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# تأثير إضافة بروتينات حليب النوق المعزولة في بعض خصائص المثلوجات اللبنية والمايونيز والقشدة المخفوقة

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## الملخص:

تم في هذا البحث إضافة بروتينات حليب النوق المعزولة الى بعض المنتجات الغذائية المصنعة من حليب النوق (مثلوجات لبنية ومايونيز وقشدة مخفوقة) بنسب مختلفة (0.5 غ و 1 غ و 1.5 غ) ودراسة بعض الخصائص الفيزيائية والكيميائية والحسية للمنتجات بعد إضافة البروتين. بشكل عام لوحظ زيادة في نسب البروتين في جميع عينات المنتجات المصنعة عند إضافة نسب البروتين السابقة. لوحظ زيادة في نسبة المادة الصلبة الكلية في منتج المثلوجات اللبنية عند إضافة 1.5 غ من البروتين، بينما لم يحدث تغيير في نسب الدهن في العينات، وكان أفضل تقييم حسي عند إضافة 1 غ من البروتين حيث لاقى أفضل قبول. وفي منتج المايونيز لوحظت زيادة واضحة في ثباتية واستقرار المستحلب عند اضافة 1.5 غ من البروتين مع ملاحظة تغيرات بسيطة في رقم الحموضة وكان أفضل قبول للمستهلك لعينات المايونيز التي أضيف لها 1 غ من البروتين. في منتج القشدة المخفوقة لوحظت زيادة واضحة في نسبة الريع الناتج عند تصنيع القشدة المخفوقة عند اضافة 1.5 غ من البروتينات.

يوصى بمتابعة الدراسة على بروتينات حليب النوق باستخدامها في تطوير وتحسين منتجات غذائية اخرى.

**الكلمات المفتاحية:** بروتينات حليب النوق المعزولة، مثلوجات لبنية، مايونيز، قشدة مخفوقة.

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# The effect of adding camel milk proteins isolates on some physical, chemical and sensory properties of some food products manufactured from camel milk.

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## Abstract:

In this research, isolated camel milk proteins were added to some food products made from camel milk (ice cream, mayonnaise, and whipped cream) in different proportions (0.5g, 1g, and 1.5g) and some of the physical, chemical, and sensory properties of the products were studied after adding the proteins. In general, an increase in protein percentages was observed in all samples of manufactured products when adding the previous protein proportions. It was observed that there was an increase in the percentage of total solids in camel milk ice cream product when 1.5 g of protein was added, while there was no change in the percentage of fat in the samples. The best sensory evaluation was when adding 1 g of protein, as it received the best acceptance. In the mayonnaise product, a notable increase in the stability of the emulsion was observed when 1.5 g of protein was added, with slight changes in the pH being noted. The best consumer acceptance was for mayonnaise samples to which 1 g of protein was added. In the whipped cream product, a clear increase in the percentage of yield generated when manufacturing whipped cream was observed when 1.5 g of protein was added. It is recommended to continue studying camel milk proteins for its use in developing and improving other food products.

**Keywords:** Camel Milk Proteins Isolate, Ice Cream, Mayonnaise, Whipped Cream.

## Introduction:

Milk is the natural secretion of the mammary glands in mammals resulting from continuous, uninterrupted milking. It is a natural nutrient for both children and adults. It provides humans with carbohydrates (lactose), fats, proteins, calcium, essential minerals and vitamins. It also plays a "major" role in nutritional intake and improves the formation of healthy bones, teeth and protects against colon cancer and high blood pressure. In order to get these benefits, humans consume milk from several animal sources such as cows, camels, buffalo and other mammals. In many industrialized countries, raw milk is treated before consumption, while its fat content is adjusted, vitamins are added, and it is heat-treated to eliminate pathogenic microorganisms (Yassin et al., 2015). In addition of being consumed as a drink, it is also used to manufacture dairy products, cheese (Haroun et al., 2012), butter (Berhe et al., 2017), yogurt (Attia et al., 2001), and other nutritional materials and supplements.

