Mycotoxins throughout the pasta process: from rivet wheat flour to dry and cooked artisanal pasta

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[1] *Université de Toulouse, INP EI-Purpan, France*
[2] *ITAB, France*
[3] *INRAE UR MycSA, France*

Introduction

Small-scale organic farmers have difficulties to correctly manage the mycotoxin risk throughout the chain, from wheat to pasta, due to a low number of analyses performed. It is the case of a producer's collective, in the South-West of France who manufacture artisanal pasta from rivet wheat flour. The effect of pasta manufacturing and cooking was already studied on common pasta and especially spaghetti made from semolina. However, to our knowledge, no study was performed on artisanal pasta, made from flour. The aim of this study was to determine the effects of drying and cooking on artisanal pasta made from rivet wheat flour (Fig. 1) on mycotoxin contamination.

Fig 1. Rivet wheat

Material & methods

Three flour samples naturally containing different levels of deoxynivalenol, nivalenol and zearalenone were followed throughout the pasta production (Fig. 2).

Pasta samples (Fig. 3A) were obtained by mixing 2 kg of flour with water at 60% of hydration and by extrusion in a fusilli shape mold (PC95, AldoCozzi). Two different drying protocols (low temperature or LT: 16h, 50°C; high temperature or HT: 5h, 90°C) were performed in a pasta dryer (PamaRoma, VR20).

To measure the impact of pasta cooking, samples were cooked in water using a standard method (S: 100g in 2L of salt water) and a method as it could be done at home (AH: 100g in 450 mL of salt water). Pasta were cooked at the optimal cooking time (OCT) corresponding to the time where starch is gelatinized (Fig. 3B).

Each experiment was performed in triplicate in Purpan Food Lab.

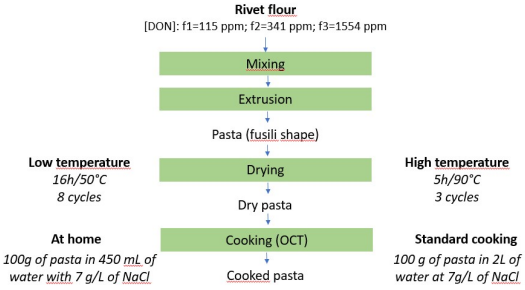
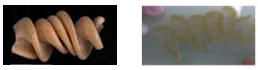


Fig 2. Artisanal pasta production process



A *B*

Fig 3. Dry pasta (A) and Cooked pasta at OCT (B)

Results & discussion

1/Drying influence on pasta's DON's contamination

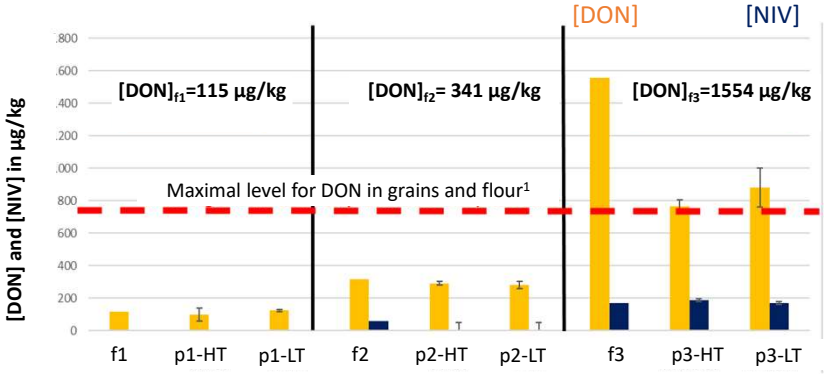


Fig 4. DON and NIV concentration on flour (f), pasta dried at high temperature (p-HT) and at low temperature (p-LT)

No significant difference was observed on mycotoxin content between dry pasta after a low or a high temperature drying (Fig. 4). For the most contaminated flour (f3), a decrease was observed after drying maybe due to a less efficient extraction of DON during the analysis of pasta compared to flour. 15-acetyl-DON, 3-acetyl-DON and DON-3-glucoside were not detected in dry pasta samples.

2/Cooking influence on pasta's DON's contamination

Table 1: DON concentration on dried pasta and cooked pasta under standard method (S) and like at home (AH)

[DON] µg/kg	Dry pasta		Cooked pasta (S)		Cooked pasta (AH)	
	Average	SD	Average	SD	Average	SD
Batch 1	124	7	0	0	0	0
Batch 2	280	24	0	0	65	60
Batch 3	881	120	262	24	447	43

A significant decrease of DON concentration was observed after cooking. The standard method of cooking (S) permitted a 65% decrease on DON concentration, more important than the cooking like at home (AH) (decrease of 40%). The swelling of pasta, similar for both cooking method (160%) do not permit to explain this difference. The decrease from dry to cooked pasta could be explained both by the water absorption of pasta and the cooking loss of dry matter in the cooking water.

Conclusion & perspectives

This study permitted to provide knowledge on the fate of mycotoxins during the process of artisanal pasta made from rivet wheat flour. Indeed, to our knowledge, it is the first time that this specific food chain is studied.

Acknowledgements & references

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[1] Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs