DETERMINATION OF SKIN PROPERTIES IN DIFFERENT TYPE, GENDER AND AGE USED FOR RIPENING OF CHEESE

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In traditional Tulum cheese production, sheep and goat skin sacks are commonly used. The realization of ripening process in Tulum cheese affects significantly the quality of the cheese. Considering the differences in casing materials, the ripening process, consequently the properties of the Tulum cheese are affected. In the present study, raw skin properties in different type, age and gender were investigated. Physical, chemical and structural characteristics of goat and sheep skins, which have different age (6 month, 1 and 2 years old) and gender (male and female), were determined according to thickness, tensile strength and elongation at break, tear strength, water vapour permeability, air permeability tests and, analyses such as pH, matters soluble in dichloromethane, shrinkage temperature and, Total KjeldahlNitrogen. For this purpose, 5 dry salted skins from each type, totally 60 skins were used. It was revealed that a big difference between the skin characteristics was determined depending on type of skins, ages, and genders used for ripening process. It is believed that the findings will lead to new technological advancements to create new casing production materials.

Keywords: Tulum cheese, goat skin, sheep skin

INTRODUCTION

Cheese is a food derived from cow, sheep, and goats' etc. milk and has a high content of proteins, calcium, fat, and phosphorus. Hundreds types of cheese from various countries are produced. Their production styles, textures and flavours can bevaried depending on the various factors (Kocak, 1996). Traditional cheese production is popular in Turkeydue to the eating habits of local population. One of the most produced traditional cheeses in Turkey is the "Tulum" cheese. "Tulum" means in Turkish skin sack and in traditional Tulum cheese production, sheep and goat skin sacks are commonly used. The realization of ripening process in Tulum cheese affects the quality of the cheesesignificantly. Casing material is one of the important effects on the ripening process. In literature, although there are various researches about the effects of ripening (Oluk, 2014) and casing materials on the quality of Tulum cheese, only a few studyis present regarding the skin used for casing material for the cheese production (Hayaloglu*et al.*, 2007; Gun, 2012).

The aims of this study are: to determine the casing properties of raw skins of different type, age and gender and to compare the properties of Tulum cheese ripened in these casings; to determine the properties of used and waste casings and to investigate changes in the packing material and to investigate the evaluation possibilities for another usage area. After considering the properties of raw and used casings on the properties of Tulum cheese, advantages and disadvantages of natural casings will be determined. Additionally determining the optimal properties of natural casings could lead the design and production of alternative industrial casings. Accordingly, in the first

part of the study, the characterization of the sheep and goat skins prior to Tulum cheese production was determined and their properties were compared according to their different type, age and genders.

MATERIAL

In the study, sixtydry salted raw skins, selected from different races (domestic goat and sheep skins), ages (6 months, 1 year and 2 years) and genders (male and female), were used. Each group had five repetitions. Analytical grade chemicals were used for the chemical analysis.

METHOD

The skins were cut along the backbones into halves. One part of the skins was used for the casing material. Pairing halves were tested and analyzed for determination of the skin characteristics. The skins were shaved before the tests and analysis.

Sampling was performed according to TS EN ISO 2418 standard (Anon. 2006c). The test samples were conditioned according to TS EN ISO 2419, at 23 ± 2°Ctemperature and 50% ± 5 relative humidity (Anon. 2006d).

For determination of the chemical and physical properties of the skins, TS 4117 EN ISO 2589 determination of thickness (Anon. 2006a), TS 4119 EN ISO 3376: tensile strength and percentage extension (Anon. 2006b), TS 4118-2 EN ISO 3377-2: tear load - Double edge tear (Anon. 2005a), TS EN ISO 4048: determination of matter soluble in dichloromethane (%) (Anon. 2009), TS 4120 EN ISO 3380:determination of shrinkage temperature (Anon. 2005b) and TS EN ISO 14268:determination of water vapor permeability (Anon. 2014) methods were used.

Air permeability properties were determined with air permeability test equipment (DEVOTRANS). The measurements were done at 200 Pa for 5 minutes for determining the amount of air passing through the skins from one side to other side as m^3.

Determination of Nitrogen Content and "Hide Substance" were carried out by using Kjeldahl principle.

For displaying cross sections of the samples, images were taken by Tabletop SEM (Toshiba, TM1000).

RESULTS AND DISCUSSION

Physical test results of thickness, tensile strength, percentage extension and tear load of the skin samples are given in Table 1.

The mean of thickness values for sheep skins was found 1.98 mm within a range of min. 0.95mm and max.4.84mm. The mean of thickness values for goat skins was found 1.57 mm within a range of min. 0.77mm and max. 2.55mm. The mean values of skins belonging to different age and gender were found similar for both sheep and goat skins. But, sheep skins were found thicker than the goat skins.

The mean of tensile strength and percentage extension values were found 8.78 N/mm^2, 32% and 14.3 N/mm^2, 27% for sheep skins and goat skins respectively. The tensile strength properties of goat skins were significantly higher than the sheep skins; although sheep skins had higher extension values.

