

1 **The effect of different production methods on quality parameters of Hatay Künefe cheese**

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5 SUPPLEMENTARY FILE

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8 **Material & Methods**

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10 *Materials*

11 Table S1. Properties of packaging materials used in the production of Künefe cheeses

Properties	Packing Name	
	Vacuum	Film
Film type	Top film	Under film
Packaging type	PET+COEX PA	PET+COEX PA
Width (mm)	350	380
Micron	110	200
Weight (g/m)	83±0.5	83±0.5
Coil inner diameter (mm)	100	100

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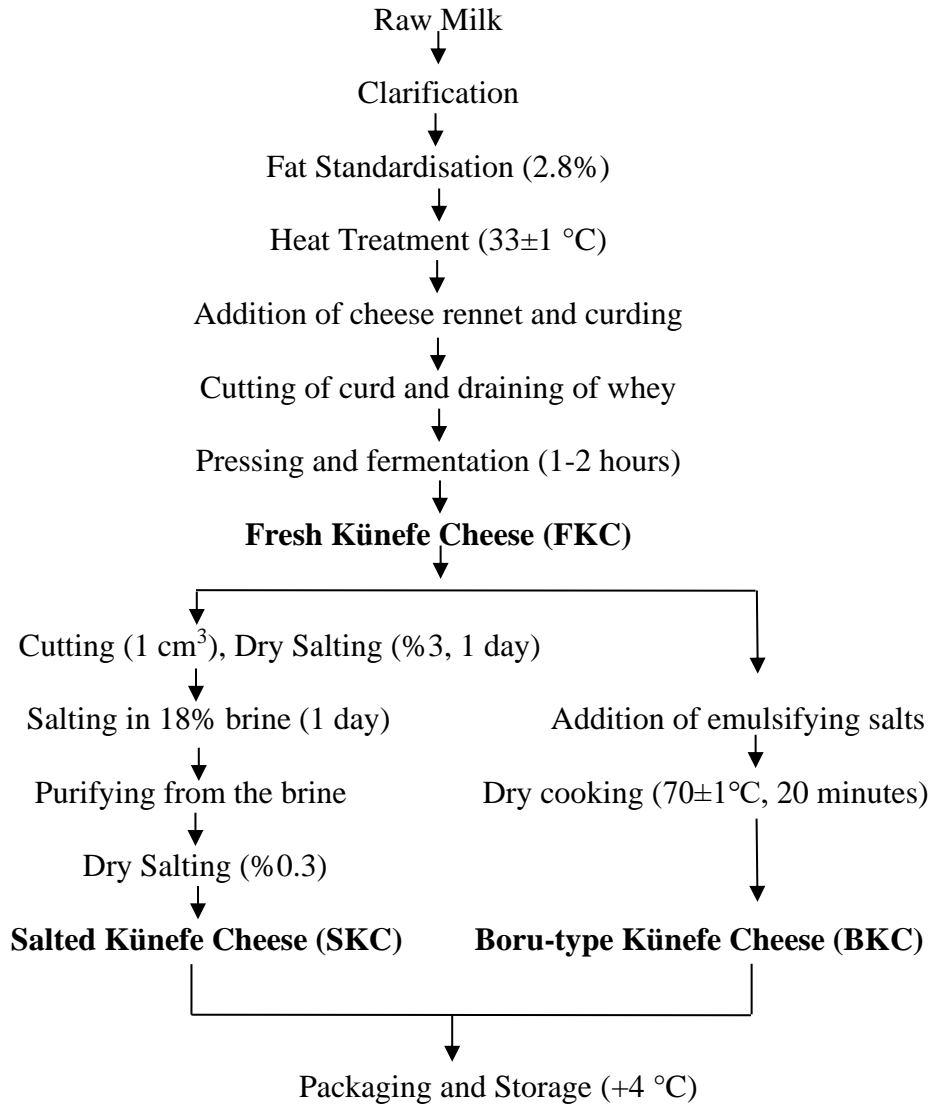
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27 *The manufacturing procedure of the cheeses*

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29 **Figure S1. Flowchart for the manufacturing of FKC, SKC and BKC**

