

CHARACTERIZATION OF WASTE SKINS USED IN TULUM CHEESE PRODUCTION

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Tulum cheese is a traditional cheese type of Turkey, which the ripening process of the cheese is carried out in sheep and goat skins. Although there are some industrial casings, sheep and goat skins are still the commonly preferred casing materials in traditional Tulum cheese production due to the natural favor and taste that give to the cheese characteristics. The difference of these natural casing materials, such as type, age, gender and sex, gives different tulum cheese quality. But not only a high quality cheese production but also the utilization of the skins used in tulum cheese production is carrying a great importance in environmental point of view. In this study, the utilization possibilities of raw skins that become the waste of the food industry after the tulum cheese production were investigated in terms of physical and chemical properties. For this purpose, forty eight (48) raw skins in different type (goat and sheep skins), age (6 months, 1 and 2 years old) and gender (male and female) were examined. The physical tests such as tensile strength and percentage of extension, double edge tear strength, shrinkage temperature, water vapor and air permeability determination; the chemical analysis such as pH, matters soluble in dichloromethane and Kjeldahl nitrogen analysis were performed to reveal the usage possibilities of these raw materials for the leather or relevant industries.

Keywords: Tulum cheese, goat skin, sheep skin, casing, utilization.

INTRODUCTION

Tulum cheese production is commonly performed nowadays with alternative casing materials such as plastic, jam, bowel, cloth and polyethylene instead of goat and sheep skins due to the factors such as decrease in the number of ovine, legal restrictions occurred by the law of forest, regulations of the European Union and ease of use (Tarakçı *et al.* 2005; Hayalo lu *et al.* 2007; Duman-Aydın and Gülmez, 2008; Arslaner and Bakırcı, 2009). However, the quality characteristics of Tulum cheese such as natural flavor and taste as well as the standardization of the applications and the shortening of ripening period have not been achieved yet by the alternative casing materials (Güven and Konar, 1994). The most important properties of the raw skins are the water vapor, air and gas permeability in addition to their unique skin characteristics. Not only a high quality cheese production, but also the utilization of the skins used in tulum cheese production is carrying a great importance.

From the environmental point of view, to utilize the waste generated by cheese production of the food industry that consists primarily of the leather protein has been the focus of interest. Although the skin characteristics of the goat and sheep skins by different age and gender was described prior to Tulum cheese production (Gun *et al.*, 2014), no report was found about the chemical and physical characteristics of raw skins obtained after the Tulum cheese production.

Characterization of Waste Skins Used in Tulum Cheese Production

In this study, the utilization possibilities of raw skins that become the waste of the food industry after tulum cheese production were investigated in terms of physical and chemical properties. The physical tests such as tensile strength, percentage of extension, double edge tear strength, shrinkage temperature, water vapor and air permeability determination; the chemical analysis such as pH, matters soluble in dichloromethane and Kjeldahl nitrogen analysis were performed to reveal the usage possibilities of these raw materials for the leather or relevant industries.

MATERIALS AND METHODS

Materials

Forty eight (48) waste raw skins in different type (goat and sheep skins), age (6 months, 1 and 2 years old) and gender (male and female) were examined after Tulum cheese production. Analytical grade chemicals were used for the chemical analysis.

The codes given to raw skins after Tulum cheese production are presented in Table 1.

Table 1. The codes for the waste raw skins of sheep and goat in different age and gender

6MSF: 6 Months Sheep Female	6MGF: 6 Months Goat Female
6MSM: 6 Months Sheep Male	6MGM: 6 Months Goat Male
1YSF: 1 Year Sheep Female	1YGF: 1 Year Goat Female
1YSM: 1 Year Sheep Male	1YGM: 1 Year Goat Male
2YSF: 2 Year Sheep Female	2YGF: 2 Year Goat Female
2YSM: 2 Year Sheep Male	2YGM: 2 Year Goat Male

Methods

The raw skins obtained after Tulum cheese production as a waste of food industry were conditioned according to TS EN ISO 2419, at $23\pm 2^{\circ}\text{C}$ and $50\%\pm 5$ relative humidity prior to physical and chemical characterization.

The Determination of Physical Characteristics

The tensile strength and percentage extension, double edge tear load, shrinkage temperature and water vapor permeability were tested in accordance with the standards TS EN ISO 3376, TS 4118-2 EN ISO 3377-2, TS 4120 EN ISO 3380 and TS EN ISO 14268 respectively.

The air permeability was tested by the brand of Devotrans, DVT-HG model device (Kanli *et al.*, 2010). The measurements were performed at 200 Pa for 5 minutes.

The Determination of Chemical Characteristics

The matter soluble in dichloromethane (%), pH and total Kjeldahl nitrogen content and hide substance were investigated according to TS EN ISO 4048, TS EN ISO 4045 and TS 4134 respectively.

