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# Effect of leavening agents on Maillard reaction products in the crust of traditional French bread.

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## INTRODUCTION

### Consumption of bread in France:

45 kg of bread / year / person – Main source of carbohydrates in the daily diet. Yeast and sourdough fermented bread most commonly consumed.

### Maillard reaction products (MRPs) in bread:

Contribution to the development of the aroma, taste (volatile compounds) and color (melanoidins) of bread.

### Among MRPs In the crust :

**-Aldehydes :** Volatile compounds generated by the Strecker degradation.

**-Melanoidins** formed at the last stages of MR: suggested to have health benefits (anti-inflammatory and bifidogenic effects). (1) (2)

## AIM

**Evaluate the effect of leavening agents on the formation of the Strecker aldehydes and melanoidins in the crust of yeast or sourdough french breads.**

## MATERIALS AND METHODS

Yeast bread (YB) and sourdough bread (SB) were prepared according to an artisanal process.

### In the dough - Maillard reaction precursors assays :

- HPLC-ELSD → Fermentable sugar content
- SDS PAGE → Protein fractions

### In the crust – Maillard reaction products assays :

- GC-MS → volatile compounds
- HPLC system coupled to a fluorescence detector → Water soluble melanoidins

## RESULTS

### BREAD DOUGH:

Table 1: Fermentable sugar contents (g/100g of dry matter) in YB and SB doughs (n=9).

SUGARS (g/100g of dry matter)	TYPE OF BREAD	BEGINNING OF FERMENTATION	AFTER 26.5H OF FERMENTATION
Maltose	YB	1654.6 ± 84.2 a	2814.5 ± 326.6 b
	SB	2245.1 ± 62.7 a	3336.0 ± 108.1 b
Glucose	YB	217.2 ± 34.3 a	78.2 ± 7.2 b
	SB	176.7 ± 21.6 a	267.0 ± 34.4 b
Fructose	YB	316.9 ± 33.0 a	176.6 ± 42.2 b
	SB	170.5 ± 24.9 a	126.9 ± 27.1 b

Different letters in the same row indicate significant differences (p < 0.05). Student t-test for unpaired samples.

### BREAD CRUST:

Table 2: Relative concentration of some Strecker aldehydes in YB and SB crust (n=9).

Strecker aldehydes	YB	SB
3-methyl-butanal	0.36 ± 0.12 a	5.08 ± 0.38 b
2-methyl butanal	0.38 ± 0.16 a	2.93 ± 0.53 b
2-methyl-propanal	nd	0.92 ± 0.21

Different letters in the same row indicate significant differences (p < 0.05). Student t-test for unpaired samples.