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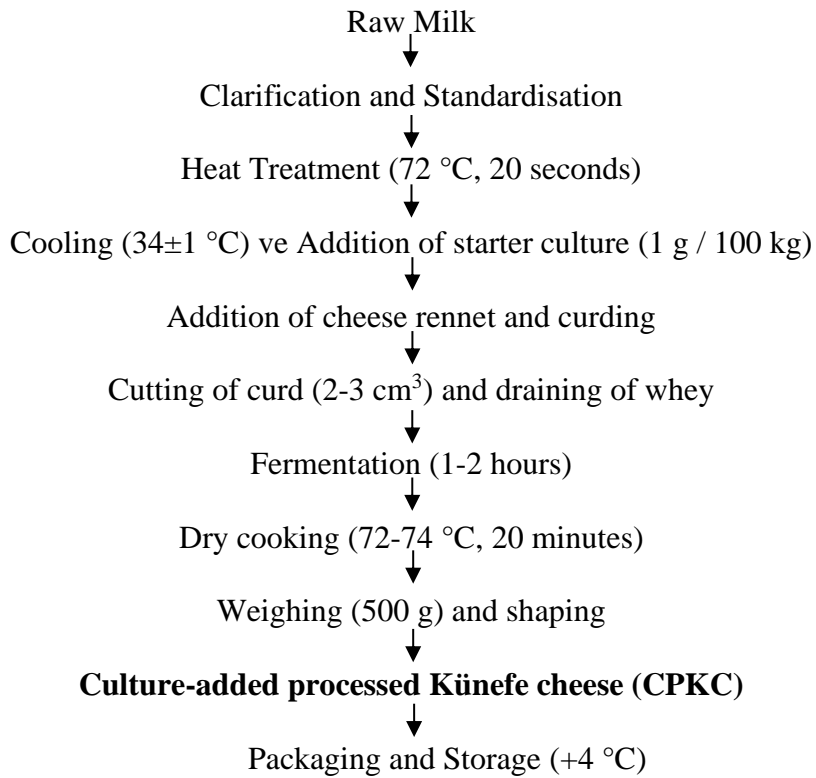
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40 **Figure S2. Flowchart for the manufacturing of CPKC**



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59 *Detailed account of cheese production*

60 To produce all cheeses, after necessary controls and clarification, the raw cow milk was
61 divided into four groups for fat standardization and different following procedures. Fat ratios
62 were determined according to the fat content recommended and used by Künefe cheese
63 manufacturers. The fat ratio of the first (FKC), third (SKC), and fourth groups (CPKC) were
64 standardized to 2.8%, and the fat ratio of the second group (BKC) to 1.1%. Afterwards, heat
65 treatment was applied to FKC, SKC, and BKC milk up to 33 ± 1 °C, and each batch was then
66 mixed with cheese rennet and left to curdle for around 40 minutes. The cheese curd was then
67 cut and left to stand until the whey was drained. The pressed cheese curd was fermented for
68 one to two hours. The finished cheese was named fresh Künefe cheese (FKC). The pressed
69 curd was separated into moulds, packaged and stored at 4 ± 1 °C until analysis. For the
70 production of SKC, the curd produced in FKC production was cut into 1 cm³ dimensions and
71 dry salted by adding approximately 3% of salt to it, and the cheeses were rested for one day.
72 Then, the cheeses were left to ripen in 18% brine for one more day in cold storage. After the
73 maturation process was completed (48 hours later), the cubed cheeses, which were purified
74 from the brine, were again dry salted at a rate of 0.3%, packaged and stored at +4 °C.

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76 A portion of the FKC was put into the dry cooking machine for the BKC production, together
77 with emulsifying salts, and the dry cooking process was carried out at 70°C for 20 minutes.
78 Then the obtained cheeses were placed into cylindrical plastic moulds. The cheese was
79 vacuumed and shrink- packaged when it had time to rest, and then it was stored at +4 °C.

