Ameliorative Effect of Dill and Coriander Oils Addition on Quality Characteristics and Oxidative Stability of Tallaga Cheese Manufactured Using Vegetable Oil

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ABSTRACT

Tallaga cheese produced exploiting milk (4% fat) as control. Sunflower oil was inserted to skim milk as an alternative for milk fat. Dill and coriander oils were included to sunflower oil cheese treatments at a percentage of 0.2%. Chemical structure, oxidative stability, antioxidant activity, microbiological and sensory characteristics of produced Tallaga cheese when fresh and after 15, 30, and 60 days of store at 7°C were investigated. The existing findings exhibited that dill and coriander oils have high content of phenolic components and presented great antioxidant activity. No significant differences were obtained among resulting sunflower oil cheeses in the chemical structure, but dill and coriander oils supplementation impacted the oxidative stability, antioxidant activity, microbiological and organoleptic properties. An evident decrease in peroxide and acid values of sunflower oil cheese comprising dill and coriander oils through the storage phase than sunflower oil cheese without tert- butyl hydroquinone (TBHQ) was detected. As well as yeasts & moulds of cheese samples encompass dill and coriander oils did not discover throughout storage when compared with sunflower oil cheese without (TBHQ). Likewise, our outcomes demonstrated that that the organoleptic properties of all cheese treatments improved throughout the storage period progressed. Sunflower oil cheese containing dill and coriander oils showed better flavor intensity and body characteristics than other cheese treatments.

Keywords: Tallaga Cheese, Coriander oil, Dill oil, Sunflower oil

INTRODUCTION

Fat consumption is associated with an increased risk of obesity, elevated blood pressure, tissue injury diseases and coronary heart disease, associated with lipid oxidation (Katsiari et al., 2002). However, fat content is responsible for many desirable functional, textural and sensory characteristics in produced cheese (Sheehan and Guinec, 2004).

Cheese analogs are cheese-like products with different compositions and functional characteristics produced by whole or partial replacement of milk components, particularly milk fat, substituted by non-milk-based components (Al-Ismail et al., 2015). In addition, recent researches have explored the possible total replacement of milk-fat by polysaturated edible vegetable oils to produce functional products with healthier unsaturated/saturated fatty acids balance that may improve consumer’s health (Yu and Hammond, 2000).

In the Middle East countries, especially Egypt, Tallaga cheese is one of the most popular soft white cheeses. According to the Egyptian standards (ES, 2005a) Vegetable oil soft cheeses are defined as white fresh or ripened soft cheeses obtained after coagulation of fresh or concentrated milk or a mixture of its fresh products, total or partial fat replacement with the addition of vegetable oils.

Sunflower seeds oil is the 5th in production among edible vegetable oils in the world. World edible oil production had been increased in the last few years, with estimated total seed production of about 400 million metric tons in 2014. The total world sunflower oil production in 2001 about 8.91 million tons. Moreover, about 13.2 million tons in 2011, in the season of 2014, is currently forecast at about 21 million metric tons. This was set considering the accepted approach that 42 g sunflower oil can be obtained from 100 g sunflower seed. (Sánchez-Muniz et al., 2016)

In order to overcome the stability problems of fats and oils, synthetic antioxidants, such as butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), tert-butyl hydroquinone (TBHQ) have been used as food additives. However, recent reports reveal that these compounds may be implicated in many health risks, including cancer and carcinogenesis (Prior, 2004). Therefore, the most potent synthetic antioxidant (TBHQ) is not allowed for food application in some countries such as Japan, Canada, and Europe. Similarly, BHA has also been removed from the generally recognized as safe (GRAS) list of compounds (Goli et al., 2005). Due to these safety concerns, there is an urgent need to replace these synthetic antioxidants with natural other ones, which in general, are supposed to be safer (Yanishlieva and Marinova, 2001). Phenol compounds are one of the most important groups of natural antioxidants (Artajo et al., 2006).

