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# The Sicilian Whey: Utilization of Ricotta whey in the production of value-added artisanal beers for local cheese aging

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## INTRODUCTION

In Sicily, Ricotta cheese was a means to recover and valorise the protein left in the whey from cheese production, Scotta, the lactose-rich, high salt, whey by-product of Ricotta making. Previous works have shown that lactose-rich by-products like yogurt whey, whey permeate, and milk permeate can be used in conjunction with barley or alone to make alcoholic, beer-like beverages. These studies used to warm up whey and to drain it for the further production of beer. This step is naturally included in the Sicilian cheese making process to obtain Ricotta.

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. Dairy farms face the problem to dispose of whey remaining from milk transformation, composed by water for the 87%, because it is considered as a "waste unusable for consumption or processing" according to the Legislative Decree 152/06 (CER code 020203). Italy, as well as Sicily, has high production of whey and actually in the North raw whey is mainly used in animal feed, pigs in particular. Other industries use the whey for producing powered whey or energy drinks.

In this study, the aim is to demonstrate that scotta can be successfully used in the production of sensorially acceptable beer styles and in turns that beer obtained by the scotta can be used for cheese ripening to add a further step in the up cycling process of dairy by products into novel ones appealing to consumers.

## OBJECTIVES

**Main Goal:** To utilize both whey and scotta in the production of artisanal beer styles and evaluate whether they would conform to establish sensory profiles for those styles. In turns, to use beer obtained from disposed of product in the ripening as well as of traditional cheeses and defining the related sensory profiles beers and cheeses.

### BEER

The aim of this research was to evaluate whether the scotta could replace part of the water used in beer production and result in acceptable beverages.

### CHEESE

The aim of this work was also to study cheese ripening methods using beer obtained from scotta to differentiate dairy products.

## MATERIALS & METHODS

The descriptive profile method was used (QDA-UNI EN ISO 13299: 2016) for sensory characterization for both beers and cheeses.

### BEER

#### PRODUCTS:

- \* Gose-style obtained by replacing 25% of water with Scotta
- \* Milk Stout-Style obtained by replacing 50% of water with whey with no salt.

**METHOD:** 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. A panel of 12 people was used. 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, 2 additional attributes were included: the odour and aroma of caramelized.

### CHEESE

**PRODUCTS:** two different methods of ripening were tested on a pressed-cheese type of 2kg weight. The two methods of ripening were: washed rind with 18% saturated beer brine (BWIR) and immersion in 18% saturated beer brine (BII). A control for each method was represented respectively by cheese washed rind with 18% saturated brine (CWR) and by cheese in immersion in 18% saturated brine (CI). For both methods, only the Milk-Stout beer was used for its sensorial characteristics.

**METHOD:** A panel of 8 people was used. For both methods of ripening 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 two cheese methods of ripening 3 visual, 4 olfactory, 5 gustatory, 4 aromatic and 4 tactile descriptors were considered.

## ACKNOWLEDGMENTS

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## RESULTS

### BEER



Figure 1. Gose-style beer produced with scotta.

**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.

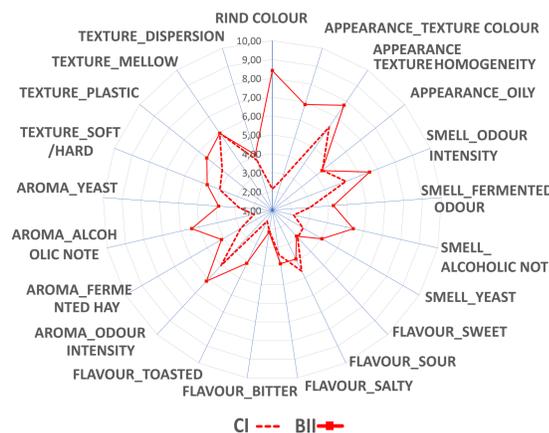


Figure 2. Milk stout-style beer produced with scotta.

