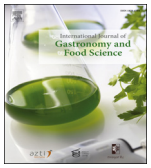

Available online at www.sciencedirect.com

ScienceDirect

International Journal of Gastronomy and Food Science 4 (2016) 19–24

International Journal of Gastronomy and Food Science

www.elsevier.com/locate/ijgfs

Culinary concept

Nettle cheese: Using nettle leaves (*Urtica dioica*) to coagulate milk in the fresh cheese making process

Camila Fiol[a,1], Diego Prado[a,1], María Mora[b,1], J. Iñaki Alava[a,*,1]

[a]*Basque Culinary Center, Faculty of Gastronomy and Culinary Arts, Mondragon University, St. Paseo Juan Avelino Barriola 101, 20009 San Sebastián, Donostia, Spain*

[b]*Research and Development Department, Spain*

Received 12 August 2015; accepted 21 May 2016
Available online 28 May 2016

Abstract

Nettle (*Urtica dioica*) is a wild plant from the Urticaceae family. It is commonly used in several countries as an edible and medicinal wild herb (China), an anti-asthmatic and an astringent (Spain) as well as a diuretic (Greece). Moreover, it is used either as a steamed vegetable or a regular ingredient in many preparations such as in pastas, omelettes (Basque country). In this article, we show that the stinging nettle acts as alternative vegetable coagulant "rennet". It uses lactic acid bacteria from fresh nettle leaves to inoculate milk where milk curd is then obtained to make fresh cheese. The results are discussed in terms of organoleptic and gastronomical qualities of cheese products and the addition of an ingredient with natural acetylcholine for future analysis. The introduction of the stinging nettle as an ingredient in gastronomy could increase the sensory appeal of vegetarian cheeses and yogurts, supporting the creation of new recipes and a new way to produce lactic fermented products.

Keywords: Nettle; *Urtica dioica*; Milk; Cheese; Curd

Introduction

Stinging nettle (*Urtica dioica*) is an herbaceous perennial flowering plant of the *Urticaceae* family that can be found on every continent. It has a long history of medicinal use in the Basque country. It also acts as a food and fiber source for fabrics. It is especially important in the elaboration of "Mamia", a very traditional Basque dessert made with sheep's milk curd and rennet that is usually served with honey or sugar. In this elaboration, nettle is used as a strainer to clean the impurities of the milk (Lapitz, 2000), mainly because of its abundance as well as the content of the stinging hairs that are used as a fine mesh adding a characteristic flavor.

Nettles are commonly used for eating its leaves, both raw or blanched, slightly steamed or fried in different preparations such as quiches, pesto, soups, purées, sauces, cookies, gelatines and jams, etc. (Bertrand and Bertrand, 2001; Frabro et al., 2008; Irving, 2009). Since the Bronze Age, the Roman civilization and the Middle Ages, nettle has had a long history in its use as a staple food, a medicine, a fiber, a dye and a nutritious addition to the diet (Brill and Dean, 1994; Letcher, 2010). Moreover, in World War I, German uniforms were made with 85% nettle fiber (Vance, 2013).

The plant is an anti-asthmatic, an astringent, a depurative, a diuretic, a galactogogue, a homeostatic, a hypoglycaemic, a blood purified and a stimulating tonic. For medicinal purposes, the plant is best harvested during the spring in Europe as it is becoming a flower and is dried for later use (Bown, 1995; Grieve, 1973).

Searching ways to use wild herbs such as nettle and its relationship with traditional preparations like "mamia", we aim to use nettle stings to inoculate whole make in order to make curd for fresh cheese.

Since the period of Pliny the elder, who referred to the first cheese preparations (Bostock and Riley, 1857), fermentations and milk curds have been a main part of gastronomic history. It

*Corresponding author.
[1]**Working during paper time in**: Basque Culinary Center, Faculty of Gastronomy and Culinary Arts, Mondragon University, St. Paseo Juan Avelino Barriola 101, 20009 San Sebastián, Donostia, Spain.
Peer review under responsibility of AZTI-Tecnalia.

http://dx.doi.org/10.1016/j.ijgfs.2016.05.001

is now a reference point for many restaurants like Mugaritz who conduct investigations with molds and fermentations such as in "Uses of *Rhizopus Oryzae* in the kitchen" (Cantabrana et al., 2015) as well as investigation centers such as The Nordic Food Lab in Copenhagen (Salminen, 2014).

Milk possesses a unique protein structure called casein, that enables coagulation allowing the maintenance of milk as a food source in the form of cheese. Casein is not coagulated by heat, but precipitates when milk is acidified to a pH 4.6 (isoelectric point) making a curd or separating the solids (curds) from liquids (whey) (Law and Tamime, 2010). In conventional cheese making, rennin (chymosin) in the form of rennet (a proteolytic enzyme that coagulates milk) is used to coagulate milk. In our experimentation, the chemical content found in nettles is used to acidify the milk and lower its pH in order to make the curd.