Dill (Anethum graveolens L.) is a member of Apiaceae. It is one of the most popular culinary herbs in the world. Dill has been cultivated since ancient times, and the use of this plant for consumption purposes and medicinal has been recorded dating back to Egyptian and Greek...
civilizations. Widely use of dill is giving flavor to food (Ramadan et al., 2013). Dill oil is extracted from the leaves, seeds, and stems of the plant and is an essential oil used as a flavoring in the food industry (Jana and Shekhawat, 2010). Moreover, it exhibits intense antioxidant activity (Ramadan et al., 2013).

Coriander (C. sativum L.) is a member of the Apiaceae family commonly used for medicinal purposes due to its antioxidant activity (Demir and Korukluoglu, 2020). In addition, the Coriander essential oil and extracts possess promising antifungal, anti-oxidative and antibacterial activities as various chemical components in different parts of the plant, which thus play a significant role in preventing foods spoilage and that maintain the shelf-life of different foods (Khan et al., 2017).

The major problem related to using vegetable oils in dairy products is that they are easily oxidized, giving rise to undesirable compounds such as aldehydes and peroxides (During et al., 2000). Therefore, the present investigation aimed to study the effects of milk fat replacement with sunflower oil and the extent to which dill and coriander oils contributes to improving the quality characteristics and the oxidative stability of resultant cheeses.

**MATERIALS AND METHODS**

**Materials**

Dill and Coriander oils were purchased from EL-Captain Company, Egypt. Distilled monoglyceride (DMG) was obtained from Al-Iman Company, imported from Turkey. Raw cow milk was collected from a private farm located in Sharquia Governorate (Egypt) and handled within 1 h after milking. Fresh cow milk (4.8% fat) was obtained from the Dairy unit, Department of Food Science, Agriculture Faculty, Zagazig University, Egypt. Milk was standardized to 4% fat using a person square and milk separator. Fresh skim milk (0.2% fat) was produced by a mechanical separator. Sunflower oil and TBHQ (E319) were obtained from SAVCO Vegetable oils Company, 10th of Ramadan City, Egypt. Freeze-dried starter culture: FD-DVS R-704 containing (Lactococcus lactis subsp. lactis and Lactococcus lactis subsp. cremoris) and rennet (HANNHLASE® TL2300 Granulato NB microbial coagulate granulate) were obtained from Christian Hansen Inc. Laboratories, Denmark, by Misr Food Additives Company, Egypt. Rennet was diluted with distilled water to a standard rennet solution before use. Calcium chloride (CaCl₂) was obtained from El-Gomhoria Company, Cairo, Egypt. Commercial fine grade salt obtained from the Egyptian Salt & Minerals Company (EMISAL), Egypt was used.

**Tallaga cheese manufacture**

Cow milk was divided into two batches. The first batch was served as control: whole milk (standardized 4% fat), the second batch fresh raw skim milk (0.2% fat) divided into four batches: T1: 4% Sunflower oil without (TBHQ), T2: 4% Sunflower oil with (TBHQ), T3: 4% Sunflower oil +0.2% dill oil and T4: 4% Sunflower oil +0.2 coriander oil. Tallaga cheese treatments were made from all milk treatments by the conventional method of making Domiati cheese (Fahmi and Sharara, 1950). With some modification as following: fresh raw skim milk (0.2% fat) was mixed with 4% of sunflower oil, and then the mixtures were salted by 4% NaCl, stabilizer DMG was added to cheese milk at 1%, the cheese milk of all treatments then homogenized at 60°C, 400 kPa. Pasteurization was carried out at 72 °C for 15 min and then cooled to 40°C. After this, 0.02% of CaCl₂ was added. Next, 0.003% of the starter was added. Cheese milk of each treatment was adjusted to 40°C and renneted with microbial rennet and incubated until coagulation, and then the curd was filtered and collected the whey of each treatment. Resultant cheeses were packaged in plastic bags containing pasteurized saline solution (10%) and stored at 7±1°C in the refrigerator for 60 days of storage. Samples were analyzed for physicochemical sensory properties, total bacterial count, and moulds & yeasts when fresh and after 15, 30, and 60 days of storage.