Camel milk proteins have positive health properties by being anti-cancer and anti-diabetic (Magjeed, 2005). It is advised to be consumed by children who suffer from allergies to cow's milk (El-agamy et al., 2009). Camel milk contains a lower percentage of casein compared to cow's milk, with a very low ratio of beta-casein to kappa-casein compared to cow's milk (Kappeler et al., 1998).

- Proteins functional properties: The functional properties of proteins mean the physicochemical property that affects the behavior of the protein in food, which reflects the complex interactions between the composition, structure, and physical and chemical properties of proteins, and the properties of the final product, its quality, and the extent of acceptability. Proteins functional properties are affected, and varied according to the source of the protein and the methods of isolation, precipitation, drying, and concentration (Alu'datt, 2013). The required functional property varies depending on the type of food and application, and of course no protein has all the functional properties.

- Camel milk products: Camel milk products are of great importance, especially in Africa and the Middle East, where they are an important source of energy and basic nutrients for people living in deserted areas. The most important of these products are: fresh milk, as most of camel milk is consumed raw, and it is considered as a source of income for many pastoralist families, and is considered a staple food for herders, as it contributes about 50% of the total nutrients (Odongo et al., 2016). The process of pasteurizing camel milk is traditionally carried out using techniques used in the production of pasteurized cow's milk in camel milk producing countries (Stabel and Lambertz, 2004).

There is a group of other products, such as butter, although it is not a traditional camel milk product and is difficult to produce, a review of the literature shows that making butter from camel milk whey has been controversial for a long time. Many nomads do not produce butter from pure fresh camel milk, But can be only made from camel milk by churning fresh or soured camel milk at 24 to 25°C, (Brezovečki et al., 2015). The difficulties seem to stem from the properties of the fat globules, which are generally small with a thick membrane. For these reasons, the mechanical resistance of the fat globules is probably strengthened, which results in a long churning time of about five hours when milk is directly processed without prior centrifugal concentration of the fat (Ramet, 1990). The camel milk butter has a bright white color, more consistent and sticky, while the flavor and smell are normal (Farah et al., 1989).

Making cheese from camel milk is considered impossible (Yagil, 1982), and this is due to the coagulation properties of camel milk that are not suitable for cheese production. Most attempts to make cheese from camel milk have revealed major difficulties in getting the milk to coagulate. Initial field attempts increased the rennet concentration compared with that usually used for clotting cow's milk by 50 to 100 times (Wilson, 1984). More recent attempts confirm that the rennet coagulation of camel milk is two to four times slower than for cow's milk treated under the same conditions (Mohamed and Larsson-Raznikiewicz, 1990). Several observations (Ramet, 1990) have shown that bovine pepsin coagulates camel milk well.

## Objectives:

Camel milk is a natural food rich in proteins compared to other types of milk, in addition to its properties that support health in general, which are considered as a supportive of sales in regions such as the Middle East, and the consumer's quest to search for new products with high nutritional value, and the lack of local research conducted on camel milk in fortifying food products. Therefore, this research was prepared to study some of the functional properties of camel milk proteins that support some food products manufactured from camel milk (physical - chemical – sensory evaluation).

**Materials and Methods:**

The experiments were carried out in laboratories of food science department in faculty of agriculture in Damascus University in 2022.

**1- Sample collection:**

Milk samples were collected from adult Shami She-camel breeding pens from the Scientific Agricultural Research Center in the Deir Hajar area located in Damascus countryside. The milk samples were sent in plastic containers in batches of 1.5 liters in each container. Analysis was performed immediately after the milk arrived, and the samples that were not used kept in the freezer at a temperature of -20°C until used. The total volume of samples was about 15 litres.

**2- Chemical precipitation of camel milk proteins:**

Preparation of milk samples: Samples were prepared for protein precipitation according to the following steps:

**2-1) Degreasing:**

The fat was removed from the camel milk by centrifugation at 3000 rpm for 15 minutes at 4°C, and this is considered the most important step in preparing samples (AOAC, 2005).

**2-2) Acid precipitation of casein**: (AOAC, 2005).

1- 0.1N hydrochloric acid was added to skimmed milk until pH = 4.3 and left at 35°C for 30 minutes.

2- Then the centrifugation was at 20,000 rpm at 5°C for 30 minutes.

