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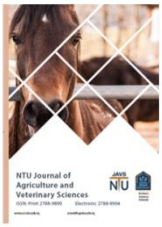

The effect of the type of milk on the chemical, rheological and yield properties of cheddar cheese produced from cow's and goat's milk

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Article Informations

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Clarification

A B S T R A C T

Abstract

This study aimed to determine the effect of the type of milk on the chemical properties, textural properties, and separation percentage of cheddar cheese produced from cow's milk and goat's milk. Where cheddar cheese is made from T1-modified cow's milk. Cheddar cheese is also made from T2 modified fat goat milk. The cheese was kept in ripening rooms at a temperature of 13°C for 6 months, and tests were conducted on the treatments during 1, 60, 120, and 180 days of the ripening period. The chemical tests included estimating the percentage of moisture, protein, fat, ash, carbohydrates, and total acidity, in addition to estimating the acidity. pH, while rheological tests included hardness, cohesion and flexibility. The percentage of purification of the cheddar cheese treatments was also estimated. The results showed that the cheddar cheese produced from goat's milk was characterized by a lower moisture content than the cheddar cheese produced from cow's milk. The percentages of protein, fat, ash, and acidity also increased, while the percentage of carbohydrates and PH decreased in the cheddar cheese produced from goat's milk compared to Cheddar cheese produced from cow's milk. The results of rheological tests also showed lower values of hardness and cohesion and higher elasticity in cheddar cheese produced from goat's milk compared to cheddar cheese produced from cow's milk. The results also showed a lower percentage of decantation in cheddar cheese produced from goat's milk compared to cheddar cheese produced from cow's milk.

Introduction

Cow's milk contains all the nutrients, especially iron, necessary for the growth and development of the infant, so it is a suitable and safe formula for the infant. In contrast, the formula of goat's milk contains higher levels of protein, and the composition of goat's milk is unique in its high levels of vitamins and minerals (Ceballos, 2009).

The physical properties of cheese (texture, , melting, expansion and color) are affected by the initial composition of the milk from which the cheese is made. (Lucey, 2003). The largest change in the texture properties occurs in the first two days of manufacturing, but the hardness lasts for a few weeks to achieve equilibrium. The surface layers of the cheese also lose moisture and change the chemical composition, which may be reflected in the rheological properties and others during ripening (Nuath, 2000).

Beta-casein is the main protein of goat's milk casein, while alpha-casein is the main protein of cow's milk casein. And that the decrease in the alpha-casein protein content of goat's milk is one of the differences between goat's milk cheese and cow's milk cheese, and that this decrease causes the formation of a soft curd with larger pores in the cheese produced from goat's milk (Haenlein, 2004).

Cheddar cheese is one of the finest types of cheese, with various flavors from mild to sharp (acidic). It is a hard cheese with a pale yellow, yellow or orange color due to the use of Annatto to color the cheese. It is the most popular cheese in the United Kingdom, accounting for around 51% of the annual cheese market. (Harris et al, 2013) Cheddar cheese is characterized by hardness with a long shelf life. It also has a viscous property, but the texture is solid with a closed structure and has a clean nutty flavor (Lawless and Heyman, 2010).

The percentage of clearance is of importance for cheese in that it is part of the economic system, and the increase in this percentage means a greater financial return, as it was found that there are differences in the percentage of cheese treatments depending on the composition of the milk used Costa et al. (2010).

The current study aimed to determine the effect of milk type on the chemical and rheological properties and the percentage of purification of cheddar cheese.

Materials and method of work

Materials:

Cow's milk and goat's milk were obtained from one of the fields near Al-Kifl district in Babil Governorate, as for rennet, it was obtained from the Turkish company (MUCO REN), and the cheddar cheese starter was obtained from the Italian company (SACCO).