The mean tear load values of sheep skins and goat skins was found 31.69 N/mm and 46.58 N/mmfor respectively. Goat skins performed better tearing strength than the sheep skins, and that might be one of the reasons that they are preferred more than the sheep skins for Tulum cheese production.

While lots of data exist in literature on the strength properties of semi-processed skins (pelts) and processed skins (leathers), no data has been found on raw materials.It could be because of the material type that is not in the form of consumer goods in that stage. But, these sheep and goat skins, used as main raw materials for leather industry, are also used in the same form for casing material of Tulum cheese production and these data may provide useful information in the search of alternative casing materials.

Table 1.Physical Test Results

	Thickness (mm)	Tensile strength (N/mm^2)	Percentage Extension (%)	Tear Load (N/mm)
Sheep, 6m, Female.	2.0	8.25	28.8	29.36
Sheep, 6m, Male	2.0	7.58	31.0	27.64
Sheep, 1y, Female	2.1	9.16	32.92	31.18
Sheep, 1y, Male	2.0	7.72	37.75	32.04
Sheep, 2y, Female	1.9	7.75	41.75	29.77
Sheep, 2y, Male	1.8	12.18	19.68	40.15
Goat, 6m, Female	1.4	12.13	19.08	34.75
Goat, 6m, Male	1.5	14.81	31.88	51.05
Goat, 1y, Female	1.7	12.38	27.82	41.67
Goat, 1y, Male	1.6	12.71	20.03	40.12
Goat, 2y, Female	1.7	15.34	32.96	59.29
Goat, 2y, Male	1.4	18.00	30.48	55.57

Water vapor and air permeability tests are related to the porosity of the material and have importance on the usage area of leather. Water vapor permeability of leathers can be changed depending on the characteristics of the structure, isolation of fiber bundles, thickness and the processes (Adiguzel and Sari, 2004). It wasrevealed that, vapor and air permeability of goat skins were higher than the sheep skins (Table 2). These results could be related to skin, fiber and hair characteristics, conservation status and fat content of the goat and sheep skins.

Table 2.Water vapor and Air Permeability Results

	Vapor Permeability ($mg/cm^2.h$)	Air Permeability From wool side (cm^3/cm^2 sec)	Air Permeability From flesh side (cm^3/cm^2 sec)
Sheep, 6m, Female.	0.56	43.97	6.07
Sheep, 6m, Male	0.54	162.90	56.27
Sheep, 1y, Female	0.31	52.93	5.70
Sheep, 1y, Male	0.65	372.27	29.97
Sheep, 2y, Female	0.41	134.60	4.93
Sheep, 2y, Male	0.41	93.40	12.73
Goat, 6m, Female	0.82	277.90	33.53
Goat, 6m, Male	0.63	196.17	14.30
Goat, 1y, Female	0.8	155.87	10.17
Goat, 1y, Male	0.46	138.00	38.90
Goat, 2y, Female	0.67	63.60	9.27
Goat, 2y, Male	0.77	169.07	13.93

Chemical characteristics of skin samples were determined in accordance with the analysis of pH, matter soluble in dichloromethane, shrinkage temperature, nitrogen content and hide substance (%)and the results were given in Table 3. The pH values of samples were found similar within the range of pH 6.3-7 without effected from type, gender and age. However, it wasdetermined that sheep skins contained more fatty substances than the goat skins and that changes were depending on the gender which female skins had more fat than the male skins.

