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NEW DAIRY PRODUCT FORTIFIED WITH ROSE WATER: EVALUATION CHEMICAL AND ANTI-MICROBIAL PROPERTIES (STUDY THE POSSIBILITY OF USING DAMASCENE ROSES/*ROSA DAMASCENA/* IN DAIRY PRODUCTS)

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ABSTRACT

Background and Objective: This study aimed to prepare a new dairy product enhanced with Damascus rose extract, which is rich in natural antioxidants and Anti-microbial compounds, has high economic value, and to study the chemical Properties of this product. **Methods:** Fresh rose samples were obtained from a arboretum in the village of Sanobar Jablah in Latakia, Syria, province at a rate of 60 kg of fresh roses, used to prepare a rose water extract, which was obtained using traditional methods in Latakia province. As for the powdered milk, full-fat New-Zealand origin powdered milk was used, as well as New-Zealand caw butter, powdered white sugar, and soy-lecithin Ferst Food brand. **Results**: The results showed the possibility of manufacturing a new dairy product with desirable sensory properties. This experimental study developed three formulations of the new dairy product. The first formulation contained 16% rose water, the second contained 25% rose water, and the third contained 40% rose water. Sensory evaluation showed that both concentrations of 16% and 40% were superior in terms of sensory properties, the dairy product with these concentrations had also antimicrobial properties. **Conclusion**: The addition of Damask rose flower extract to dairy can enhance its flavor and aroma, making it more appealing to consumers. The antioxidant properties of the extract can also help extend the shelf life of the dairy product by preventing oxidation and spoilage. Overall, incorporating Damask rose flower extract into dairy production can provide numerous health benefits and add value to the final product.

KEYWORDS: Damascene rose, new dairy product, Anti-microbial Properties.

INTRODUCTION

The damascene rose belongs to Rosa damascene mill. ,Rosaceae family and Rosa genus, which includes more than 200 species, it is a deciduous or evergreen shrub, climbing or standing, its branches are often covered with hard, sharp thorns. The Damascene rose is one of the most important species belonging to the genus of roses, known by the English name Damask rose (Radwan *et al*.,2020). In Syria, the Damascene rose spreads wildly in the Qalamoun Mountains and rain-fed in the Qalamoun region in the villages of Kalmarah and Qastal. There are also irrigated crops in the Neirab region, north of Aleppo, with an area of about 200 hectares. The use of its flowers is limited to the production of rose water and rose syrup on a local scale. As for the production of rose oil, it is still unknown locally(Abaas,2010). Apart from its uses as a decorative plant in recreational greenhouse and gardens. They predominantly cultivated for use in perfume, medicine, and food industry. The plant has revealed diverse biological and pharmacological active. It has used in Unani medicine (Tibb-e-Unani)since ancient era(Ansari et al.,2017). Rose water contains four major polyphenols, namely flavonoids, tannins, saponins, and triterpenoids, which are responsible for antioxidant and anti-inflammatory properties (Safia *et al*.,2019). Most of the central nervous system effects are sedative, analgesic, and anticonvulsant effects. The effect on the respiratory system, cardiovascular system, laxative effect, anti-diabetic, anti-microbial, anti-HIV, anti-inflammatory, antioxidant are other effects of this plant. It is suggested that soluble (non-polar) lipids are mainly responsible for most of these effects (Labban & Thallaj,2020). The essential oil of the Damascene rose showed antibacterial ability against Staphylococcus aureus 250, Escherichia coli and Salmonella typhi at concentrations of 500 and 1000 µl/ml. The essential oil is

a promising source of natural antioxidants and antimicrobials for foods (Kheikhahan *et al*.,2020). Adding rose extract to functional beverages that primarily contain milk, the optimal concentration of rose extract was found to be 10%. There was a noticeable decrease in the fiber and beta-glucan content when adding rose syrup, while there was a significant increase in total phenolics, beta-carotene, anthocyanins, and antioxidant activity when adding flower extracts. The rose extract was the most accepted and stable during storage for 50 days at refrigeration temperature (kumar *et al*.,2020).

MATERIALS AND METHODS

Preparation of the aqueous extract of roses (rose water):
Prepared by following these steps
Picking fresh flowers: Damascene rose flowers were picked early in the morning from a Jableh pine arboretum _ The petals were washed well with water _ then were placed in a pot and placed on a low heat until the water boiled, and it began to evaporate _ When the boiling began, the pot was connected to a cold water tap and turned on to allow With the condensation process - the distillation process continued to reach a yield equivalent to a liter of rose water per kilo of fresh rose flowers - the condensed rose water was filled in sterile, and clean bottles and closed immediately after the filling process.

Product preparation
The new product was prepared according to the following steps:
1. Prepare of the Dry Ingredients Mixture:
The dry ingredients were mixed weight by weight by adding a specific weight of sugar corresponding to the same weight of full-fat powdered milk, and then the two ingredients were mixed together.

2. Add the fat
The butter was melted to reach a temperature of 60-Celsius degrees, then added to the mixture (powdered milk and sugar). Fat was added in a concentration, weight for weight, with the previous mixture.

