Extrusion-cooking of maize flours with different amylose:amylopectin ratio for the production of gluten-free snacks

Debora Giordano[1], Andrea Bresciani[2], Francesca Vanara[1], Massimo Blandino[1], Alessandra Marti[2]

[1] Department of Agricultural, Forest and Food Sciences (DISAFA), Università degli Studi di Torino, Italy

[2] Department of Food, Environmental and Nutritional Sciences (DeFENS), Università degli Studi di Milano, Italy

massimo.blandino@unito.it, alessandra.marti@unimi.it

Introduction

Ready-to-eat foods market is growing. Maize thanks to its feature could be a suitable ingredient for the production of gluten-free snacks.

Aim

To investigate how the **amylose:amylopectin ratio** affects the bioactive compounds and the technological properties of snacks obtained by extrusion-cooking.

Materials and Methods

SAMPLES

Maize flours (particle size <250 µm) and snacks obtained from:

- ✓ Conventional hybrid (P1547; **CVM**) amylose = 18%
- ✓ High-amylose hybrid (Amylor; **HAM**) amylose = 42%
- ✓ Waxy hybrid (Pioneer 1547E; **WAM**) amylose = 2%

SNACK PRODUCTION BY EXTRUSION-COOKING

- ✓ Co-rotating twin-screw extruder
- ✓ Screw speed: 100 rpm
- ✓ Temperature: 117 °C
- ✓ Pressure: 70 bar

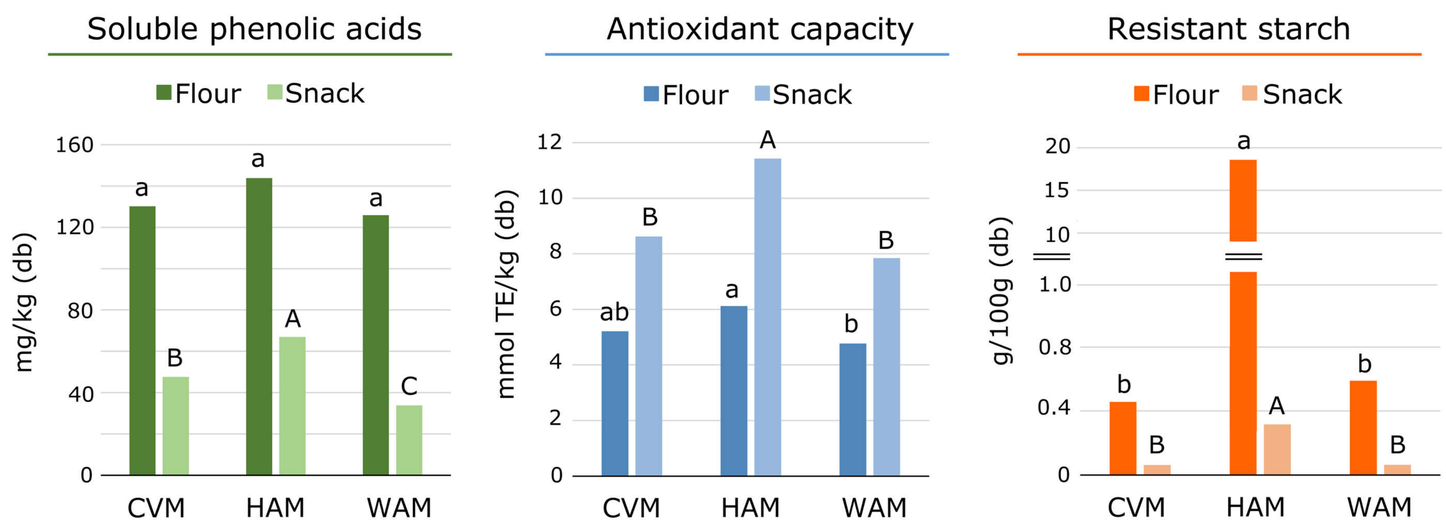
FLOUR AND SNACK CHARACTERIZATION

Analysis	Flour	Snack
Soluble and cell wall-bound phenolic acids (RP-HPLC/DAD)	✓	✓
Antioxidant capacity (QUENCHER-FRAP)	✓	✓
Resistant starch (AACCI 32-40.01)	✓	✓
Starch susceptibility to α-amylase (AACCI 76-31.01)	✓	✓
Pasting properties (MVAG Brabender ©)	✓	✓
Images analysis (Image Pro Plus 6.0)	✗	✓
Three point bend test (TA.XT plus)	✗	✓
Porosity test (P240, Fisons Instruments)	✗	✓