3- The casein precipitate was washed with distilled water (pH set at 6.8) 3 times to remove any serum residue from the casein precipitate.

4- Ammonium water was added to re-dissolve, and after each step the casein was washed by centrifugation at 5000 rpm for 30 minutes at 10°C.

**3- Camel Milk Ice Cream:**

Materials used: camel milk ice cream was manufactured by adding the following ingredients:

**Table (1): Ingredients used in the manufacture of milk ice cream from camel milk**

| | Milk | Orchid | Sugar | Co-participate |
|---|---|---|---|---|
| 1 | 100 ml | 0.5 g | 1.5 g | 0 g |
| 2 | 100 ml | 0.5 g | 1.5 g | 0.5 g |
| 3 | 100 ml | 0.5 g | 1.5 g | 1 g |
| 4 | 100 ml | 0.5 g | 1.5 g | 1.5 g |

**3-1- Determination of total solid matter (AOAC, 2005):**

Drying oven was used at a temperature of 105°C. The percentage of total solids was calculated as following:

$$\frac{\text{Weight of the plate with the sample before drying - Weight of the plate with the sample after drying}}{\text{Sample weight.}} \times 100$$

**3-2- Proteins (AOAC, 2005):**

Protein was estimated using the formula method by adding an indicator to the milk sample and titrating until the color inversion.

The protein was calculated by weight = (volume consumed for titration - 0.1) x 1.7

**3-3- Fat: (AOAC, 2005).**

Fat was estimated according to Gerber tube method 10% for measuring milk fat.

**3-4- Color measurement:** according to the HUNTER-Lab scale (AOAC, 2005).

**3-5- Sensory evaluation of ice cream:** The sensory characteristics were read as 40 degrees according to taste, 30 degrees according to texture, and 10 degrees according to color (Abu-Lehia and Al-Mohizea, 1989).

4- **Camel Milk Mayonnaise**:

Materials used: camel milk mayonnaise was manufactured by adding the following ingredients:

**Table (2): Ingredients used in the manufacture of mayonnaise from camel milk**

| | Mustard | Salt | Sugar | Vinegar | Milk | Oil | Protein |
|---|---|---|---|---|---|---|---|
| 1 | 3 g | 0.5 g | 1 g | 6 ml | 30 ml | 60 ml | 0 g |
| 2 | 3 g | 0.5 g | 1 g | 6 ml | 30 ml | 60 ml | 0.5 g |
| 3 | 3 g | 0.5 g | 1 g | 6 ml | 30 ml | 60 ml | 1 g |
| 4 | 3 g | 0.5 g | 1 g | 6 ml | 30 ml | 60 ml | 1.5 g |

Analysis of mayonnaise samples made from camel milk:

**4-1- Measuring the acidity number (pH):**

Using the MI 180 Bench Meter pH-meter (AOAC, 2005)

**4-2- Acidity titrated with acetic acid (AOAC, 2005):**

Through titrating by taking a 10 g of mayonnaise sample and completing the volume to 100 ml distilled water, then titrating with a 0.1 N NaOH solution in the presence of the indicator phenolphthalein, and the acidity of the titration is estimated according to the following:

%titration acidity = $\frac{0.6 \times V}{M}$ where V is the volume of NaOH used in the titration, M sample weight

**4-3 -Emulsion stability (Yang et al., 2018):**

1 .Place 50 g of sample into sealed, graduated centrifuge tubes and record the full volume of fresh emulsion (Wv).

2 .The emulsion layer volume (ELv) was recorded after centrifuging the samples at 5000 rpm for 30 min.

3 .The tubes were taken and placed in a water bath at 50°C for 30 minutes, and then the samples were centrifuged at 5000 rpm for 30 minutes.

4 .The stability of the emulsion was calculated: E.S = ELv X 100/ Wv

**4-4- Color measurement**: according to the HUNTER-Lab scale (AOAC, 2005).

**4-5- Sensory evaluation of mayonnaise samples:** Sensory characteristics were read according to taste score of 10 and texture of score of 3 (Piggot, 1984; Herald et al., 2009).