3. Mixing and Smoothing the Initial Mix
Mixed using an electric mixer to smoothen the mixture before adding the aqueous extract of the rose.

4. Adding the emulsifier: lecithin was added 0.1 g per 1 g of fat, which is equivalent to 8 g per 100 g of butter (80% fat content).

5. Add the aqueous extract of roses (rose water)
Rose water was added to the mixture in small quantities and gradually while softening the product in the blender, according to the proportions (16,25,40)% as weight in relation to the weight of the product, which are the concentrations to gave the best product. Whereas, the product prepared with a concentration of rose water extract (>40%) was fluid and did not have stretchable properties, and on the contrary, regard to the concentration (<16%), the product was somewhat solid.

6. Mix filling
The product was packaged in glassware immediately after manufacture.

7. Pasteurization
The glassware was placed in a water bath, 100 °C for a quarter of an hour. The pasteurization took place at a relatively high temperature due to the high fat content in the prepared product.

8. Cool the mix
After pasteurization, the product was cooled to 21°C.

9. Aging
The mixture was left for 24 hours after its preparation to mature or age the mixture.

Experiments have shown that the maturation or aging of the mixtures for a period ranging from 4-6 hours is sufficient to give the desired effects. However, there are some cases in which a longer aging period is recommended for the mixtures, ranging between 12-24 hours, as in the case of mixtures that consist mainly of butter, milk, dried screening and water. (Issa et al., 1998).

This process aims to crystallize the fat granules, give the stabilizing materials the opportunity to melt and absorb water, change the nature of the milk proteins as they bulge and help reach a gelatinous consistency, and finally increase the viscosity of the mixture as a result of the previous changes (Abu Ghara and Hadal, 1997).

10. Preservation and Storage
The product was kept at refrigerator temperature and stored for 14 days, in which tests were carried out on days 1and 14 of storage.

The control was manufactured according to the previous steps, with the replacement of the aqueous extract of roses (rose water) with distilled water, boiled and cooled to room temperature, according to the mentioned concentrations.

Physical tests
- Estimation of density: by pycnometer
- Estimating the refractive index: using the OPTIC ivymen system.

Chemical tests
- Moisture rating: Moisture was determined using the oven drying method at 105±2°C to hold to weight
- Estimating the percentage of acidity: Using an alkaline titration of sodium hydroxide (NaOH) 0.1 in the presence of a phenolphthalein indicator (AOCA, 2005).

- Estimating the percentage of fat using the Gerber method (AOCA, 2005).
- Determination of protein content: formalin titration method (Sorensen's method)
- Determination of the free acidity of the fat

Bacteriological tests

- Decimal dilutions were prepared from dilution 1-10 to dilution 10^{-6}, and it was found that dilution 10^{-5} is the most suitable for microbial culture. The total number of microorganisms was determined using nutrient agar medium (N.A) using sterile Petri dishes after incubating them at 31°C for 48 hours.
- Yeasts and fungi were enumerated using potato dextrose agar (P.D.A) in sterilized Petri dishes after incubating them at 25 °C for 48 hours.

Statistical analysis

- Experiments were designed in a randomized complete block method
- All analyzes were performed in three replicates and the results were recorded as the mean ± the standard deviation.
- An analysis of variance (ANOVA) was conducted using the General Linear MODEL method, and then followed by Tukey's test to determine the significant differences between the means at a 1% confidence level ($p \leq 0.01$).
- All previous statistical analyzes were conducted using the SPSS program

RESULTS

The results of tests of the aqueous extract of the rose:
Table No. (1) shows the results of analysis of the aqueous extract of Damask rose

Table 1: Results of analysis of the aqueous extract of the rose.

Test	*Result*
Density (g/cm3)	**0.98**
The refractive index	**1.234**
The PH number	**5.5**
The base oil percentage	**0.018**

Results of chemical tests for milk and butter used:
Table (2) shows the chemical composition of powdered milk and butter used in the study.

Table (2): The average chemical composition of powdered milk and the butter used.

Ingredients	*powdered milk*	*butter*
%Moisture	**3±0.13**	**18±0.22**
% Fat	**26±0.4**	**80±0.099**
% protein	**26±0.03**	**2±0.05**
%Total acidity	**0.17±0.012**	**0.88±0.01**
Free acidity	**0.2±0.01**	**0.28±0.02**

The percentages of moisture, fat, protein, total acidity and free acidity in powdered milk ranged between 3.5-3%, 26.1-26%, 26-26.3%, 0.17-0.15% and 0.2-0.21%, respectively, with an average of 0.2, 0.17. 26, 26, 3, respectively. The percentage of moisture and protein increased from the results obtained by (Gasmalla et al., 2013), while the percentage of fat decreased, as it was 1.96% for moisture, 25.5% for protein, and 26.3% for fat, while the titrable acidity was lower. From the result of (Gasmalla et al., 2013), it was 0.22%, which is evidence of the quality of the milk used.

