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Carob enriched buckwheat bread – a new alternative in the gluten-free diet

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From tradition to innovation in buckwheat, oats and gluten-free
- strategies for SMEs in production, processing and marketing

Warswa, Poland

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Gluten-free Diet Definition

- Gluten causes inflammation in the small intestines of people with celiac disease.
- The only available treatment for celiac disease is a strict gluten-free diet, diet that excludes the protein gluten.



Gluten-free bread

- making bread without gluten presents a technological challenge
- crumbling texture, poor colour, not satisfying taste, low specific volume, fast staling
- elimination of a raw material causing gluten intolerance (wheat, rye, barley), leads to a considerable reduction of the levels of dietary fiber, protein, vitamins B and minerals (magnesium, zinc, iron, copper)



Gluten free raw materials.....

- gluten free flours (rice, maize, sorghum),
- pseudocereals (quinoa, amaranth, buckwheat),
- legume flours (soya, chickpea, pea),
- starches (corn, potato, cassava),
- hydrocolloids, emulsifiers and shortenings,
- proteins (whey, soy, pea, egg),
- and.....



.... it can also be used carob flour

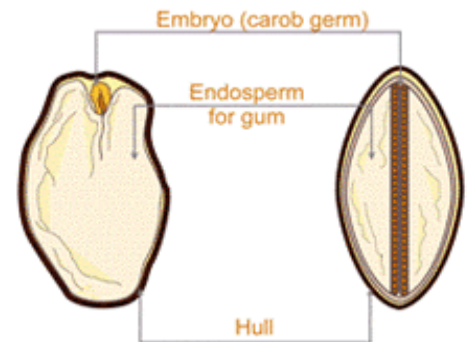
- Carob tree (*Ceratonia siliqua* L.) is a leguminous shrub native to the Mediterranean region
- The fruit is a pod:

Pulp:

- sugars (48–56%)
- cellulose and hemicellulose (18%)
- condensed tannins (16-20%)

Seeds:

- coat (30-33%)
- endosperm (42-46%) (Carob gum, Locust bean gum)
- embryo (23-25%)



Carob flour

Crushing
seedless pods



Roasting
(120-180 °C),
(10-60 min)



Milling



- natural sweetener with flavor and appearance similar to chocolate, cocoa substitute
- no caffeine and theobromine
- high levels of dietary fibre and phenol compounds
- high levels of carbohydrates, proteins and low levels of fat
- amino acids (aspartic and glutamic acids, alanine, valine)
- minerals (Fe, Ca, Na, K, P and S) and vitamins (E, D, C, niacin, B6 and folic acid)

The aim of R&D

- to develop a new functional bakery product with improved nutritional value & technological properties

Gluten-free buckwheat flour



Carob flour



+

5 %
10 %
15 %
20 %
30 %

=

Carob enriched buckwheat bread



- **Sensory evaluation**
- **Technological properties**
 - **Nutritional value**
- **Antimicrobial potential**

Porosity and volume

- evenly distributed pores of the bread crumb
- higher volume of the baked product
- richer aroma and more complex flavor

