, protein isolates)	55	 (2002) Am. J. Clin. Nutr. 76:5-56. Packer et al. (2000) Diabet. Med. 17:657-660

Price Differential between GF and Traditional Pasta

Country	Year	Price differential	Sources
Australia	2000-2009	x 4.9	Lambert and Ficken (2015) Nutr. Diet. DOI: 10.1111/1747-0080.12171
UK	2005-2010	x 2.7	Singh and Whelan (2011) J. Hum. Nutr. Diet. 24: 479–486
USA	2000-2005	x 2.2	Lee et al. (2007) J. Hum. Nutr. Diet. 20: 423–430
France	2015	x 5.0	prices recorded on web sites of different French supermarkets and health food shops (based on 36 durum wheat pasta formats and 36 GF equivalent products + 1 pasta made with legumes)

Conclusions

- 1. Durum wheat remains the most suited raw material to reach pasta quality attributes expected by consumer with a very high reliability.
- 2. GF pasta can be elaborated from a large diversity of raw materials. It results as a "non well-defined" product exhibiting large variability.
- 3. Except celiac patients and other gluten proven pathologies, eviction of gluten in pasta is not justified neither for sensorial properties nor for nutritional aspects.
- 4. For non-celiac sensitivity, not only gluten has to be considered but other hypothese should be explored (fodmaps, ATI, etc). It is suggested to organise a vast study through an international consortium.
- 5. In a longer term vision, pasta stakeholders should be able to separate trends from fads with the aim not to demonize traditional pasta which is a pillar of the Mediterranean diet.