The method of work :

Manufacture of Cheddar Cheese: Making Cheddar Cheese according to the method described by Hill and Ferrer (2020)

My agencies:

Raw cow's milk and raw goat's milk were received separately, then their components were modified, pasteurized at a temperature of 63°C for 30 minutes, then cooled to 30°C and inoculated with Lactococcus starter bacteria. Lacts subsp lactis and Lactococcus lactis subsp. Cremoris in direct addition and according to the instructions of the producing company. Leave the milk with the starter for 30 minutes at the abovementioned temperature. Then I added the annatto dye, then added the rennet (chymosin enzyme) and left the milk for 35 minutes until coagulation occurred. Then I cut the curd and left it for 15 minutes without stirring. Then I stirred slightly before the cooking process. The curds were then cooked with the whey by raising the temperature from 30 to 39°C. This process took about 20 minutes and gradually. Then drain the whey from the sink. Then the tuberization process was carried out by stacking the slices on top of each other on both sides of the basin. Once the pH of the clot reached 5.20 to 5.25, two hours later, the clot was chopped using a clean, sterile machine. Then add dry salt to the curd and mix well. The clot was then placed in molds made of stainless iron. After that, the cheese molds were pressed using a continuous pressure system. The cheeses were then coated in molten paraffin wax. Then it was transferred to a ripening room at 13°C for 6 months.

Chemical tests:

Moisture content was estimated according to the method mentioned in Ling, (2008). The fat percentage was estimated according to the method mentioned by Min and Ellefson (2010). While the percentage of ash was estimated by direct burning according to the method mentioned by (A.O.A.C, 2005). The percentage of carbohydrates was estimated according to the method he mentioned. Ihekoronye Ngoddy (1985) and. The pH was also estimated according to the method mentioned by Ling (2008). The total acidity percentage was estimated according to the method mentioned by A.O.A.C (1980).

Rheological tests:

The texture of the cheese treatments was estimated using a histometer (Brookfield engineering lab CT3,4500), with a load cell of 5 kg, according to Joon (2017).

Estimating the liquidation percentage:

The netting percentage was calculated by adding the weight of the processed cheese to the weight of the milk used in the manufacturing process, as mentioned by Kosikowski and Mistry (1999).

Statistical analysis :

Use the statistical program Statistical Analysis System -SAS (2018).

Results and discussion

The chemical composition of cheddar cheese produced from cow's milk and cheddar cheese produced from goat's milk:

The results shown in Table (1) show the percentage of moisture for each of the cheddar cheese treatments, the T1 treatment made from modified-fat cow's milk, and the T2 treatment made from modified-fat goat's milk, after one day of manufacturing and during the ripening period at a temperature of (13°C) for a period of 6 months. As its percentage, immediately after manufacturing, for treatment T1 was 36.15% and for treatment T2, it was 36%, respectively, and this result is similar to what was found by Claire (2014), who indicated that the moisture content of cheddar cheese was 35.70%. It is noted from the results that the moisture content of cheddar cheese produced from goat's milk is low compared to cheese produced from cow's milk. The reason for this may be because the main protein in goat's milk cheese is beta-casein, which is more hydrophobic, and thus the cheese produced from goat's milk is less moisture. This is consistent with what was mentioned by Haenlein (2004), who pointed out the dominance of beta-casein protein in goat's milk, which leads to less binding of this protein to water than cow's milk. It is also observed that the moisture percentage decreases as the ripening period advances, and this is consistent with what was stated by Al-Badrani (2019), who indicated a decrease in the moisture percentage as the ripening period advances due to an increase in total solids**.**

Tables. All included tables must be referred to in the main text, and the table title and caption are to be positioned above the table. The captions need to be written in Times New Roman (body), 9pt.

Table 1. Chemical analysis, pH values, and total acidity treatments for cheddar cheese produced from cow's milk and cheddar cheese produced from goat's milk immediately after manufacturing and during the ripening period.

Treatment	Age of cheese (days)	The components						
		Moisture%	Protein%	Fat%	Acidity%	pH	Ash%	Carbohydrates%
T1	1	36.15	25.20	27.00	0.42	5.7	2.2	9.45
	60	35.53	25.46	27.29	0.49	5.5	2.4	9.32
	120	35.23	25.61	27.42	0.55	5.3	2.5	9.24
	180	34.91	25.76	27.61	0.66	5.2	2.6	9.12
T2	1	36.00	25.30	27.20	0.48	5.6	2.3	9.20
	60	35.41	25.53	27.45	0.53	5.4	2.5	9.11
	120	34.80	26.01	27.59	0.61	5.2	2.6	9.00
	180	34.65	26.12	27.71	0.74	5.1	2.7	8.82
LSD value		3.072 NS	2.392 NS	1.871 NS	0.239 *	0.489 *	0.447 *	0.849 NS
* (P≤0.05), NS :not significant .								

