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Antioxidant Activity and Total Phenolic Properties of Teleme Made with Different Milks

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Abstract: Teleme is an Anatolian shepherd's food, which is a coagulated dairy product made by dripping the milk of freshly plucked raw figs into raw milk. It is also called as teleme cheese or teleme yoghurt. It is an important and forgotten food alternative to nutritious yogurt and milk, which has been known in Anatolian geography for centuries and can be made practically. In this study, antioxidant activity and total phenolic substance values of teleme obtained from three different milks, which are ancient but less known today, were determined. For this purpose, wasteleme made by using fig milk from 3 different milks, sheep, goat and cow milk. Total Phenolic Substance (TPS), Antioxidant Activity (AA), Total Antioxidant Levels (TAL) and Total Oxidant Levels (TOL) analyzes of the extracts of fresh and freeze-dried powdered curds with water, 80% methanol and 100% methanol were performed. Among the fresh curd extracts prepared with different solvents, the highest total phenolic content was found in curd prepared with sheep's milk and extracted with 80% methanol (4,879±0.043 mg GAE (Gallic acid) /g dry weight), the lowest value was also sheep milk. It was determined in curd prepared with water and extracted with water (0.787±0.030 mg GAE/g dry weight). In powder curd products, the highest and lowest total phenolic contents are in curd prepared with sheep milk and extracted with water (2.161±0.033 mg GAE/g dry weight) and curd prepared with sheep milk and extracted with 100% methanol, respectively. (0.680±0.070 mg GAE/g dry weight) was determined. The highest antioxidant activity value was found in fresh curd prepared with sheep's milk extracted with 100% methanol and (6,832±0.029 mg trolox/g dry weight) and powdered curd prepared with goat's milk (1.697±0.006 mg trolox/g) dry weight, respectively. detected. While the total antioxidant values were found to be good in all samples, the oxidant values were detected at low levels. As a result, we believe that curd can be considered as a functional food with very good values in terms of antioxidant values as well as being nutritious.

Keywords: Teleme, TPS, AA, TAL, TOL, GAE

Introduction

Teleme is a very ancient food that has been traditionally produced and consumed by shepherds as a meal while herding sheep in the mountains for centuries. There is very little information in the literature about the biological effectiveness of the content of teleme, which many people are unaware of. Curd is defined as a coagulated dairy product in few scientific texts. Namely, it is possible to use plant-based fig milk as an alternative to various enzyme-structured compounds of animal origin used for curdling milk in cheese making. In cheese technology, enzymes obtained from animal, vegetable and microbial sources are used in the enzymatic coagulation of milk. Coagulant enzymes obtained from different sources and made ready for use are called 'rennet'. Enzymes, also referred to as 'coagulating enzyme' or 'rennet', are all acid proteases. (Fox et al., 2000). Plant-derived coagulant enzymes (papain, bromelin, ricin, ficin, etc.) are obtained from certain parts of plants such as roots, stems, seeds, flowers, leaves, using different extraction methods. These are known as plant-based rennet (vegetable/plant rennet). The coagulation stage is very important in the production and maturation of

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cheeses obtained by using these coagulants, and proteolysis affects the textural and sensory properties of cheese (Amira et al., 2017).

The herbal coagulant used in curd is *Ficus carica* (incir) milk. Although the use of herbal coagulants dates back to ancient times, their use is limited until now due to their high proteolytic activities, except for a few varieties. It is mostly used as a herbal coagulant for figs, golden berries, curd grass, kenger, especially for small consumption purposes. It is even reported that fig milk is impregnated with cotton cloths and frozen and used in making curd in winter. Extracted from the fig tree, ficin is the first plant-derived enzyme used in cheese making and is known to cause bitterness in cheeses due to its high proteolytic activity (Mazorra-Manzano et al., 2013; Shah et al., 2014; Lomolino et al., 2015). Component analysis, gastronomic analysis and biological activity of curd have never been studied before. Therefore, in this study, some biological activity determinations of curd obtained from different milks were evaluated by using fig milk as a coagulating herbal factor.

Materials and Methods

Materials

Sheep and cow's milk was procured from Gaziantep Durantaş village. Figs (kerik) were collected from the same village in August 2021 Turkey, Gaziantep.

Methods

The milk of sheep, goats and cows was dripping from the branch without waiting. After waiting for about 10-15 minutes, the coagulated milk became curd 15 minutes later. The curds were stored in glass jars and brought to the laboratory.

Drying Procedure

Three different milk Teleme cheeses were placed at -24 °C for 24 h, and then, frozen samples were transferred to a freeze dryer (FreeZone 6 Labconco, USA) which was operated at 0.250 mbar and -50 °C for 24 h. At the end of the drying, the obtained dried Teleme cheeses were ground with a coffee grinder (Kiwi KSPG-4811, Turkey).

Analysis

Moisture Content (MC)

The moisture content of the Teleme cheeses and powders was determined using an infrared moisture analyzer (Daihan Scientific MA10, Korea) at 102 °C, where the correlation with the oven method was 0.99.