**Methods of analysis**

- **Total phenolic content (TPC) determination:** TPC concentration in oil and cheese was determined according to (Hassani et al., 2013) for oil and Reis et al., (2012) for Tallaga cheese by using reagent of Folin-Ciocalteu and expressed as mg GAE/100g.
- **Radical scavenging activity (RSA %) determination:** According to (Brand-Williams et al., 1995), RSA of oil and Tallaga cheese were measured by bleaching of the purple-colored solution of 2,2-diphenyl-1-picrylhydrazyl (DPPH). Antioxidant activity of DPPH percent was calculated as follows:

\[
RSA \% = \frac{[(A0 - A1)/A0]}{A0} \times 100
\]

Where: A0 is the absorbance of the control reaction, and A1 is the absorbance in the extract.

**Chemical analysis**

Cheeses were analyzed in duplicate for moisture, fat, fat in whey, titratable acidity, and pH values were determined in homogenized cheese samples using HNNA Digital Hi 8014 pH meter using the methods of AOAC (2000). The modifications suggested by Hefnawy (1988) were applied to determine fat in cheese made using vegetable oils. Total nitrogen (TN) and soluble nitrogen (SN) content were determined by the Kjeldahl method. Total volatile fatty acids (TVFA) were estimated according to Kosikowski (1978).

**Oxidative stability tests**

To determine oxidative stability, cheese samples were dried at 40°C for 12 hrs in a hot air oven, grounded, and mixed with n-hexane as a solvent for oil extraction. Then, the solvent was evaporated in a hot air oven, and the extracted oils were analyzed for peroxide and acid values according to the method described in AOAC (2000).

**Microbiological examination**

The total bacterial count was determined using plate count agar (Houghtby et al., 1992). Bacterial count plates were incubated at 37°C for 48 h. According to Marshall (1992) moulds and yeasts counts were enumerated. The plates were incubated at 25°C for 5 days.

**Organoleptic properties**

The cheese was organoleptically evaluated when fresh and after 0, 15, 30, and 60 days of storage at the refrigerator temperature 7±1°C by the staff members of the Food Science Department, Faculty of Agriculture, Zagazig University. As a result, the panel scores for appearance (10), body and texture (40), and flavor (50), as described by Scott (1981).

**Statistical analysis**

The experiment was carried out in triplicate, and the data were transferred to the SPSS (2007) version 16.
RESULTS AND DISCUSSION

TPC and RSA of dill and coriander oils

Phenolic acids are the most prominent class of bioactive chemicals grouped under phenolic compounds present in various plant sources such as spices, beverages, grains, vegetables, and fruits (Stupper-Szablewska and Perkowski, 2019); which are distributed in different parts of plants. They are the secondary aromatic metabolites flavor, color, astringency, harshness, and imparting, which contribute to the typical sensory characteristics of the foods. Phenolic acids have gained momentum owing to their immense dietary health benefits and functionalities like antioxidant, immune regulatory, anti-allergenic, anti-inflammatory, anti-microbial, anti-atherogenic, anti-thrombotic, anti-cancer activities, cardioprotective and anti-diabetic properties (Kumar and Goel, 2019).

Dill and coriander oils were investigated for (TPC). The results showed that total phenolic content of dill oil was 1862 mg/100g. The radical scavenging activity (RSA%) of dill oil was 72.8%. These results are in harmony with those found by (Ramadan et al., 2013), who studied the antioxidant activity of dill oil. The results revealed that TPC and RSA of coriander oil were 2590 mg/100g and 77.6%, respectively. Similar results were reported by (Khan et al., 2017).

The yield and chemical analysis of Tallaga cheese

The results tabulated in Table 1 clear that the average yield of fresh cheese from milk was 26.56 -30.16 kg/100 kg. The obtained results indicated that Tallaga cheese made using sunflower oil scored the lowest cheese yield.

Chemical analysis was assessed by determining moisture, fat, in whey, total protein, pH, acidity, and ripening indices.