**5- Camel milk whipped cream:**

**Method:**

1 . 2000 ml of camel milk was put it in a large bowl in the refrigerator for 48 hours.

2 .the bowl was removed from the refrigerator and the layer of fat formed on the surface of the milk was collected.

3 .The collected fat layer was placed in a mixer, proteins were added, and the mixing process was continued until the volume increased and remained stable at a certain limit, and readings were taken.

Analysis of whipped cream samples:

The following analyzes were performed:

**5-1-** Determination of total solid matter using a drying oven (AOAC, 2005)..
**5-2-** Protein estimation according to the Kjeldahl method (AOAC, 2005)..

**5-3-** Fat: (AOAC, 2005) Fat was estimated according to the Gerber tube method for measuring milk fat.

**5-4-** yield estimatoin: $\frac{M1-M2}{M}$

Where M1 is the weight of the cream before whipping to a certain volume, and M2 is the weight of the cream after whipping to the same volume.

**5-5-** Color measurement: according to the HUNTER-Lab scale (AOAC, 2005).

**Results and discussion:**

**1**) Milk ice cream:

**1-1)** Chemical composition of milk ice:

Table (1) shows the results of the chemical composition of ice cream made from camel milk during the period between June 2021 and June 2022, and the results were as follows:

**Table (1): Results of a study of some chemical properties of ice cream made from camel milk**

| | **Standard sample** | **0.5 g protein** | **1 g protein** | **1.5 g protein** |
|---|---|---|---|---|
| (%) Total solids | $^{a}$0.05 ±29.17 | $^{b}$0.08 ±29.59 | $^{c}$0.22 ±29.71 | $^{d}$0.11 ±30.34 |
| Fat(%) | $^{a}$0.15 ±4.77 | $^{a}$0.15 ±4.73 | $^{a}$0.10 ±4.80 | $^{a}$0.10 ±4.80 |
| Proteins(%) | $^{a}$0.15 ±3.37 | $^{b}$0.06 ±3.87 | $^{c}$0.05 ±4.31 | $^{d}$0.07 ±4.79 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \le 0.05$.

•The average total solid matter of the control sample was 29.17% and was similar with the results of El Owni and Khater (2009) of 31.82±2.84%.

•The average percentage of total solid matter for the samples to which protein was added in proportions of 0.5g, 1g, and 1.5g was about 29.59%, 29.7%, and 30.34%, respectively. The highest percentage was when 1.5g protein was added, and this is due to the increase in the percentage of protein in food substance which increases the percentage of total solid matter in it (Berrak and Tulay, 2016).

•The average percentage of fat content in the control sample was 4.77%, and this result was consistent with the findings of Ahmad and El Zubeir (2015) of 5.09% regarding the percentage of fat content.

•No differences were observed in the percentage of fat content when adding protein treatments at 0.5g, 1g, and 1.5g, as the average percentage of fat content was 4.73%, 4.8%, and 4.8%, respectively (Casper and Schingoethe, 1989).

•The average percentage of protein in the control sample was 3.36%, and this result was consistent with what was reported by (Abd Rabo and Dewidar, 2017), where it reached 3.51%.

•The average percentage of protein in milk ice cream when adding 0.5g, 1g, and 1.5g protein was 3.87%, 4.31%, and 4.79%, respectively. The highest percentage was when adding 1.5g protein. This is due to the fact that the increase in the percentage of protein in the mixture is directly proportional to Increased protein content in processed milk ice cream (El-Zeini et al., 2016).

**1-2-)** Color estimation of camel milk ice cream:

Table (2) shows the results of the values resulting from color estimation of ice cream made from camel milk for the control sample and the samples with added proteins, according to Hunter-Lab scale.

**Table (2): Results of a study on color estimation of ice cream made from camel milk**

| | **Standard sample** | **0.5 g protein** | **1 g protein** | **1.5 g protein** |
|---|---|---|---|---|
| L | $^{a}$0.03 ±89.85 | $^{b}$0.06 ±90.63 | $^{c}$0.08 ±91.28 | $^{d}$0.06 ±91.81 |
| a | $^{a}$0.02 ±-1.79 | $^{b}$0.01 ±-1.68 | 0.01$^{b}$±-1.63 | $^{c}$0.02 ±-1.54 |
| b | $^{a}$0.02 ±6.70 | $^{b}$0.03 ±6.37 | 0.04$^{c}$±5.89 | $^{d}$0.02 ±5.74 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \leq 0.05$.