RESULTS AND DISCUSSIONS

Physical test results of waste sheep and goat skins obtained after Tulum cheese production are given in Table 1. Two different ripening periods were selected for the production of Tulum cheese as 60 and 120 days.

Table 1. Tensile strength (N/mm²), percentage of extension (%) and double edge tear load (N/mm) test results of sheep and goat skins after Tulum cheese production

	0. day			60. day			120. day		
	TS	%E	DET	TS	%E	DET	TS	%E	DET
6MSF	8.25	57.60	29.36	11.98	63.66	69.33	10.02	47.48	43.77
6MSM	7.58	62.00	27.64	11.03	53.58	55.31	10.32	45.64	48.22
1YSF	9.16	65.74	31.18	8.07	45.11	43.56	11.65	51.94	55.65
1YSM	7.72	75.50	32.04	11.61	49.11	54.80	11.87	56.16	67.26
2YSF	7.75	83.50	29.77	14.82	65.18	78.03	10.22	45.94	43.33
2YSM	12.18	39.36	40.15	17.69	59.05	78.83	16.23	46.60	62.94
6MGF	12.13	38.16	34.75	21.05	48.22	91.92	15.20	46.38	112.82
6MGM	14.81	63.76	51.05	17.64	64.00	78.54	16.61	34.31	60.23
1YGF	12.38	55.64	41.67	19.14	72.78	93.41	16.16	47.38	63.90
1YGM	12.71	40.06	40.12	17.88	44.09	84.03	15.78	53.05	80.89
2YGF	15.34	65.92	56.29	17.97	41.53	80.88	21.38	42.13	75.70
2YGM	18.00	60.96	55.57	28.04	47.72	112.89	19.19	35.51	58.02

* TS.: Tensile Strength; %E.: Percentage Extension; DET.: Double Edge Tear Load; the mean values were presented

The tensile strength, percentage elongation and double edge tear values of sheep skins were found 8.77 N/mm², 63.97% and 31.69 N/mm respectively. The same tests were applied to sheep skins after 60 and 120 days of cheese ripening and the results were found 12.53 N/mm², 55.95%, .63.31 N/mm and 11.72 N/mm², 48.96%, 48.96 N/mm respectively.

And for the goat skins, the tensile strength, percentage elongation and double edge tear values were found 14.23 N/mm², 54.08% and 46.58 N/mm respectively. After 60 and 120 days of cheese ripening, the results were found 20.29 N/mm², 53.06%, .90.28 N/mm and 17.39 N/mm², 43.13%, 75.26 N/mm respectively.

The goat skins used as a casing material had better tensile, tear load and elongation at break values than the sheep skins. A difference in the physical properties of raw skins was determined depending on the ripening period. Generally, tensile strength and tear load values were increased, although percentage of extension values was decreased after the ripening process.

The shrinkage temperatures TS (°C) of sheep and goat skins were found 68°C prior to ripening process. After the ripening period, shrinkage values were found 65°C in common. This decrease was attributed to the long storage time during the ripening of Tulum cheese (Table 2).

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Table 2. Shrinkage temperatures of sheep and goat skins after Tulum cheese production (°C)

	TS(°C) 0. day	TS(°C) 60. day	TS(°C) 120. day
6MSF	67	64	66
6MSM	67	64	66
1YSF	70	66	63
1YSM	69	65	65
2YSF	67	66	69
2YSM	68	63	63
6MGF	66	65	66
6MGM	70	64	5
1YGF	66	65	64
1YGM	65	65	65
2YGF	69	67	67
2YGM	70	65	65

*The mean values were presented in the table

The water vapor permeability of sheep and goat skins were found 0.48 mg/cm².h and 0.70 mg/cm².h respectively before the ripening process. After 60 and 120 days of cheese ripening, the results were found 0.53 and 0.35 mg/cm².h for sheep skins and 0.41 and 0.50 mg/cm².h for goat skins respectively. The water vapor permeability of goat skins was found higher than the sheep skins; however a decrease was determined after the ripening period for both skin types (Table 3).

Table 3. Water vapor (mg/cm².h) and air permeability (cm³/cm².sec) results of sheep and goat skins after Tulum cheese production

	WVP	0. day		WVP	60.day		WVP	120.day	
		AP wool side	AP flesh side		AP wool side	AP flesh side		AP wool side	AP flesh side
6MSF	0.56	43.97	6.07	0.42	3.78	8.55	0.27	5.97	23.67
6MSM	0.54	162.90	56.27	0.67	0.88	11.40	0.79	4.20	15.33
1YSF	0.31	52.93	5.70	0.57	2.22	15.18	0.17	19.57	20.80
1YSM	0.65	372.27	29.97	0.71	3.92	7.70	0.27	6.53	7.63
2YSF	0.41	134.60	4.93	0.35	7.57	20.72	0.20	5.85	7.48
2YSM	0.41	93.40	12.73	0.43	1.53	7.77	0.41	2.57	7.95
6MGF	0.82	277.90	33.53	0.49	10.82	15.08	0.17	9.68	17.35
6MGM	0.63	196.17	14.30	0.41	6.37	10.93	1.30	15.93	33.90
1YGF	0.80	155.87	10.17	0.34	12.08	16.70	0.36	11.13	31.40
1YGM	0.46	138.00	38.90	0.47	25.28	27.22	0.48	16.78	27.33
2YGF	0.69	63.60	9.27	0.35	14.50	27.77	0.49	20.62	32.62
2YGM	0.77	169.07	13.93	0.41	4.85	12.62	0.23	11.77	25.50