Porosity and volume

7 cm



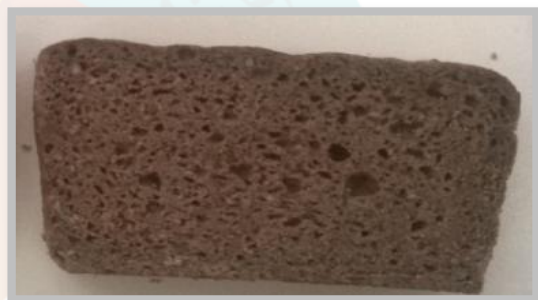
control



5 % carob



10 % carob



15 % carob



20 % carob



30 % carob

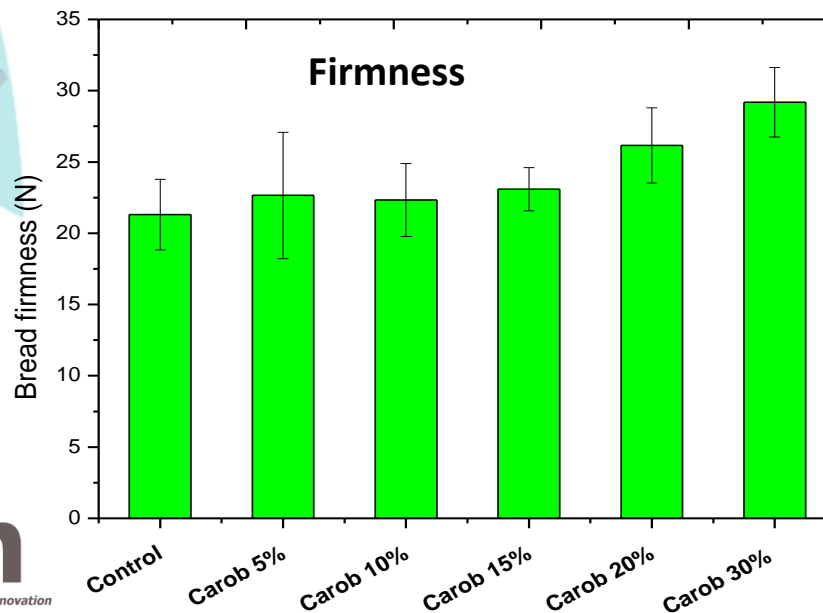
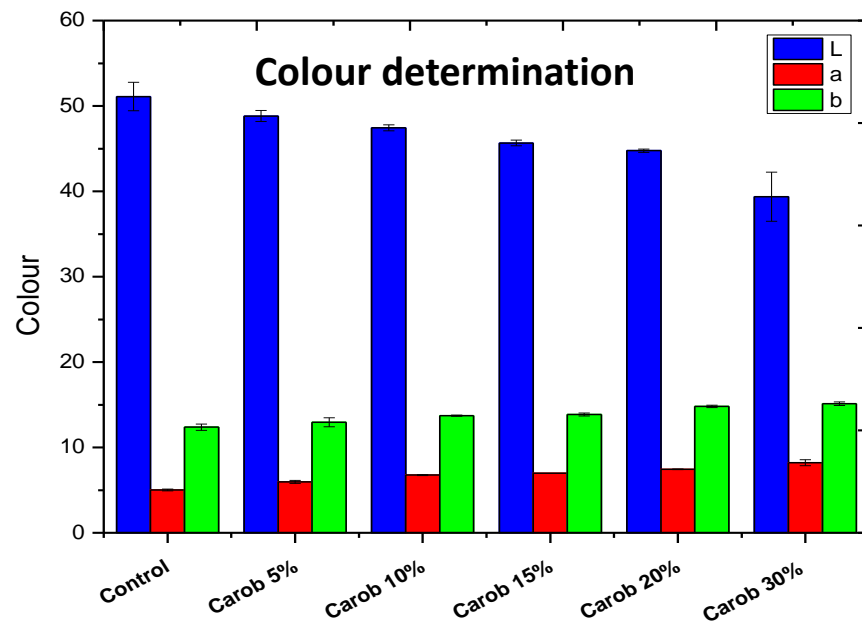
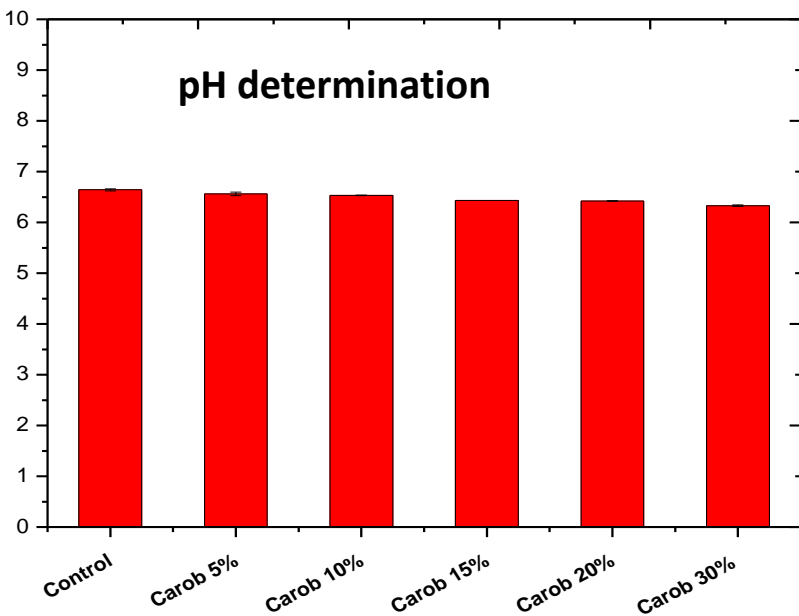
Technological properties

