# Pasta and Gluten: Facts and Fakes 

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Manufacturers Association (SIFPAF) but the content of this presentation is on the sole responsibility of the authors


## 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 $\left(<55^{\circ} \mathrm{C}\right)$
- 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)


## Proteins and Gluten

Semolina


Cytoplasmic or metabolic proteins

(35 \%)
Diluted
Acid
$\pm$
detergents


## Gluten (wheat) Related Pathogenesis




Mediated by anti- $\omega$ gliadin IgE

- Respiratory symptoms (baker asthma)
- Induced by physical effort
- Skin and digestive symptoms


## Non autoimmune <br> Non allergic

non coeliac gluten sensitivity NCGS

Gluten intolerance (?) with :

- No serological markers
- No IgE
- No atrophy of intestinal mucosis

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1. Abdominal pains (68 %)
2. Epigastric burns (15 %)
3. Nausea and vomiting (15 %)
4. Borborygmus (10%)
5. Bloating, flatulences (25 %)
6. Constipation (20 %)
7. Diarrohea (33 %)
8. Eczema /erythema(40 %)
9. Headache (35 %)
10. Disturbance in attention(34 %)
11. Chronic tiredness (35 %)
12. Neuromuscular troubles
13. Comportemental troubles
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## Global Social Media Hype :

 Eating wheat makes you fat and sick ? Paleo Diet $=$ Lose Weight and Get Healitiy by Eatingthe Food You Were Designed to Eat

[^0]
## REASONS FOR PURCHASING 'GLUTEN-FREE' FOODS



GRAIN BRAIN

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


## CHEAPER THAN HEROINE

## 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) | Protein isolates from <br> pea or lupin | Hydrocolloids and gums <br> • Xanthan <br> • Guar |
| Corn (flours and starches) |  | •... |

## Some Examples of GF Pasta



Rice pasta



Buckwheat Pasta


Lentil Pasta


## Macronutrients of Traditional and GF Pasta

| Pasta | Protein <br> $(\%)$ | Total <br> Carbohydrates <br> $(\%)$ | Total <br> Lipids <br> $(\%)$ | Fiber <br> $(\%)$ |
| :--- | :---: | :---: | :---: | :---: |
| 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

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

## Micronutrients of Traditional and GF Pasta Vitamins

|  | Vitamins $(\mathrm{mg} / 100 \mathrm{~g})$ |  |  |  |  | Folate <br> $(\mathrm{\mu g} / 100 \mathrm{~g})$ |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Products |  | Thiamin | Riboflavin | Niacin | B 6 | E |  |
| GF pasta | 0.25 | 0.08 | 1.99 | 0.16 | 0.11 | 30 |  |


| Durum <br> pasta | 0.25 | 0.14 | 5.19 | 0.21 | 0.28 | 43 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Sensorial Properties of GF Pasta

| Composition | Colour |  | Cooking Quality |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Brightness | Yellowness | Losses | Firmness | Stickiness |
| Rice Flour | 7 | $\searrow>$ | スフ | $\rightarrow$ | フフォ |
| Yellow Corn Flour | $y$ | 入 | スフ | $\rightarrow$ | 7 |
| Corn Starch | $\searrow$ | $\rightarrow$ | ス入 | $\rightarrow$ | スオ |
| Rice＋Corn <br> flours＋ <br> additives | $\rightarrow$ | $\rightarrow$ | スス | $\rightarrow$ | 入 |

## Glycemic Index of Traditional and GF Pasta

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

## Price Differential between GF and Traditional Pasta

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

[^0]:    - Learn the secrets of our Stene Age ancestors
    - Eat lean protein to maximize your metabolism and energy
    - Prevent and heal heart disease, cancect, and Sjutrome X
    - Over 100 delicious Paleo recipes and 6 meeks of meal plans