Table 1 showed that the control Tallaga cheese (4% fat) had the lowest moisture content compared to sunflower oil cheeses treatments. The moisture content of all samples decreased during the storage period progressed up to 60 days of storage. The decrease in moisture content of cheese samples during the storage period may be due to the penetration of salt into the cheese and syneresis, which occurred as a result of decreasing pH. (Abd El-Salam, 2015; El-Sheikh et al., 2001).

Concerning fat content in manufactured Tallaga cheese made using skim milk affected by sunflower oil treatments Table 1. It could be observed that the fat content of experimental cheese samples increased significantly (P<0.05) up to 60 days of storage, depending on the loss of moisture. Control cheese showed the highest fat content compared with other treatments. The increase in fat content might decrease moisture content and, consequently, increase total solids. The results agree with those reported by (Javidipour and Tunceturk, 2007; Mahgoub et al., 2013). Table 1 also shows increasing in fat % in whey of Tallaga cheese manufactured with vegetable oils compared with control cheese. And in all cheese samples the fat % in whey was increased during storage period progressed up to 60 days of storage.

Table 1 shows that the TPC% content of cheese samples slightly decreased up to the end of the storage period. However, the slightly decreasing in TPC% during the storage period. This may be due to lower proteolysis and high protein content in all treatments. Similar results were stated by (Abd El-Galeel and El-Zahar, 2018; Salem et al., 2010).

<table>
<thead>
<tr>
<th>Storage period (day)</th>
<th>C</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>30.16 a</td>
<td>27.18 a</td>
<td>27.06 a</td>
<td>26.56 b</td>
<td>26.77 b</td>
<td>0.19</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>62.50 b</td>
<td>62.97 b</td>
<td>62.94 b</td>
<td>62.90 b</td>
<td>62.92 b</td>
<td>0.33</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>17.22 a</td>
<td>15.52 a</td>
<td>15.58 a</td>
<td>15.62 b</td>
<td>15.66 b</td>
<td>0.63</td>
</tr>
<tr>
<td>pH</td>
<td>5.42 a</td>
<td>5.48 a</td>
<td>5.54 a</td>
<td>5.56 b</td>
<td>5.59 b</td>
<td>0.04</td>
</tr>
<tr>
<td>Acidity (as lactic acid %)</td>
<td>0.35 a</td>
<td>0.32 a</td>
<td>0.30 a</td>
<td>0.32 d</td>
<td>0.25 b</td>
<td>0.02</td>
</tr>
<tr>
<td>SN/TN %</td>
<td>9.97 a</td>
<td>8.94 c</td>
<td>8.9 b</td>
<td>8.84 c</td>
<td>8.80 c</td>
<td>0.16</td>
</tr>
<tr>
<td>Total Volatile Fatty Acids (TVFAMg NaOH)</td>
<td>19.40 a</td>
<td>16.80 a</td>
<td>16.92 a</td>
<td>15.40 a</td>
<td>15.70 a</td>
<td>0.18</td>
</tr>
</tbody>
</table>

A significant increasing trend (P<0.05) in the acidity for all cheese treatments during storage. Tallaga cheese manufactured with vegetable oils showed the lowest acidity than control cheese. Also, cheese-containing vegetable oils with dill and coriander oils decreased cheese acidity than vegetable oils control cheese. This may be due to the antimicrobial activity of dill oil (Ramadan et al., 2013) and coriander oil (Khan et al., 2017). The acidity of all cheese treatments increased gradually with the progress in the storage period. These results are in line with those stated by (Abd El-Salam, 2015; Abd El-Galeel and El-Zahar, 2018). The trend of the changes in pH values of all treatments was opposite to that of acidity Table 1.

Ripening indices of Tallaga cheese during storage at 7°C The rate of proteolysis

Soluble nitrogen content as a percentage of total nitrogen (SN/TN%) of Tallaga cheese samples during storage
is presented in Table 1. The control cheese had the highest SN/TN% compared with other treatments. SN/TN% content in cheese samples had significant differences between control and other treatment along the storage period due to the differences in moisture content. The increase in soluble nitrogen content in all cheese samples throughout the storage period may be due to proteolysis breakdown. These results are following those results reported by (Salem et al., 2010).