Carob flour addition significantly changed the rheological properties of the dough:

- increased water absorption during mixing
- more compact and less sticky dough - easier molding
- increased dough stability after fermentation

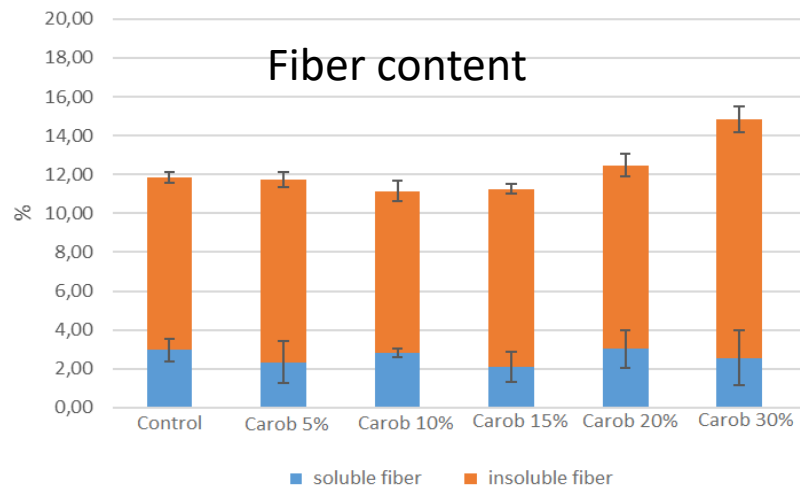
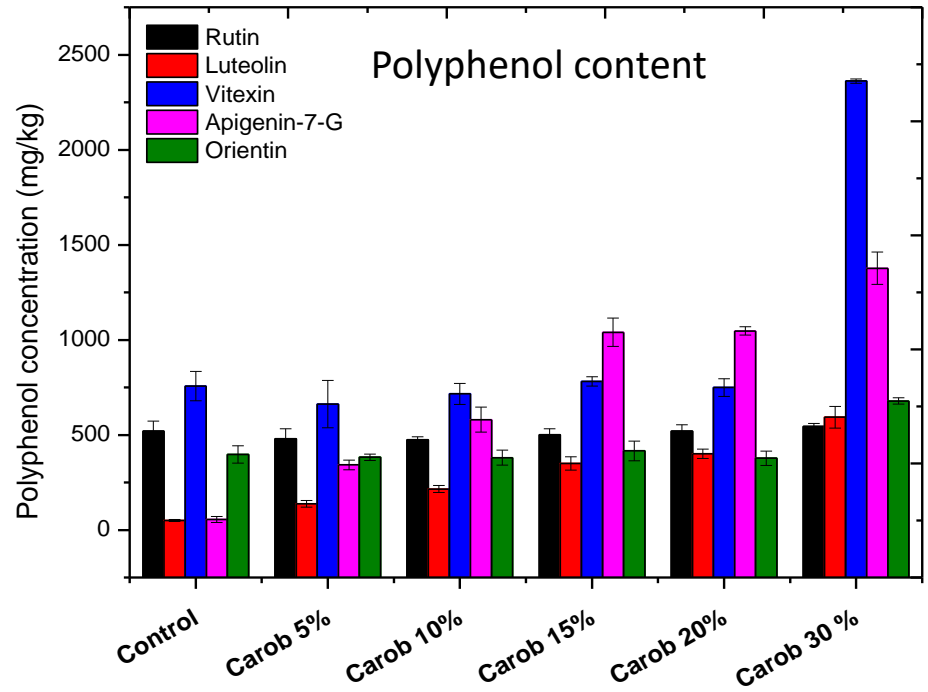
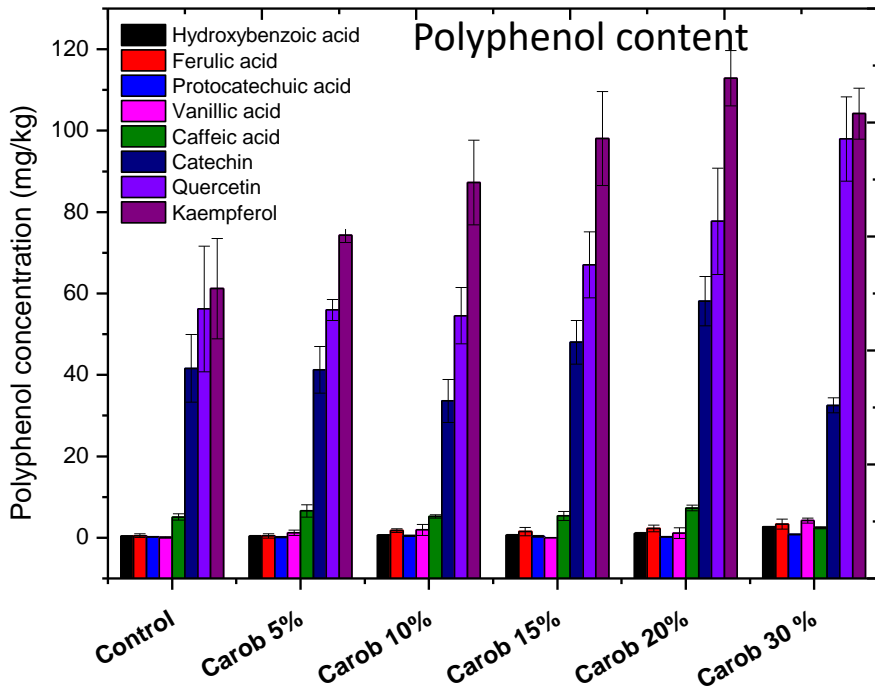