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81 In CPKC production, standardized milk (fat content is 2.8%) was heat treated at 72 ± 1 °C for
82 20 seconds. Then the milk was cooled to 34 ± 1 °C and 1 g/100 kg of starter culture was added.
83 Cheese rennet was then put into each batch and left to curdle for approximately 40 minutes.
84 The curd was then cut into 2 to 3 cm³ cubes and left to stand until the whey was drained. For
85 one to two hours, the cheese curd was fermented. When the pH reached 5.30-5.50, the curd
86 was cut into blocks and cooked with the emulsifying salts in a dry cooking machine at 72-74
87 °C for 20 minutes. The obtained cheese was shaped and weighed (500 g) after resting, then
88 vacuum packed and stored at +4 °C.

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90 The production of Künefe desserts has been adapted by utilizing the production method of
91 Antakya Künefe, which received a Geographical Indication Registration Certificate from the
92 Turkish Patent Institute (TPE, 2007). For dessert, 1 kg of kadayıf (It is a food obtained as a

93 result of the dough obtained by mixing flour and water into thin wires) was mixed with 300
94 grams of butter and separated by hand. Aluminum Künefe cups with a diameter of 14 cm and
95 a depth of 3 cm were well-oiled separately for each sample to prevent shredded phyllo dough
96 from sticking. Then, 50 g of shredded phyllo dough prepared on the bottom of each Künefe
97 cup was pressed, and 70 g of Künefe cheese was added. Unlike other Künefe cheeses, Salted
98 Künefe cheese (SKC) is placed in drinking water one day before making Künefe dessert so
99 that the salt is completely removed. In order to completely remove the salt from the cheese,
100 the water in which the cheese is kept is changed at intervals of several hours. Then, 50 g of
101 shredded phyllo dough was pressed to cover the Künefe cheese and cooked on low heat. After
102 the bottom of the Künefe is fried, the dessert is turned upside down and cooked on low heat
103 until fried. After the cooking process, the hot syrup was prepared with water (60%), sugar
104 (40%), and 3-4 drops of lemon juice over the hot Künefe.

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106 *Cheese analyses*

107 The total solid content of each cheese was determined using the gravimetric method (IDF,
108 2004), total nitrogen and protein content was determined using the Kjeldahl method (IDF,
109 2014), fat content was detected using the Gerber method (IDF, 2008), and salt content was
110 determined using the Mohr method (TOKB, 1983). After determining the protein, fat, and salt
111 content, the protein, fat, and salt content in the dry matter (%) were also determined.
112 According to Koçak (2007), cheese yield was measured as the amount of cheese (kg)
113 manufactured from 100 kilograms of milk. The pH of the cheese was determined using a pH
114 meter (Inolab pH 720, WTW GmbH, Weilheim, Germany) (Hannon et al., 2003).

115 The color properties of Künefe cheeses were analysed using a Chroma Meter (Minolta, model
116 CR300, Minolta Camera Company, Osaka, Japan). Results were expressed in terms of L*, a*,
117 and b*. The instrument was calibrated with a white reference layer before measurements were
118 made (Voss, 1992; Martley & Michel, 2001).

119 A TA.XTPlus Texture Analyser (Stable Micro Systems, Godalming, Surrey, UK) was used to
120 examine the textural properties. For the purpose of the texture analysis profile (TPA), cheese
121 samples were sliced into cylinders of 10 mm and 25 mm in diameter, wrapped in plastic, and
122 left to warm up to about 20 °C. Test parameters: P/36 stainless steel cylinder probe; 1 mm s⁻¹
123 test speed; 5 mm s⁻¹ pretest speed; 1 mm s⁻¹ posttest speed; 25% compression (strain); 5-
124 second time pause. Data collection and calculation were done using Exponent Stable Micro
125 Systems Version 6.1.16.0 equipment software (Stable Micro Systems Ltd, Godalming, UK)
126 (Kahyaoglu, 2002).

127 The Poduval & Mistry (1999) method was used to determine the Künefe cheeses' meltability.
128 For this, 10 g of grated cheese was put into a test tube (32 x 250 mm) to form a plug at the
129 bottom. The tube was covered with aluminum foil after the sample's height was marked, and
130 many holes were made to allow hot gas to escape during heating. The tubes were rested for 30
131 minutes vertically in a 4°C refrigerator. Afterwards, they remained horizontally in a 104°C
132 oven for 60 minutes. The tubes were taken out of the oven and allowed to cool for 30 minutes
133 on a smooth surface at room temperature. The cheese flow was then determined in terms of
134 meltability in millimeters.

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