Increasing in ripening indices of cheeses throughout the ripening period reported by (Arslan et al., 2012).

**Total Volatile Fatty Acids**

Results under discussion in Table 1 also show the changes in total volatile fatty acids TVFA of Tallaga cheese samples made using sunflower oil treatments. There were significant differences in TVFA content of cheese as compared with control when fresh and during the storage period. Moreover, TVFA content of all cheese samples showed a significant gradual increasing during the storage period, which could be attributed to lipolysis of fat and the higher rate of proteolysis and formation of free amino acids, which could be converted to volatile fatty acids through a specific metabolic pathway (Nakae and Elliott, 1965). Control cheese had the highest TVFA content (27.14) after 60 days of storage. Similar results were reported by (Salem et al., 2010; Abd El-Galeel and El-Zahar, 2018).

**Total phenolic content (TPC) and radical scavenging activity (RSA %) of Tallaga cheese during storage at 7°C**

Phenolic contents and radical scavenging activity of Tallaga cheese samples are presented in Table 2. There were significant differences in the samples' phenolic contents and radical scavenging activity (P ≤0.05). Sunflower oil cheese treatments showed higher phenolic content and radical scavenging activity compared with control cheese. The addition of dill and coriander oils significantly increased phenolic contents and radical scavenging activity of sunflower oil cheese treatments.

**Table 2. Total phenolic content and radical scavenging activity of Tallaga cheeses during storage at 7°C**

<table>
<thead>
<tr>
<th>Storage period (day)</th>
<th>Treatment</th>
<th>C</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>Total phenolic content (TPC) mg/100g</td>
<td>38.8</td>
<td>30.7</td>
<td>36.5</td>
<td>47.0</td>
<td>49.4</td>
<td>8.22</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>32.2</td>
<td>27.1</td>
<td>32.2</td>
<td>43.0</td>
<td>46.8</td>
<td>9.14</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>27.0</td>
<td>78.4</td>
<td>318.0</td>
<td>412.0</td>
<td>446.0</td>
<td>9.60</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>22.0</td>
<td>74.0</td>
<td>298.0</td>
<td>386.0</td>
<td>394.0</td>
<td>8.55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radical scavenging activity (RSA %)</th>
<th>28.0</th>
<th>45.0</th>
<th>47.0</th>
<th>51.0</th>
<th>55.0</th>
<th>2.14</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>24.0</td>
<td>42.0</td>
<td>44.0</td>
<td>47.0</td>
<td>50.0</td>
<td>3.20</td>
</tr>
<tr>
<td>30</td>
<td>23.0</td>
<td>38.0</td>
<td>40.0</td>
<td>45.0</td>
<td>47.0</td>
<td>3.42</td>
</tr>
<tr>
<td>60</td>
<td>21.0</td>
<td>36.0</td>
<td>38.0</td>
<td>42.0</td>
<td>44.0</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Means followed by different small letters in the same column are significantly different (p ≤0.05). L.S.D: Least significant difference

**Oxidative stability**

The data presented in Table 3 shows that control cheese had lowest peroxide values than cheeses made with sunflower oil. Sunflower oil cheeses containing coriander oil had lower peroxide values (PV) compared with sunflower cheese without (TBHQ). The addition of dill and coriander oils improved cheeses' stability for oxidation. The peroxide value (PV) increased significantly in different experimental cheeses and control with extended storage period, but this increase within the legal standard specification for sunflower oil (10 meq/kg) (ES, 2005b). The addition of (TBHQ), dill and coriander oils decreased PV in all treatments compared with cheeses without (TBHQ). Similar results were obtained by (Al-Ismaiel et al., 2015; Abdel-Ghany et al., 2020), who reported that cheese containing vegetable oil had higher PV than control cheese. As the storage period progressed, the acid value (AV) increased gradually in all cheese samples, as shown in Table 3. Control cheese had the lowest AV, followed by sunflower + (TBHQ) cheese, coriander oil cheese, dill oil cheese, and finally, control sunflower oil cheese. Control cheese was recorded (0.92 mg KOH/g) after 60 days of storage. While the cheese made using sunflower without (TBHQ) scored the highest AV (1.20 mg KOH/g). The presented data agree with (Al-Ismaiel, et al., 2015), who found that cheese made with butter oil had lower AV than cheeses containing olive oil. Also (Abdel-Ghany et al., 2020) found that cheese made with butter oil had lower AV than cheeses containing rice bran oil.