Technological properties



L* + darker, - lighter
a* + redder, - greener
b* + yellower, - bluer

Nutritional properties

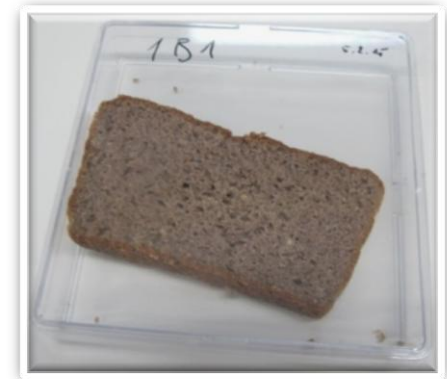


Antimicrobial properties

- Determination of yeasts, molds and bacteria
Bacillus on selective agar media



- Visual observation of mold colonies on bread slices

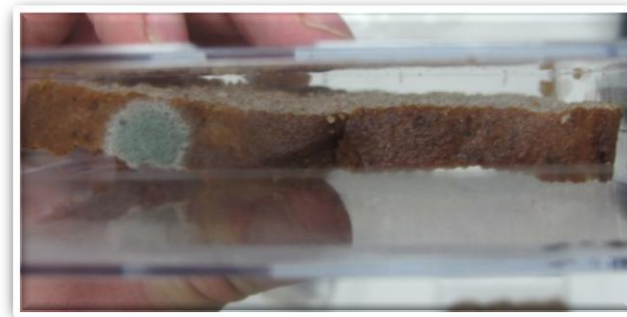


- Minimal inhibitory concentration (MIC) of
carob polyphenol extracts

Antimicrobial properties

- Visual observation of mold colonies on bread slices

Bread with 20 and 30 % carob flour was less contaminated compared to the control

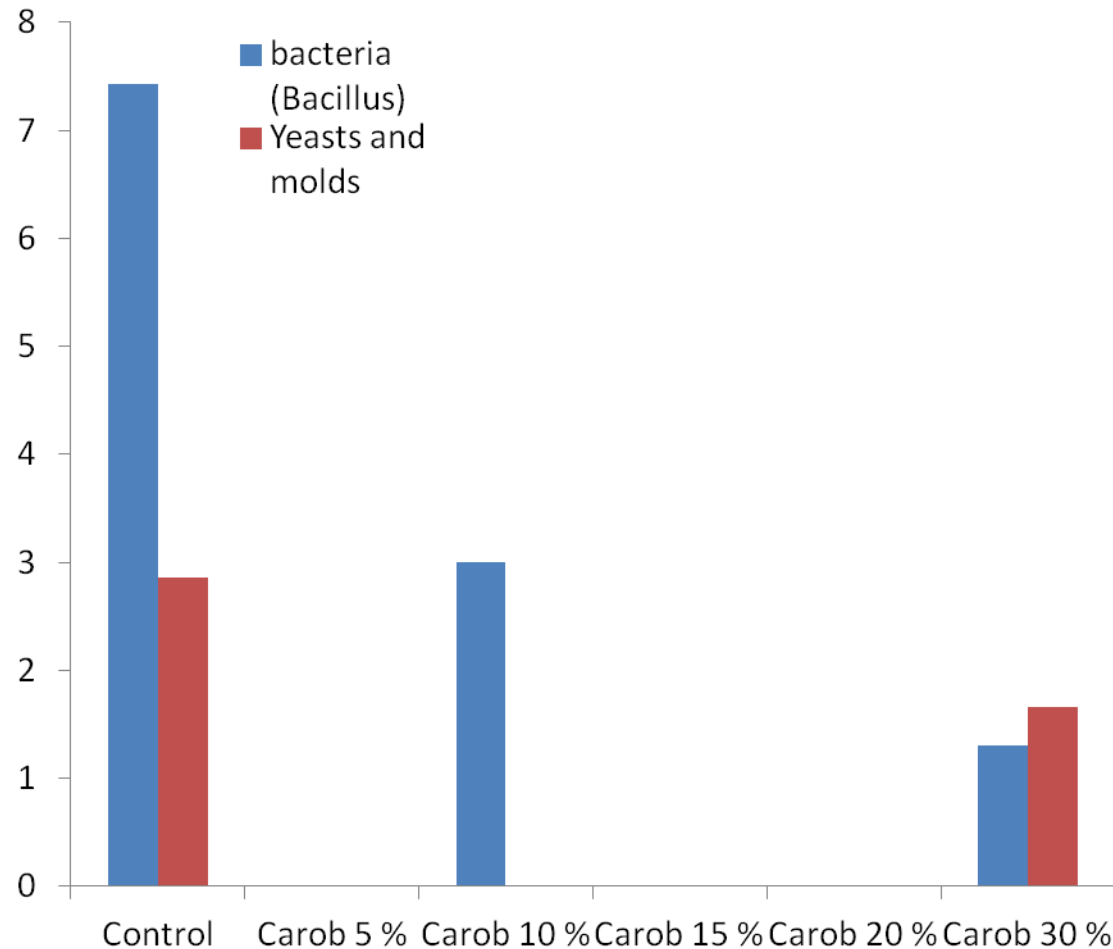


Antimicrobial properties

- Determination of yeasts, molds and bacteria *Bacillus* on selective agar media

Point system:

0 colonies	0 points
1-4 colonies	1 point
5-50 colonies	2 points
> 50 colonies	3 points



Quality and safety challenges in carob (supplemented foods) consumption

- general regarded as safe
- also used in infant formulas
- occupational exposure to carob bean flour could cause rhinitis and asthma (Van der Brecht et al., 1992)
- carob-specific sensitization can be concordant with peanut allergy – heat processing deactivates carob protein allergenicity (Fiocchi et al., 1999)

Outcome

- Based on our results we can conclude that carob as ingredient is just right choice for gluten-free industry due to its high nutritional value, positive technological impact and antimicrobial potential and we demonstrated it in combination with pseudocereal buckwheat as good combination for gluten-free bread



Outcome

What about **Carob?**

- is a welcome supplement or additive in conventional food products
- is an appropriate starch analogue in gluten-free bread
- improves taste and aroma of gluten-free bread
- improves technological properties
- improves nutritional value
- has antimicrobial potential against molds and bacteria (Bacillus)
- is safe for the consumer

Thank you

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Thank you for your attention

Dziękuję za uwagę