• The average value of the white color L for the control sample was 89.85, while the results were 90.63, 91.28, and 91.81 when adding 0.5g, 1g, and 1.5g protein, respectively. The highest value for of brightness L was when adding 1.5g protein, and this is due to the fact that adding proteins increased the intensity of the white color. (Berrak and Tulay, 2014) reported results between 90.23 and 95.10.

• The average value of a in the control sample was -1.79, while the results were -1.68, -1.63, and -1.54 when adding 0.5g, 1g, and 1.5g protein, respectively, where the highest value of the yellow color a was in the control sample. This is until the addition of proteins reduced the intensity of the yellow color. (Berrak and Tulay, 2014) reported between -1.40 and -0.43.

• The average value of b in the control sample was 6.7, while the results were 6.37, 5.89, and 5.74 when adding 0.5g, 1g, and 1.5g protein, respectively. The highest value of the red color B was in the control sample, and this is due to the fact that adding proteins reduced the intensity of the red color. (Berrak and Tulay, 2014).

**3-1)** Sensory evaluation of camel milk ice cream:

Table (3) shows the results of the sensory evaluation process of camel milk ice cream samples, where taste value was estimated at 40, texture at 30, and color at 10.

The sensory evaluation test was carried out by 6 people from faculty of Agriculture in Damascus University (professors and students), whose ages ranged from 25 to 60 years, and the results were as follows:

•The best taste of the milk ice cream samples was when 1g of protein was added to the mixture, with an average result of 37/40, and differences were noted between the other samples.

•The best consistency of the camel milk ice cream samples was when adding 0.5g and 1g protein to the mixture, with an average result of 27.3/30, and significant differences were noted between the other samples.

•The best color of the samples was when 1g protein was added to the mixture, with an average result of 8.67/10, and no significant differences were observed between the other samples.

**Table (3): Results of the sensory evaluation study of ice cream made from camel milk**

| | Standard sample | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|---|
| Taste/40 | $^{a}$1.00 ±35.00 | $^{b}$0.58 ±36.33 | $^{c}$1.00 ±37.00 | $^{a}$1.00 ±35.00 |
| Texture/30 | $^{a}$1.00 ±25.00 | $^{b}$0.58 ±27.33 | $^{b}$1.15 ±27.33 | $^{c}$1.00 ±26.00 |
| Color/10 | $^{a}$1.00 ±8.00 | $^{b}$0.76 ±8.33 | $^{c}$0.29 ±8.67 | $^{b}$0.29 ±8.33 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of P≤0.05.

**2) Mayonnaise:**

**2-1)** Chemical properties of mayonnaise made from camel milk:

Table (4) shows the results of studying some chemical properties of mayonnaise made from camel milk. The results were as follows:

**Table (4): Results of a study of some chemical properties of mayonnaise samples made from camel milk**

| | Standard sample | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|---|
| pH | $^{a}$0.03 ±4.54 | $^{a}$0.02 ±4.54 | $^{a}$0.01 ±4.52 | $^{b}$0.03 ±4.46 |
| Acidity | $^{a}$0.02 ±0.35 | $^{a}$0.03 ±0.33 | $^{a}$0.02 ±0.38 | $^{b}$0.01 ±0.44 |
| Emulsion stability | $^{a}$1.53 ±77.67 | $^{b}$1.00 ±81.00 | $^{b,c}$1.53 ±82.33 | $^{c}$0.58 ±83.67 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of P≤0.05.

- The average pH of the control samples was 4.54, and this result was close to what was found by Pradhanganga and Adhikari (2015), where the average pH was 3.91, and the slight differences are due to the different type of acid used in manufacturing mayonnaise.