Using nettle as a vegetable "rennet" to make milk curds or fresh cheeses, is accepted by consumers which improves their organoleptic capabilities, is also useful for new culinary preparations and helps increase the value of a product using edible wild herbs.

Materials and methods

Materials used: whole cow's milk (3.6 mg fat material, UHT, pH 7.3), *Urtica dioica* leaves, sea salt flakes (non-iodized sodium chloride), calcium chloride (Calcic E509). Stinging nettle plants (*Urtica dioica)* were grown during spring in the Miramon park field (43°17′22.7″N 1°59′18.6″W). Leaves were collected and stored in a plastic bag and were taken to the laboratory of the Basque Culinary Center and were subsequently cleaned and separated into "edible" and "refuse portion" categories. The latter generally consists of older leaves and fibrous stems that are removed during normal food preparation. Edible leaves were stored at 4.0 ± 0.5 °C for 24 h until the time of processing (Renna and Gonnella, 2012).

First, a sample study preparations for milk coagulation and second, a study on the production of fresh cheese.

Samples preparation

3 Control cups of 100 g of whole cow's milk were used, 6 sample cups with 1 g of fresh *Urtica dioica* leaves were used in the sample preparation. This amount of nettle leaves was decided because of the minimum quantity in previous experiments (no show data).

All 9 cups were covered with plastic film and stored in controlled temperature conditions (37 °C for 24 h) using a Digitronic oven (Brito et al., 2002).

After this period, all 9 cups were examined. The nettles were removed from the 6 sample cups leaving only the milk curd to be compared to the control cups.

3 Control cups pH remained with the same texture and pH (7.26) as the initial milk.

6 Samples with fresh nettle leaves have a lower pH from 7.4 to 4.3 with a texture of greek yogurt before making cheese and putting them in a brine (Table 1).

Cheese production

2 l of whole cow's milk in a sterilized plastic container with 20 g of *Urtica dioica* leaves covered with plastic film, stored in controlled temperature conditions (37 °C for 24 h).

After this period of time, the nettle leaves were removed leaving the curd in a strainer lined with a cheese cloth. The curd was strained for 24 h at 4 °C.

The cheese was placed in 6 molds of 100 g each. It was lined with a cheese cloth, and a weight of 300 g. was placed on top of the cheese molds as the whey drained out.

The cheeses rested for 24 h at 4 °C in a gastronorm grid on top of another gastronorm pan. Every 4 h, the cheeses were turned over in the same mold and this helped to make the cheese uniform in both texture and shape (Karling, 2011).

Brine: 2.5 l whey, 10% (250 g) salt and 0.2% (5 g) of calcium chloride, boiled and chilled at 10 °C (Davies, 2012; Karling, 2011; Walker-Tisdale, 2005). Cheeses were soaked in the brine for 1 h and stored ad 4 °C with 75–80% relative humidity.

The brine enhances the flavor of the cheese and acts as a preservative by suppressing the growth of undesirable bacteria and fungus (Carroll, 2002).

Blanched nettle leaves were used to cover the cheeses to enhance their flavor and improve the esthetics (Fig. 1).

Cheese analysis

Preliminary physical–chemical parameters were determined by standard procedures at the laboratory and kitchen of Basque Culinary Center.

Titratable acidity: the acidity was determined with a standardized solution of 0.1 N sodium hydroxide (4.00 g of NaOH per liter) and taking 10 g of fresh cheese adding 100 ml of distilled water with added phenolphthalein indicator (prepared at 1% in ethanol at 95%) and titrated until the first dye of light pink is permanent. Acidity is expressed as percentage of lactic acid (1 ml of 0.1 N NaOH = 0.009 g lactic acid) (Wehr and Frank, 2004) (Fig. 2).

pH: pH's were measured with a HI98127 Waterproof pH Temperature Tester Hanna Instruments according to standard procedure as describes in AOAC 14th 981.12 (Association of Official Analytical Chemists., 1984) (Fig. 3).

Sensory analysis

The sensory analysis was performed with a consumer panel consisting of 53 untrained consumers from San Sebastián – Donostia (28 females and 25 males between 20 and 52 years old), using a structured 9-point hedonic scale ranging from 1 (disliked it extremely) to 9 (liked it extremely). Two dishes were prepared, one sweet and one savory evaluated for smell, color, taste and texture (Figs. 4 and 5).

Approximately 30 g of each sample dish was placed in a 50 ml disposable plate which was coded with three-digit different numbers; first one (number 669) "nettle cheese ice cream with almond sand and black cherry gel" (Fig. 6), and second one (number 429) "nettle cheese croquette, sautéed