

From the research to company: Case study on the biogenic amines in craft beers and cheeses

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INTRODUCTION

Biogenic amines (BAs) are low molecular weight nitrogenous compounds, mainly produced by the decarboxylation of free amino acids, through the action of microbial decarboxylase enzymes. Their presence in foods could pose a risk to consumers.

The health consequences for consumers could be mild or severe, depending on the amine assumption amount and the consumers' susceptibility and lifestyle (drug and alcohol consumption).

Dairy products represent a **suitable matrix for BAs accumulation** due to the microbial contamination, low pH, high proteolysis rate; in fact, cheeses are the second most contaminated food after fish.

Craft beers are non-filtered and unpasteurized, and could be susceptible to microbial spoilage, which may result in BAs accumulation. The presence of **ethanol** inhibits the oxidase enzymes (human defence mechanism against BAs), **increasing the amine toxicity**.

AIM

Make a **survey** on the content of **these toxic compounds** in craft beers and hard cheeses on the market **to evaluate if these products could pose health risks for consumers**.



Sampling

METHODS

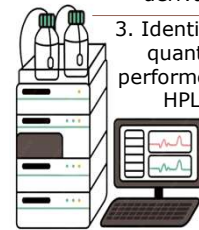
BAs determination



45 craft beers of different styles were purchased from Italian (IT) and Romanian (RO) market and specialised stores.

40 hard cheeses were purchased from small/medium-scale Italian dairies.

1. Extraction phase²
2. Pre-column derivatisation³
3. Identification and quantification performed using an HPLC-DAD



RESULTS AND DISCUSSION – HARD CHEESES

Table 1. Content of individual and total BAs in hard cheeses (mg/Kg).

	TRY	PHE	PUT	CAD	HIS	TYR	SPD	SPM	TOT BAs
Hard cheeses	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.9
	Max	406.0	243.5	1158.9	3964.4	1668.2	3738.8	3030.5	96.2
	Average	88.4	56.5	205.9	500.9	266.3	818.8	193.8	24.9

On average, the main BAs detected in hard cheeses were **TYR, HIS and CAD** (Tab. 1). It is possible to observe a **high variability** among samples due to the large number of cheese considered. Concerning the average content HIS, TYR and PHE were above the suggested limit of 100 mg/kg, 800 mg/kg and 30 mg/kg, respectively¹.

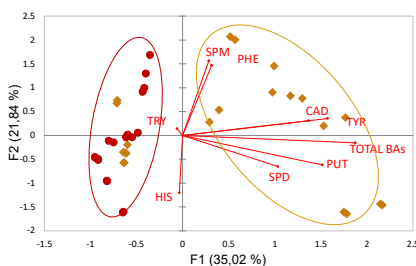


Figure 1. Result of the multivariate analysis of cheeses based on the ripening environment.

• Active variables ♦ natural cell • controlled cell

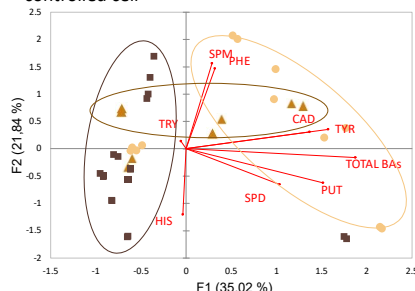


Figure 2. Result of the multivariate analysis of cheeses based on the type of milk used.

• Active variables ▲ Goat ● Ewe ■ Cow

Some qualitative variables were studied to evaluate their influence on BAs accumulation. The most **influencing factors**, according to the multivariate analysis, were the **cheese ripening environment** (Fig. 1) and the **milk specie used in cheesemaking** (Fig. 2). The reason could be ascribable to the uncontrolled fermentations and contaminations or due to the intrinsic characteristics of the raw matter used.

RESULTS AND DISCUSSION – CRAFT BEERS

Table 2. Content of individual and total BAs in craft beers (mg/L).

	TRY	PHE	PUT	CAD	HIS	TYR	SPD	TOT BAs
Craft beers	Min	0	0.0	0.3	0.32	0	0.60	0
	Max	21.68	2.7	5.15	6.87	1.40	5.6	6.52
	Average	3.21	0.59	2.13	1.46	0.39	1.54	1.32

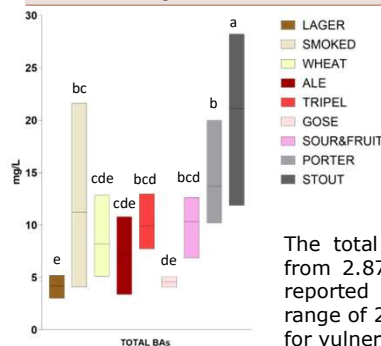


Figure 3. Total BAs in different craft beer styles. The same letters indicate no significant difference ($p > 0.05$).

The total content of BAs in craft beers ranged from 2.87 to 30.88 mg/L (Tab. 2). It has been reported that concentration of total BAs in the range of 20-50 mg/L could represent a health risk for vulnerable people.

TRY, TYR and PUT were the main BAs detected. Stout & Porter samples showed **significantly higher content of total BAs** than the other styles (Fig. 3). Craft beers investigated **showed TYR content** (one of the most toxic) **below the limit of 6 mg/L**, which according to EFSA is the NOAEL (no observed adverse effect level) in patients taking drugs inhibiting monoamine oxidases. However, higher TYR amount were found in top fermented beers (i.e. stout, sour&fruit), close to the NOAEL (data not shown). HIS was present in concentrations ranging from 0.0 to 1.4 mg/L. These values were also considerably lower than those considered toxic for alcoholic beverages (8–20 mg/L). Nevertheless, the presence of other amines (i.e. PUT and CAD) could enhance the toxic effect even at low concentrations of HIS, TYR, PHE. Lager beers showed the lowest PUT and CAD content.

CONCLUSIONS

With regard to **hard cheeses**, it was found that the **greatest concerns** could be towards the **most sensitive consumers**, who are most susceptible to amine intoxication. The multivariate results showed that uncontrolled ripening could deeply affect the amine content, as well as the milk used for cheesemaking.

The BAs content of the investigated **craft beers could involve a risks to vulnerable consumers**. The experimentation is underway, considering a larger sampling to obtain more consistent results. Furthermore, the next aim of this research will be to identify **critical points** that could lead to the BAs formation, in order to reduce their content with a bio-technological approach in lab and industrial scale.

References

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