- The average pH result when adding 0.5g, 1g, and 1.5g protein to the manufactured mayonnaise samples was about 4.54, 4.52, and 4.46, respectively. The highest pH value was when 1.5g protein was added, and this is due to the fact that proteins work to raising the acidity of the food substance because it contains an acidic carboxyl group. (Berrak and Tulay, 2016)
- The average results for the titration acidity based on acetic acid for the control samples were 0.35, and this result was close to what was reported by Johary (2015), where it was 0.34 for mayonnaise.
- The average acidity results based on acetic acid when adding 0.5g, 1g, and 1.5g protein treatments to manufactured mayonnaise samples were about 0.33%, 0.37%, and 0.44%, respectively, the highest titration acidity results were when adding 1.5g protein. For samples, this is consistent with what was mentioned by (Berrak and Tulay, 2016), as increasing protein leads to raising acidity.
- The average result of the physical stability of the emulsion for the control samples was 77.3%, and this result was close to what was reported by (Nikzade et al., 2012; Mun et al., 2009) when studying the effect of storage period on mayonnaise, where the stability of the emulsion was 74.95%. Differences are due to different manufacturing conditions and materials used in the manufacturing process.
- The average percentage of emulsion stability when adding 0.5g, 1g, and 1.5g protein treatments to the manufactured mayonnaise samples was 81%, 82.33%, and 83.67%, respectively. The best emulsion stability was when adding 1.5g protein, and this is due to the functional properties of the proteins associated with its ability to increase emulsion stability (Zhang et al., 2022).

**2-2) Color estimation in mayonnaise:**

Table (5) shows the results of the color values of mayonnaise samples made from camel milk using the Hunter-Lab device, and the results were as follows:

•The average value of the white color L for the control sample was 88.52, while the results were 89.85, 90.31, and 91.54 when adding 0.5g, 1g, and 1.5g protein, respectively. The highest value for the white color L was when adding 1.5g protein, and this is due to the fact that adding proteins increased the intensity of the white color (Berrak and Tulay, 2014).

•The average value of a in the control sample was -3.73, while the results were -3.05, -2.43, -2.01 when adding 0.5g, 1g, and 1.5g protein, respectively, where the highest value of yellow color A was in the control sample. This is until the addition of proteins reduced the intensity of the yellow color (Berrak and Tulay, 2014).

•The average value of the b in the control sample was 19.73, while the results were 17.84, 16.63, 15.85 with additions of 0.5g, 1g, and 1.5g protein, respectively. The highest value of the red color b was in the control sample, and this is due to the addition of proteins reducing Due to the intensity of the red color (Berrak and Tulay, 2014).

**Table (5): Results of the color estimation study of mayonnaise samples made from camel milk**

| | Standard sample | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|---|
| L | 88<br>[a]0.08 ±88.52 | [b]0.04 ±89.85 | [c]0.05 ±90.31 | [d]0.04 ±91.54 |
| a | [a]0.02 ±-3.72 | [b]0.01 ±-3.05 | [c]0.02 ±-2.43 | [d]0.06 ±-2.01 |
| b | [a]0.03 ±19.73 | [b]0.02 ±17.84 | [c]0.12 ±16.63 | [d]0.02 ±15.85 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \leq 0.05$.

**3-2)** Sensory evaluation of mayonnaise:

Table (6) shows the results of the values of the sensory evaluation of mayonnaise samples made from camel milk, where the taste value was estimated at 10, and the consistency value at 3.

The sensory evaluation and taste test was carried out by 8 people, whose ages ranged from 25 to 60 years, and the results were as follows:

•The best taste of the mayonnaise samples was when 1g of protein was added to the mixture, with an average result of 9/10, and no significant differences were observed between the other samples.

•The best consistency of mayonnaise samples was when 1.5g of protein was added to the mixture, with an average result of 3/3, and significant differences were noted between the samples.

**Table (6): Results of the sensory evaluation study of mayonnaise samples made from camel milk**

| | Standard sample | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|---|
| Taste/10 | a0.29 ±8.67 | a0.29 ±8.67 | b0.50 ±9.00 | a0.29 ±8.67 |
| Texture/3 | a0.10 ±2.60 | b0.10 ±2.70 | c0.06 ±2.83 | d0.00 ±3.00 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \leq 0.05$.