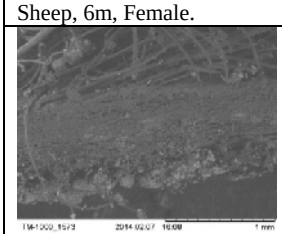
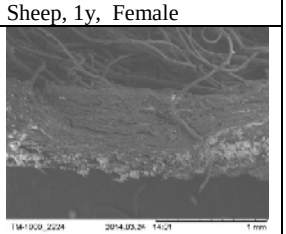
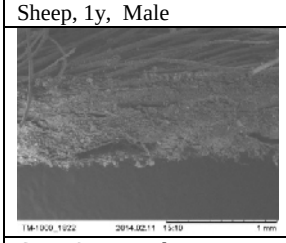
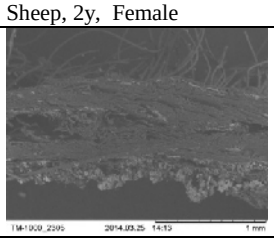
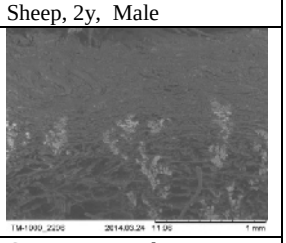
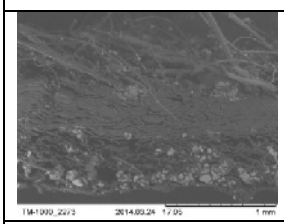
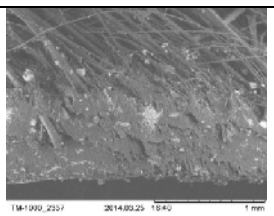
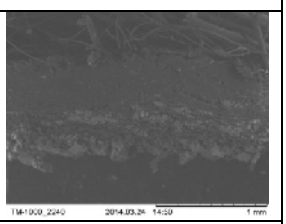
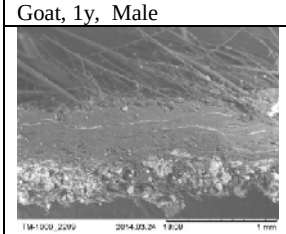
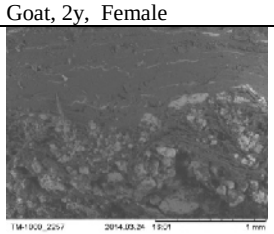
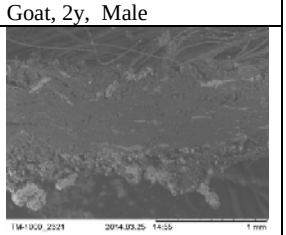
Determination of shrinkage temperature is a measure of hydrothermal stability of hide/skin and leathers which is related with fibre stabilization as a result of tanning. In practice, it is used to measure the success of the tanning (Mutlu*et al.*, 2014). In this research, shrinkage temperature was determined in order to find out if the status of the skins and also to compare the differences if any occurs after the cheese production. The measurements showed that the shrinkage temperatures of conserved raw sheep and goat skins varied between 65-70°C with an average of 68°C for sheep skins and 67°C for goat skins. Gustavson (1956) has stated that shrinkage temperatures of sheep and goat skins were between 64-66°C and 63-65°C respectively. O'flaherty*et al.* (1962) has stated that shrinkage temperatures of raw skins were 67°C in average.

When Nitrogen content and hide substance content percentages of the skins were examined, it was seen that sheep skins had lower values than goat skins. The average Nitrogen content and hide substance content percentages were found 8.7%-50.9% and 10.28%-59.24% for sheep and goat skins respectively.

Table 3.Chemical Analysis Results

	pH	Matter soluble in dichloromethane (%)	Determination of shrinkage temperature (^{0}C)	Nitrogen Content (%)	Hide Substance (%)
Sheep, 6m, Female.	6.9	15.11	67	7.33	42.89
Sheep, 6m, Male	6.8	7.0	67	8.93	52.27
Sheep, 1y, Female	6.7	8.58	70	8.75	51.21
Sheep, 1y, Male	6.6	8.99	69	8.94	52.28
Sheep, 2y, Female	6.6	13.88	67	8.16	47.71
Sheep, 2y, Male	7.0	8.29	68	10.09	59.04
Goat, 6m, Female	6.3	4.78	66	10.94	62.89
Goat, 6m, Male	6.6	5.98	70	8.90	51.81
Goat, 1y, Female	6.3	5.4	66	10.66	61.33
Goat, 1y, Male	6.6	2.77	65	10.82	62.20
Goat, 2y, Female	6.3	8.08	69	9.64	55.44
Goat, 2y, Male	6.3	4.31	70	10.74	61.77

Table 4. Displays of SEM images

Sheep, 6m, Female.	Sheep, 6m, Male.	Sheep, 1y, Female
		
Sheep, 1y, Male	Sheep, 2y, Female	Sheep, 2y, Male
		
Goat, 6m, Female.	Goat, 6m, Male.	Goat, 1y, Female
		
Goat, 1y, Male	Goat, 2y, Female	Goat, 2y, Male
		

The cross section images of sheep and goat skins can be seen in Table 4. The structural weakness and looseness and even layer separation in sheep skins can be seen from the displays. Contrarily, goat skin images show denser packed fibers. Accordingly, it is expected that these structural differences could have an effect on the properties of the casing material.

CONCLUSION

In this research, physical, chemical and structural properties of sheep and goat skins, that have different gender and age and will be used in Tulum cheese production, are determined.

Results of the present study indicate that:

- Sheep skins are thicker than the goat skins.
- The tensile strength properties of goat skins have been significantly better than sheep skins; but sheep skins have higher extension values.
- Goat skins perform better tearing strength than the sheep skins
- Water vapour and air permeability of goat skins are higher than the sheep skins.
- Sheep skins contain more fatty substances than the goat skins
- Shrinkage temperatures have an average of 68°C for sheep skins and 67°C for goat skins.
- The average Nitrogen content and hide substance content percentages are 8.7%-50.9% and 10.28%-59.24% for sheep and goat skins respectively.

The above findings will be used for the comparison of the skin properties after the Tulum cheese production and these results will be revealed the most suitable casing material for cheese production in food industry.Additionally, this will also lead alternative casing researches with the similar properties of skin samples.

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