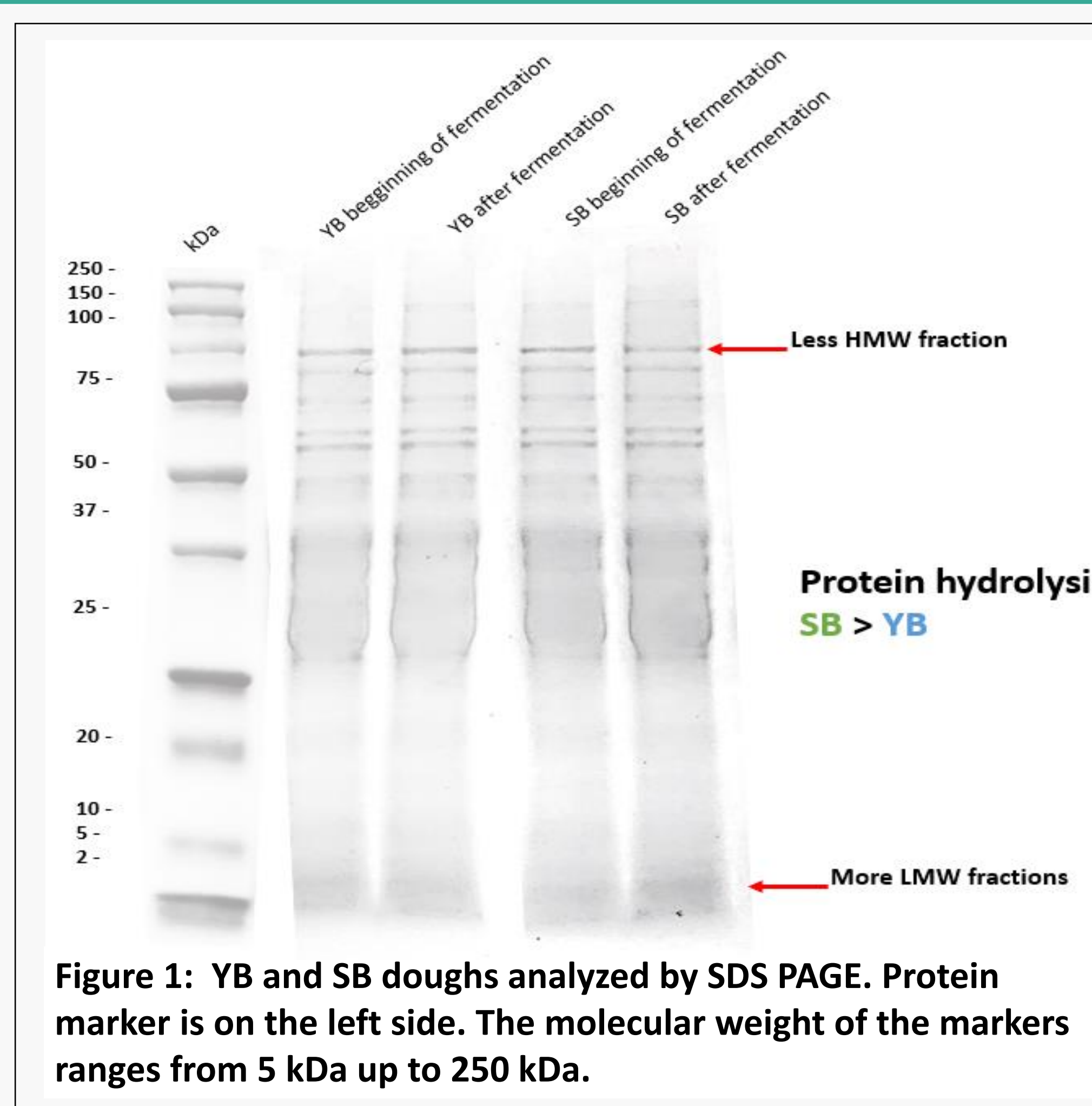


Figure 1: YB and SB doughs analyzed by SDS PAGE. Protein marker is on the left side. The molecular weight of the markers ranges from 5 kDa up to 250 kDa.

The Maillard reaction precursors were predominant in the dough of SB compared to YB.