**3) Whipped cream:**

**3-1)** Chemical composition and yield of whipped cream made from camel milk:

Table (7) shows the results of a study of the chemical composition of cream samples made from camel milk.

• The average percentage of total solids for whipped cream samples manufactured when adding protein at a concentration of 0.5g, 1g, and 1.5g, were respectively: 34.99%, 36.29%, and 40.80%, where the highest percentage of total solids was when adding 1.5g protein to the samples. This is due to the fact that increasing the percentage of protein in a food products increases the percentage of total solid matter in it. (Berrak and Tulay, 2016)

• The average percentage of fat matter when adding protein treatments at 0.5g, 1g, and 1.5g, respectively, was 25.53%, 30.20%, and 35.17%, where the highest percentage of fat matter was when adding 1.5g protein to the manufactured samples, as increasing the percentage of protein works to increased lipid binding during the whipping process (Fangshuai et al., 2018).

• The average percentage of proteins when adding protein treatments at 0.5g, 1g, and 1.5g, respectively, was 422%, 32.4%, and 52.5%, and the highest percentage of protein was when adding 1.5g protein to the manufactured samples, as adding higher percentages of protein will lead to an increased protein content in the product, and this was similar with what was found by (El-Zeini et al., 2016) when different percentages of protein were added.

• The average yield of whipped cream samples manufactured from camel milk when adding 0.5g, 1g, and 1.5g protein treatments, were respectively: 28.64%, 40.13%, and 49.42%, where the highest percentage of yield was when 1.5g protein was added to the manufactured samples, and this is due to the functional properties of protein in binding air and thus increases the ability to form foam (Kashaninejad, 2022) and it was reported that the result of the overrun was 36.68%.

**Table (7): Results of a study of the chemical composition of whipped cream samples made from camel milk**

| | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|
| (%) Total solids | a0.24 ±34.99 | b0.31 ±36.29 | c0.43 ±40.80 |
| Fat(%) | a0.31 ±25.53 | b0.30 ±30.20 | c0.45 ±35.17 |
| Proteins(%) | b0.03 ±2.42 | b0.03 ±2.43 | a0.15 ±2.55 |
| Yield | a1.02 ±28.64 | b1.96 ±40.13 | c2.40 ±49.42 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \leq 0.05$.

**3-2)** Color estimation in whipped cream:

Table (8) shows the results of the color values of cream samples manufactured from camel milk using the Hunter-Lab device, where:

**Table (8): Results of the color estimation study of whipped cream samples made from camel milk**

| | 0.5 g protein | 1 g protein | 1.5 g protein |
|---|---|---|---|
| L | a0.03 ±92.23 | a0.05 ±92.24 | a0.54 ±92.31 |
| a | a0.03 ±-0.88 | b0.01 ±-0.79 | b0.02 ±-0.72 |
| b | a0.01 ±9.81 | b0.04 ±9.91 | c0.25 ±11.81 |

*Similar letters in the same row indicate that there are no significant differences at the confidence level of $P \leq 0.05$.

•The average value of the white color L was: 92.23, 92.24, 92.31 when adding 0.5g, 1g, and 1.5g protein, respectively, where the highest value of the white color L was when adding 1.5g protein (Berrak and Tulay, 2014).

•The average value of a was: -0.88, -0.79, and -0.72 when adding 0.5g, 1g, and 1.5g protein, respectively, where the highest value of the yellow color A was when adding 0.5g protein (Berrak and Tulay, 2014).

•The average value of b was: 9.81, 9.91, and 11.81 when adding 0.5g, 1g, and 1.5g protein, respectively, where the highest value of the red color b was when adding 1.5g protein (Berrak and Tulay, 2014).

**6- Conclusions:**

1. Camel milk ice cream, mayonnaise and whipped cream can be made from camel milk and are characterized by acceptable physical and chemical properties and acceptable texture and flavour.
2. The percentage of total solids and the percentage of protein in camel milk ice cream product increased by adding camel milk proteins.
3. Mayonnaise samples of 1.5 g of added protein had the highest emulsion stability.
4. Whipped cream samples of 1.5 g of added protein had the highest yield.

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