For cow butter, the percentages of moisture, fat, protein, total acidity and free acidity ranged between 18.22-17.99%, 80.5-79.8%, 1.95-2.11%, 0.88-0.87%, 0.28-0.26%, respectively, with an average capacity of 0.28, 0.88, 2.80. 18, respectively. Moisture was greater than the moisture content that appeared in the results of(Kahyaoğlu & Çakmakç,2018), it was 17.12%, while the fat was less, as it was 81.70%, while the free acidity was 0.23, which is less than the results obtained, and as for the total acidity, it was 0.84.

Determination of the optimal addition ratios for the aqueous extract of rose petals:
A medium concentration was chosen in relation to the concentrations that will be studied in this research from the natural additives, and the research of Safia was cited, which used 30 and 50 g of aqueous extract of roses (rose water) to make a cream based on rose water with anti-inflammatory and antioxidant properties (Safia et al., 2019).

Through the sensory evaluation of the studied concentrations, which ranged between 10% and 50% rose water, the best sensory concentrations were chosen, which were 16, 25, and 40%.

The results of the chemical analysis of the product:
Table (2) shows the chemical composition of the product:

Table (2): The average chemical composition of the product.

Ingredients	*16% Rose water*	*25% Rose water*	*40% Rose water*	*16% water*	*25% water*	*40% water*
%Moisture	**31.08±0.21**	**40.19±0.4**	**55.3±0.25**	**31.09±0.21**	**40.2±0.3**	**55.35±0.26**
% Fat in the dry matter	**57.11±0.14**	**51.00±0.17**	**48.76±0.2**	**57.09±0.21**	**50.99±0.11**	**48.75±0.21**
% protein in the dry matter	**12.84±0.15**	**12.21±0.11**	**12.4±0.12**	**12.84±0.12**	**12.22±0.2**	**12.42±0.16**
%Total acidity	**0.18±0.1**	**0.18±0.04**	**0.18±0.1**	**0.09±0.05**	**0.09±0.02**	**0.09±0.05**

The humidity was lower in the samples to which the aqueous extract of roses was added than the control. However, the differences were not statistically significant at a significant level of 0.01 between samples and control. The addition of the aqueous extract of the rose may have led to an increase in the total solids content in the formula and thus a decrease in the moisture content. In studies, several examples confirmed a decrease in the moisture content of milk with the addition of rose water to the product (Andarini et al., 2019). The percentage of fat in the dry matter was higher in samples than control. This is explained by the presence of small amounts of essential oil in the aqueous extract samples of the Damascene rose. A higher acidity was observed in all samples than control, which was consistent with the results of (Lucera et al., 2018) and with the results of (Andarini et al., 2019). This is due to the high natural acidity of the aqueous extract of the Damascene rose. Because of the presence of organic acids and natural plant materials dissolved in the extract such as tannins.

Results of microbial analysis of stretchable product samples and comparison with the control:

Table No. (4) shows the microbial content of the product after preparation and during the storage period.

Table (4): Results of microbiological tests carried out on samples of the prepared product.

test	*16% rose water*		*25% rose water*		*40% rose water*		*16% water*		*25% water*		*40% water*	
	1	**14**	**1**	**14**	**1**	**14**	**1**	**14**	**1**	**14**	**1**	**14**
Total Count	0	0	0	$1*10^5$	0	0	0	$1*10^5$	0	$1*10^5$	0	$2*10^5$
Yeasts and fungi	0	0	0	0	0	0	0	0	0	$2*10^5$	0	$2*10^5$

Both concentrations of 16% and 40% rose water were free of microbes and remained stable during storage, while after 14 days of storage only bacterial colonies appeared in the concentration of 25% rose water while it was free of yeasts and fungi, which is consistent with (Chroho et al., 2022) who reported that the ethanol Damascene rose extract showed activity against pathogenic microbes, and we notice the emergence of microbes after 14 days of storage in a concentration of 25% rose water due to the high moisture content in it, while no growths appeared in a concentration of 40%. Whereas, the antimicrobial effect appears at concentrations of 500 and 1000 microliters. This is also consistent with what was found by (Talib and Mahasneh,2010) who reported that the aqueous extract of Damask rose showed antimicrobial activity against Methicillin-resistant Staphylococcus aureus, and the ethanol extract showed activity against Pseudomonas aeruginosa, Bacillus cereus, and Candida species, as well as other than bacteria. It is well evident that the antimicrobial effect of a plant extract is closely related to its chemical composition and the presence of secondary metabolites (such as phenols, flavonoids, essential oils, etc.) (Sepahpour et al., 2018 and Wang et al., 2013). The antibacterial activity of the aqueous and ethanolic extract of Damask rose petals was dependent on the composition of the phenols in the extracts, which mainly consist of flavonoids (derivatives of quercetin and kaempferol). A previous study reported that flavonoids (eg, myricetin, quercetin, kaempferol, and phenolic acids) are responsible for antimicrobial effects (Sepahpour et al., 2018).

We also note that samples had less microbial growth than control, due to the antimicrobial effect of the aqueous extract of roses.

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