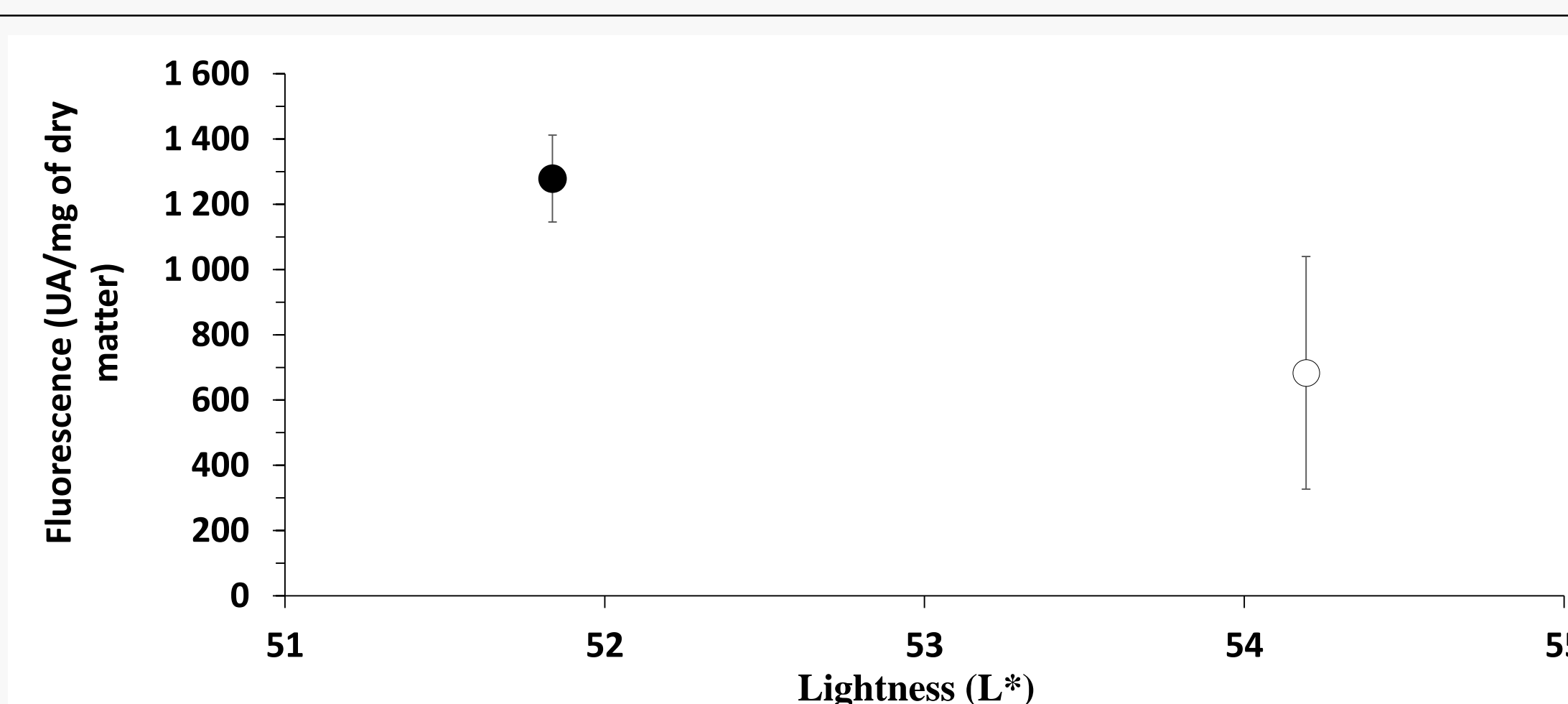


Figure 2: Melanoidins in the crust of YB (White mark) and SB (black mark) according to the lightness (L\*) of the crust (n=9).

Different MRPs formation pathways:  
**-Sourdough bread:** Strecker degradation  
**-Yeast bread :** Melanoidization pathway

## CONCLUSION

Both types of leavening agent had a significant effect on the Maillard reaction pathways. The Strecker degradation could direct the Maillard reaction towards aroma generation rather than melanoidins formation, thus affecting the sensory quality of the crust.

(1)HELOU, C., DENIS, S., SPATZ, M., MARIER, D., RAME, V., ALRIC, M., TESSIER, F.J., & GADONNA-WIDHEM, P. « Insights into Bread Melanoidins: Fate in the Upper Digestive Tract and Impact on the Gut Microbiota Using in Vitro Systems ». *Food & Function* 6, n° 12 (2015): 3737-45. <https://doi.org/10.1039/C5FO00836K>

(2) JOUQUAND, C., NIQUET-LÉRIDON, C., JACOLOT, P., PETIT, N., MARIER, D., & GADONNA-WIDHEM, P. « Effects of Maillard Reaction Products on Sensory and Nutritional Qualities of the Traditional French Baguette: Food Quality of the French Baguette... ». *Journal of Food Science* 83, n° 10 (october 2018): 2424-31. <https://doi.org/10.1111/1750-3841.14331>.