Antioxidant Activity and Total Phenolic Content (TPC)

Three different solvents were used in the extraction process. Powders and Teleme cheeses (2 g) were extracted with 20 mL of water, 20 mL of 80% methanol and 20 mL of 100% methanol. The mixtures were incubated for 2 h at room temperature in a shaking incubator (Mikrotest MSC-30, Turkey) to extract the bioactive compounds. The mixtures were then centrifuged (PCE Instruments CFE100, Germany) at 6000 rpm for 10 min, and the supernatants were collected.

TPC was determined by the Folin-Ciocalteu colorimetric method (Elmas et al., 2019). Absorbance was compared with a standard curve (Gallic acid, 0–10 mg), and results were expressed as mg gallic acid equivalent per gram dry matter (mg GAE/g dry matter). Antioxidant activity of extract of powders was analyzed using DPPH (2,2- difenil- 1- pikrilhidrazil) method (Baysanet al., 2019). Measurements of DPPH were determined by spectrophotometric method (Soif Optical Instruments V-5000H, Turkey). Antioxidant activity was expressed as µmol Trolox equivalent per g dry matter (mg troloks/g dry matter)

Table 1. Phenolic and antioxidant levels of samples

Sample	Solvent	Total Phenolic Content (mg GAE/g dry matter)	Antioxidant activity (mg troloks/g dry matter)	TAL (mmol/L)	TOL (mmol/L)
Cow Milk Fresh Teleme	Water	1.429±0.041	5.433±0.106	0.683	29.32
Sheep Milk Fresh Teleme	Water	0.787±0.030	3.215±0.075	0.772	20.66
Goat Milk Fresh Teleme	Water	1.521±0.111	3.706±0.165	0.547	23.50
Cow Milk Teleme Powder	Water	0.850±0.039	0.343±0.006	1.144	14.58
Sheep Milk Teleme Powder	Water	2.161±0.033	0.531±0.012	0.905	25.55
Goat Milk Teleme Powder	Water	1.235±0.017	0.548±0.006	0.826	22.44
Cow Milk Fresh Teleme	100% MeOH	1.808±0.016	6.089±0.121	0.966	18.48
Sheep Milk Fresh Teleme	100% MeOH	0.890±0.032	6.832±0.029	0.620	25.68
Goat Milk Fresh Teleme	100% MeOH	1.941±0.203	6.475±0.031	0.558	35.99
Cow Milk Teleme Powder	100% MeOH	1.001±0.068	1.679±0.006	0.708	24.16
Sheep Milk Teleme Powder	100% MeOH	0.680±0.070	1.656±0.026	0.603	22.77
Goat Milk Teleme Powder	100% MeOH	1.272±0.042	1.697±0.006	0.779	26.87
Cow Milk Fresh Teleme	80% MeOH	3.422±0.201	6.819±0.023	0.793	19.43
Sheep Milk Fresh Teleme	80% MeOH	4.879±0.043	4.362±0.605	0.848	20.86
Goat Milk Fresh Teleme	80% MeOH	2.644±0.016	5.503±0.085	0.773	26.57
Cow Milk Teleme Powder	80% MeOH	1.296±0.088	1.530±0.045	0.985	26.61
Sheep Milk Teleme Powder	80% MeOH	0.786±0.003	1.537±0.045	0.705	26.41
Goat Milk Teleme Powder	80% MeOH	1.470±0.008	1.551±0.009	1.057	45.81

Among the fresh curd extracts prepared with different solvents, the highest total phenolic substance content was determined in curd prepared with sheep's milk and extracted with 80% methanol (4.879±0.043 mg GAE (Gallic acid) /g dry weight), while the lowest value was determined in curd prepared with sheep's milk and extracted with water (0.787±0.030 mg GAE/g dry weight). In powder curd products, the highest and lowest total phenolic substance contents were determined in curd prepared with sheep's milk and extracted with water (2,161±0.033 mg GAE/g dry weight) and curd prepared with sheep's milk and extracted with 100% methanol (0.680±0.070 mg GAE/g dry weight). The highest antioxidant activity value was found in fresh curd (6,832±0.029 mg trolox/g dry weight) prepared with sheep's milk extracted with 100% methanol and powder curd prepared with goat's

milk (1,697±0.006 mg trolox/g), respectively. Total antioxidant values were found to be good in all samples, while oxidant values were found to be low.

Conclusion

Milk coagulation is one of the main reactions of cheese production. The first and most commonly used rennet for this purpose are coagulants of animal origin. The worldwide increase in cheese production has led to the inadequacy of animal rennet, and studies have been carried out for suitable rennet substitutions for a long time, and with the developments in recombinant DNA technology, the lack of resources has partially ceased to be a problem. However, ethical issues and religious restrictions related to the use of animal-derived rennetin, as well as the fact that the products obtained with this enzyme are not suitable for vegetarian eating habits, have increased the interest in plant-based coagulants (6). Herbal coagulants have been used in cheese production since ancient times and increase the variety of products. In this context, plant-based coagulating enzymes have been preferred to be used in cheese and new dairy products in recent years, and fig milk is a good kaogulant in this context. With this study, some bioactive components of the curd obtained by coagulating with fig milk have been evaluated and we think that it should be considered as an alternative nutrient. We believe that by making much more detailed analyzes, an ancient product can be used as an innovative nutrient.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPHELS journal belongs to the authors.

Acknowledgements or Notes

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