Results

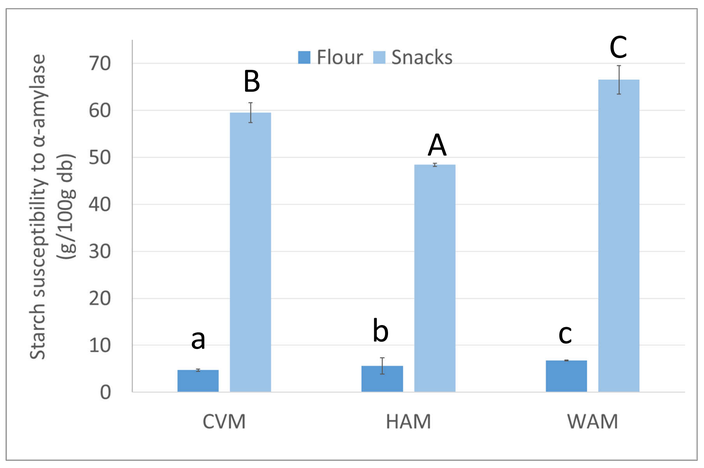
Bioactive compound content

Snacks from **high-amylose maize** showed the highest antioxidant capacity (6.12 mmol TE/kg db) as well as the highest concentration of both soluble and cell wall-bound phenolic acids (144 and 629 mg/kg db). HAM was also characterized by the highest **resistant starch** content, nevertheless, extrusion-cooking reduced significantly its concentration (**18%→0.3%**).

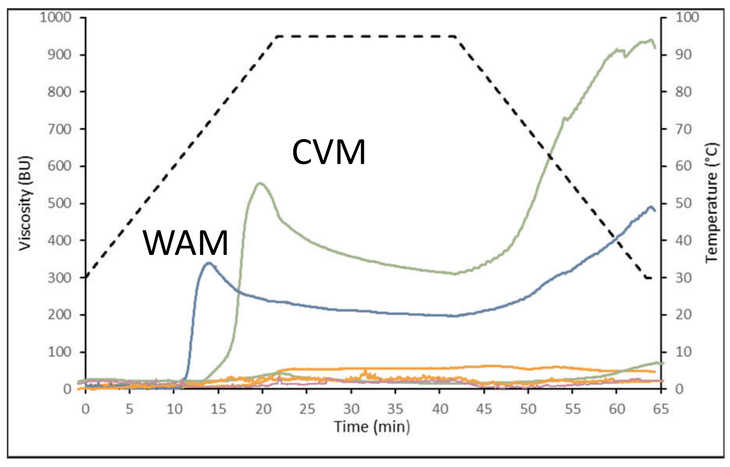


Different letters indicate significant differences (Tukey HSD test; p<0.05). Lowercase letters refer to flours; uppercase letters refer to snacks.

Starch susceptibility



Pasting properties



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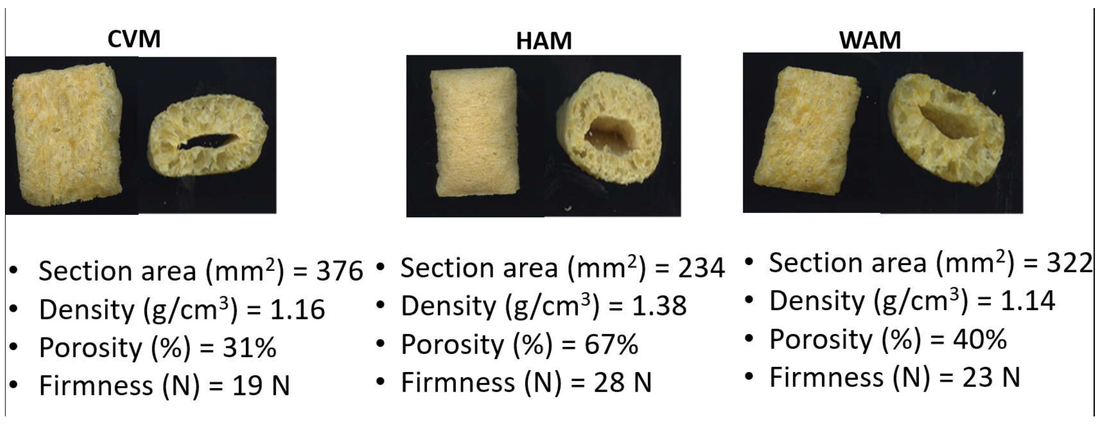
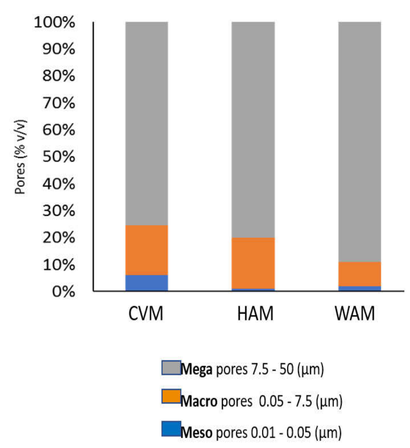
Regardless of the maize flour used, extrusion-cooking promoted significant changes in starch properties. Starch susceptibility to enzymatic hydrolysis significantly increased (up to 12 times) after extrusion-cooking suggesting starch gelatinization, as indicated by the absence of the typical gelatinization peak in the MVAG test.

Snacks characteristics





High-amylose maize was the one with the best technological performance and this could be related to its compact starch structure.

Snacks formulated using **high-amylose** maize showed the highest density (1.38 g/cm³), the lowest section area (234 mm²), the highest porosity rate (67%) resulting in a high number of small pores per mm², and the highest breaking force (28 N).

Conclusions

✗ After extrusion-cooking the RS content decreases up to values lower than 1%, because of an increased starch susceptibility to α-amylase hydrolysis, as result of starch gelatinization.

✓ HAM shows the highest content of antioxidant compounds and the best technological performance, suggesting its use in the production of filled snacks.

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