**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.

### CHEESE

Figure 5. Sensory profile cheese Beer Immersion vs Control Insaturated Immersion



TAB 1. Means Values Differences by ripening methods vs control

DESCRIPTORS	BWIR-CWR	BII-CI
RIND COLOUR	5.27	6.28
TEXTURE COLOUR	2.02	4.14
TEXTURE HOMOGENEITY	0.84	1.40
OILY	0.40	-0.02
ODOUR INTENSITY	0.32	1.35
FERMENTED ODOR	0.70	1.25
ALCOHOLIC NOTE	1.68	3.25
YEAST	0.77	1.15
SWEET	0.29	-0.09
SOUR	-0.53	-0.71
SALTY	0.32	-0.47
BITTER	-0.47	0.07
TOASTED	1.21	2.48
ODOUR INTENSITY	0.17	1.14
FERMENTED HAY	0.31	1.17
ALCOHOLIC NOTE	1.43	3.39
YEAST	0.58	1.10
SOFT/HARD	0.63	0.72
PLASTIC	0.67	1.04
MELLOW	-0.05	-0.01
DISPERSION	0.02	0.31

\*higher value compared to the control in both methods of ripening; difference cutoff >1.00

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

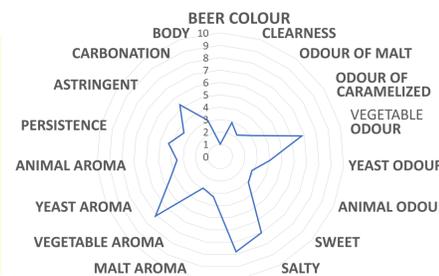


Figure 4. Sensory profile of Gose-style beer made with scotta

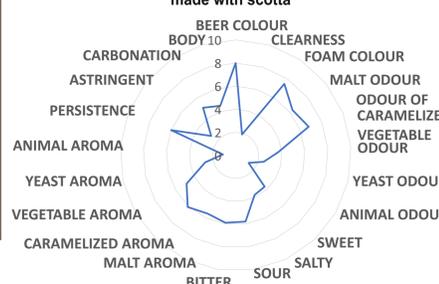


Figure 6. Sensory profile cheese Washed Crust Beer Immersion vs Control Washed Insaturated

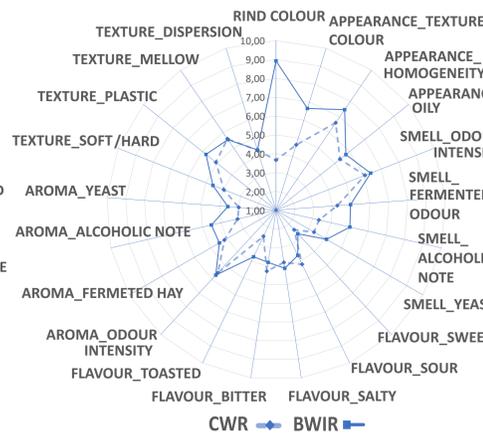
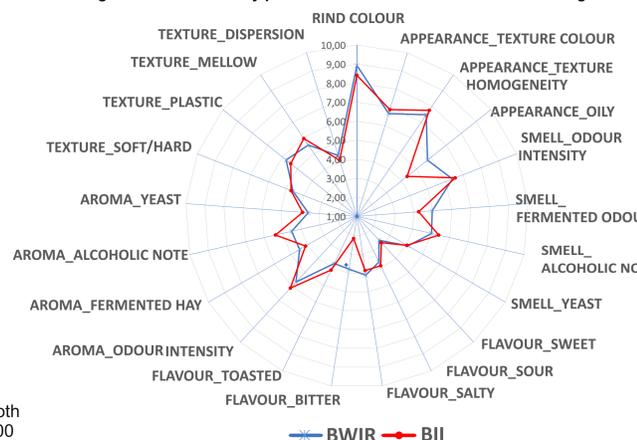


Figure 7. Chese Sensory profiles with the two methods of beer affinage



## CONCLUSIONS

Our work demonstrates that scotta can be successfully used in the production of sensorially acceptable beer styles, like Goses and Milk Stouts, whose profiles compliment the natural components found in scotta, such as salt, sugar, and acidity. The Milk Stout beer for its components is a good ingredient for the ripening of pressed cheeses, especially for the washed rind method, releasing a cheese with strong smell, a gentle taste and a complex and balanced aroma compared to the one ripened using the immersion method.

Both methods of ripening highlight texture colour and appearance able to catch consumers interest.

This work highlights the opportunities for dairy producers to upcycle dairy by-products into novel beverages and cheeses with flavor profiles that would be appealing consumers.

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