The Sicilian Whey: Utilization of Ricotta whey in the production of value-added artisanal beers.

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SUMMARY

- The aim of this research was to evaluate whether scotta, the whey left from Ricotta making, could replace some of the water utilized in beer production and result in acceptable beverages.
- Our previous work has shown that lactose-rich by-products like yogurt whey, whey permeate, and milk permeate can be utilized in conjunction with barely or alone to make alcoholic, beer-like beverages.
- Our work demonstrates that scotta can be successfully used in the production of sensorial acceptable beer styles, like Goses and milk stouts, whose profiles compliment the natural components found in scotta, such as salt, sugar, and acidity.
- This work highlights the opportunities for dairy producers to upcycle dairy by-products into novel beverages with flavor profiles that would be appealing consumers.

INTRODUCTION

There is a long history of utilizing every drop of milk in cheese making. In Italy, Ricotta cheese was a means to recover and valorize the protein left in the whey from Ragusano cheesemaking. Scotta is the lactose-rich, high salt, whey by-product of Ricotta making. Scotta is currently disposed of, however the increasing need to reduce waste and improve the profitability of cheesemaking has created an interest in developing new value-added alternatives for scotta. In this study, we investigate the utilization of scotta in beer production, where the lactose can be used to generate alcohol or sweetness for the product.

OBJECTIVE

To utilize scotta in the production of artisanal beer styles and evaluate whether they would conform to establish sensory profiles for those styles.

MATERIALS & METHODS

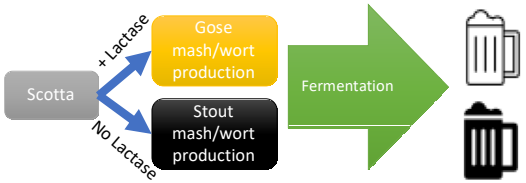


Figure 1. Scotta incorporation into beer production.

Sensory

The descriptive profile method was used (QDA-UNI EN ISO 13299: 2016) for the sensory characterization. An initial training and familiarization was carried out with the raw materials used in beer production and in some Gose-style and milk stout-style beers in the market. For each beer a form with specific attributes was created. The form provided a quantitative evaluation of each descriptor on a continuous scale from 1 to 10. For the Gose, 6 visual, 4 olfactory, 4 gustatory, 5 aromatic and 3 tactile descriptors were considered. For the milk stout made from the scotta, we included 2 additional attributes the odour and aroma of caramelized.

RESULTS

SCOTTA

Table 1. Analysis of scotta from producers in Sicily

Farm	pH	Protein (%)	Fat (%)	Lactose (%)	Salt (%)	Dry Matter (%)	Titratable Acidity	Total Plate* Count (CFU/g)	MRS* (CFU/g)
1	6.19 ± 0.31	0.53 ± 0.09	0.06 ± 0.05	4.49 ± 0.19	0.78 ± 0.33	5.53 ± 0.28	4.15 ± 0.86	< 10 to 7,300	<10
2	6.05 ± 0.12	0.60 ± 0.03	0.07 ± 0.04	5.12 ± 0.09	1.23 ± 0.20	6.37 ± 0.10	4.97 ± 0.39	<10 to 100	<10 to 50
3	6.32 ± 0.18	0.77 ± 0.23	0.76 ± 0.63	4.29 ± 0.82	1.12 ± 0.04	7.37 ± 1.03	4.81 ± 0.64	<10 to 180	<10
4	5.90 ± 0.13	0.42 ± 0.05	0.10 ± 0.07	4.40 ± 0.21	0.78 ± 0.37	5.41 ± 0.23	4.72 ± 1.06	50 to 2,5000	<10 to 20
5	6.00 ± 0.05	0.47 ± 0.01	0.21 ± 0.04	4.37 ± 0.06	1.04 ± 0.05	5.76 ± 0.10	5.36 ± 0.33	<40 to 1,400	<10 to 20
6	6.07 ± 0.05	0.50 ± 0.06	0.07 ± 0.06	5.02 ± 0.19	1.03 ± 0.10	6.08 ± 0.24	4.76 ± 0.58	<10 to 20	<10 to 700
7	6.18 ± 0.04	0.53 ± 0.06	0.02 ± 0.01	5.40 ± 0.01	1.33 ± 0.17	6.26 ± 0.04	3.70 ± 0.71	<10	<10

Note: all averages from of 4 samples taken on different days, except for farm 7 which only had 2 samples
* Denotes the max and minimum microbial counts across the samples taken.

Beer

A Gose-style lager: The style originated from Leipzig Germany traditionally involves fermentation with both lactic acid bacteria and yeast, with the addition of salt. In this product, the scotta contributes the salt. The final beer was 4.64% ABV with 0 g/L residual sugar.

Figure 2. Image of Gose-style beer produced with scotta.

Milk stout: Belonging to the stout family, having a more pronounced body and sweetness, due to the addition of lactose. The lactose is not fermentable by the yeast, thus remains to provide residual sweetness. In this product the scotta contributes the lactose. The final beer was 4.04% ABV with 16 g/L residual sugar.

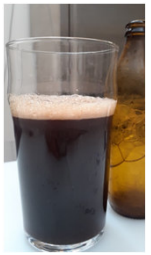


Figure 4. Image of Milk stout-style beer produced with scotta.

Figure 3. Sensory profile of Gose-style beer made with scotta.

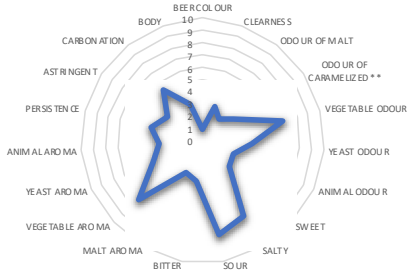
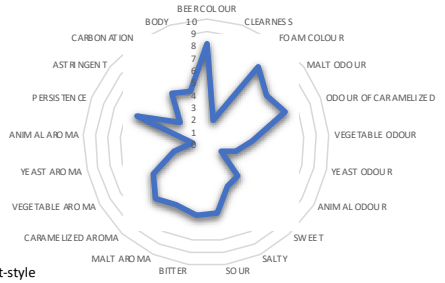


Figure 5. Sensory profile of Milk stout-style beer made with scotta.



CONCLUSIONS

- Scotta is consistent in its analytical attributes, making it a suitable ingredient, though there is some variability between producers.
- Scotta can be incorporated into beer production, and its natural properties can be used to add specific attributes to beer like sweetness, saltiness, or alcohol.
- These scotta-containing beers fall acceptably within the profiles of current commercial beer styles, suggesting scotta can be upcycled to make value-added beers that consumers would enjoy.

REFERENCES

- Lawton, M. R., and S. D. Alcaine. "Leveraging endogenous barley enzymes to turn lactose-containing dairy by-products into fermentable adjuncts for Saccharomyces cerevisiae-based ethanol fermentations." Journal of dairy science 102.3 (2019): 2044-2050.
- Luo SR, DeMarsh TA, DeRiancho D, Stelick A, Alcaine SD. Characterization of the fermentation and sensory profiles of novel yeast-fermented acid whey beverages. Foods. 2021 Jun;10(6):1204.
- Rivera Flores VK, DeMarsh TA, Gibney PA, Alcaine SD. Fermentation of dairy-relevant sugars by Saccharomyces, Kluyveromyces, and Brettanomyces: An exploratory study with implications for the utilization of acid whey, Part I. Fermentation. 2021 Nov 17;7(4):266.

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