**Table 3. Oxidative stability of Tallaga cheeses during storage at 7°C**

<table>
<thead>
<tr>
<th>Storage period (day)</th>
<th>Treatment</th>
<th>C</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>Peroxide value (meq/kg)</td>
<td>3.63</td>
<td>5.89</td>
<td>4.54</td>
<td>4.72</td>
<td>4.60</td>
<td>0.22</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>4.92</td>
<td>7.19</td>
<td>5.22</td>
<td>6.56</td>
<td>5.64</td>
<td>0.18</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>5.86</td>
<td>7.81</td>
<td>5.64</td>
<td>6.94</td>
<td>6.64</td>
<td>0.12</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>6.77</td>
<td>8.99</td>
<td>7.00</td>
<td>8.00</td>
<td>7.90</td>
<td>0.14</td>
</tr>
<tr>
<td>Acid value (mg KOH/g oil)</td>
<td>0.60</td>
<td>0.77</td>
<td>0.87</td>
<td>0.97</td>
<td>0.98</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>0.78</td>
<td>0.89</td>
<td>0.90</td>
<td>0.92</td>
<td>0.88</td>
<td>0.06</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>0.88</td>
<td>1.12</td>
<td>0.94</td>
<td>1.04</td>
<td>0.99</td>
<td>0.04</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>0.92</td>
<td>1.20</td>
<td>1.00</td>
<td>1.10</td>
<td>1.05</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Means followed by different small letters in the same column are significantly different (p ≤0.05). L.S.D: Least significant difference

**Microbial examination**

**Total bacterial count**

Differences in total bacterial counts of cheese made from sunflower oil treatments are presented in Table 4. A significant difference in viable bacterial count between control and the other cheese treatments was observed. The results stated that the total bacterial count decreased gradually throughout the storage until the end of the storage period. Generally, the highest counts of the total bacterial count were found in control cheese made with 4% fat milk (C) after 60 days of storage compared with cheese made from sunflower oil. While adding dill and coriander oils to cheese made from sunflower oil decreased total bacterial count compared with the other treatments, this might be due to the antibacterial action of dill oil (Ramadan et al., 2013) and coriander oil (Khan et al., 2017). The results are in agreement with those reported by (Mahgoub et al., 2013).
had the highest organoleptic properties compared with control cheeses (C) and all experimental cheeses when fresh and during ripening period up to 60 days. Control cheese treated with coriander oil+0.2% dill oil significantly improved flavour, texture and free of rancidity during ripening period up to 60 days. These results agree with the results obtained by Abd El-Salam, Al-Ismail, 2015; Omar et al., 2017.

CONCLUSION

The previous results confirmed that Dill and Coriander oils as natural antioxidants improved oxidative stability, antioxidant activity, microbiological and organoleptic properties of produced cheese and encourage recommending to using it as alternative to TBHQ in vegetable oil Tallaq cheese manufacture.

REFERENCES


التأثير الاسمائي لإضافة زيت الشبت والكزبرة على خصائص الجبن الثانوي لعينات الجبن التلاجة استخدمت زيت نباتي

اللذي تم تصنيعه باستخدام لبن دزميتي، وزيت دوار الشمس المحتوية على زيوت الشبت والكزبرة.

تستخدم هذه المصنعة لصنع عينة من الجبن. وتستند هذه العينة لبعض الجبنات الشبيهة.

تستخدم هذه المصنعة pour studying the effects of adding coriander (Coriandrum sativum L.) and fennel (Foeniculum vulgare M. Bieb.) oils to cheese. Int. Dairy J., 12(8): 757-764.


Abd El-Sattar, E. and Hend A. Elakkad