*WVP; Water vapor permeability; AP; Air permeability, the mean values were presented in the table

The air permeability values of waste sheep and goat skins are shown in Table 3 and the test were performed from wool and flesh side of the skins. A decrease from 2 to 10 times at 60 and 120 days of ripening was determined for the air permeability values compared prior to ripening process. This might be because of the protein materials filling the porous structure of the raw skins (Table 3).

Table 4. pH and matter soluble in dichloromethane (%) results of sheep and goat skins after Tulum cheese production

	0. day		60. day		120. day	
	pH	Matter soluble in dichloromethane (%)	pH	Matter soluble in dichloromethane (%)	pH	Matter soluble in dichloromethane (%)
6MSF	6.9	15.11	5.8	21.60	6.4	13.94
6MSM	6.8	7.00	6.1	13.50	6.5	12.23
1YSF	6.7	8.58	6.2	14.02	5.9	18.44
1YSM	6.6	8.99	5.9	14.10	6.2	12.25
2YSF	6.6	13.88	6.4	18.62	6.9	13.83
2YSM	7.0	8.29	5.7	16.77	6.1	15.88
6MGF	6.3	4.78	6.1	10.56	6.2	6.21
6MGM	6.6	5.98	6.1	8.81	6.4	10.16
1YGF	6.3	5.40	5.9	10.91	6.2	16.13
1YGM	6.6	2.77	6.1	5.71	6.3	9.46
2YGF	6.3	8.08	6.2	5.73	6.3	6.04
2YGM	6.3	4.31	5.8	7.64	6.1	6.23

*The mean values were presented in the table

The pH values were found 6.8 and 6.4 for sheep and goat skins before the cheese production. Later, these values were shifted to a little acidic side and then raised again during the ripening process. This was attributed to the fermentation during the cheese production. An alteration was found for the fatty substance (matter soluble in dichloromethane %) for the skins depending on the ripening time (Table 4).

Table 5. Nitrogen Content (%) and Hide Substance (%) results of sheep and goat skins after Tulum cheese production

	0. day		60. day		120. day	
	Nitrogen Content (%)	Hide Substance (%)	Nitrogen Content (%)	Hide Substance (%)	Nitrogen Content (%)	Hide Substance (%)
6MSF	7.33	42.89	9.14	51.34	10.70	60.15
6MSM	8.93	52.27	10.06	56.54	10.31	57.97
1YSF	8.75	51.21	10.07	56.58	10.59	59.52
1YSM	8.94	52.28	10.19	57.24	9.89	55.56
2YSF	8.16	47.71	9.72	54.65	9.77	54.88
2YSM	10.09	59.04	10.12	56.87	10.33	58.04
6MGF	10.94	62.89	11.02	61.94	10.69	60.05
6MGM	8.90	51.81	11.20	62.96	12.20	68.58
1YGF	10.66	61.33	11.02	61.94	10.20	57.32
1YGM	10.82	62.20	12.27	68.94	12.16	68.36
2YGF	9.64	55.44	11.38	63.98	11.52	64.75
2YGM	10.74	61.77	11.27	63.36	11.11	62.44

The hide substance % of sheep skins were found lower than the goat skins. Gun *et al.* (2014) was found the total nitrogen% and hide substance values as 10.77-16.85 and 86.32%. Dikmelik (1978) was determined the hide substance for raw goat skins as 81.72%.

CONCLUSIONS

In this research, physical and chemical characterization of the raw sheep and goat skins generated as a waste of food industry was investigated to determine the utilization possibilities in leather or relevant industries. And the following conclusions have been drawn: a) The physical strengths, matters soluble in dichloromethane, nitrogen content (%) and hide substance (%) values were increased in parallel with the ripening process time. On the contrary, percentage of extension, shrinkage temperature, water vapor and air permeability values were decreased. b) The physical strengths, water vapor and air permeability values of the goat skins were found higher than the raw sheep skins. This could be the reason of the goat skin preference for traditional Tulum cheese production. c) The matters soluble in dichloromethane of goat and sheep skins after the Tulum cheese production were increased in the proportion of 50% and 100%, respectively that was a well indication of the cheese production effect on the amount of raw skin fat.

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