It is also noted from the results of the low content of the two transactions in the absence of criminalization and with the same period and the like lihood is due to the evaporation of part of moisture during the migration and this is consistent with what (Muresan, 2021)). Who referred to the low moisturizing chemical moisture by the progress of the panic. The results of the statistical analysis indicate that there are no moral differences (0.05 p) (between the chef of the chef of the chef of the casting milk and cheese produce of the milk milk. The protein contained from the results of the rise in the cheese cheese product of milk milk from the milk milk from the milk milk. It may return due to the chemical bulk of the goat of the goat, which is high of protein in the comparison of the burning in the standards of the protein, which is noted from the results of the protein thermoplastic period during the preparation of the mixtures of the total, the proportion of the micro-toe, which is due to the increase in the rate of the glorious materials associated with the duration of the chemicals during this period of the mirage, and is in line with what is found in the mandate of Ismail (Joyner and melito, 2018), which indicated that the main reason for the high rate of solid material for cheese is the low protein of the cheese by providing the duration of the pandemic. The results of the statistical analysis indicate the lack of moral differences (0.05 p) (between 055 p) (between 055 P) (including 0) of the casting of the male milk and the treatment of the cheese milk from the male milk. The ratio of the fattence of the results of the fat ratio of the chef of the goat of the goat milk compared to the cheese of the milk from the milk mountainry. The reason for the lowest content of the gear of milk milk has been due to the lowest product of milk milk more than the cotton of the milk milk. In addition to the loose milk. The amount of fat is still as well as the fascist milk with the mask is relatively because of the smallest of the size of the mask and the absolute

compared to cheap thermometer from the milk Milk Mail (standards,2011). It also notes from the results of the fattest ratio during the preparation of the pirate in the treatment of the two transactions and is due to the cause of increased fattest proposal to offer the duration of the panic to the decline of humidity and then the high percentage of the total solid materials, including the fat (GAFOUR et al., 2020). The statistical analysis results indicate no moral differences (0.05 p) (between the treatment of cheese cheese produced from the milk milk and cheese product of milk milk. The percentage of the grade notes from the results in the cheese cheese product from the milk milk compared to the product cheese from the milk mountains may return due to the high ratio of Magnesium, Calcium and the philosophers in the goat milk compared to the milk of the peak (iBrahim, 2020). The results are high of the asset in the cheese of the two as the two rates of the grass of the ascentives to the pretext of the panoramic to the pretectment of the petition-based maize in the milk milk of the castles of the cow to the right of the protein in the milk milk and the ability to link and keep the fat and ash. The production of the protein is the result of the inhibition of the inhabitants of the goat of the goats of the goat. The statistical analysis results indicate no moral differences (0.05 p) (between the treatment of cheese cheese produced from the cast milk and the treatment of cheese cheese from goat milk.

The carbohydrate in the cheese cheese produced the product of male milk from the milk milk of the milk mountains and may cause the cause of the carbohydrates in cows of milk in the milk of the Carbohydrates in Goat Milk (Thai Agricultural, male), and the results of the currency rates are carried out as the durable period of the cartoids during the preparation of the cyboat and the return of the panic in the proportion of the latocoma and the transition of the mandate of the Lactosecopath and their devotation of the Lactic acid and other flavor vehicles due to the activity of the Citarita, the predator in the mandatory mandate during this migration and this is in line with what is found (Drake et al., 2010), which indicated the low percentage of the bobboards the progress of the wooden to cheap. The statistical analysis results indicate no moral differences (0.05 p) (between the treatment of cheese cheese produced from the cast milk and the treatment of cheese cheese from goat milk.

It is also noted from the results that the pH value in cheddar cheese produced from goat's milk is lower compared to cheese produced from cow's milk because the pH is affected by two main factors: the amount of acidity and the amount of calcium phosphate in the cheese, and this is close to what was found by Park et al. (2007). It is noted from the results that the pH value decreases during the ripening period in the cheese of both treatments. The reason for this decrease in pH values as the ripening period advances may be due to the conversion of the remaining lactose sugar in the cheese into lactic acid, which consequently leads to a lowering of the pH. This is consistent with what was found by AL-Saadi (2022) who indicated that the decrease in pH values during storage time is due to the activity of the Starter that converts lactose into lactic acid. The statistical analysis results indicate no significant differences (P≤0.05) in the pH values between the treatment of cheddar cheese made from cow's milk and the cheddar cheese made from goat's milk.

As for the percentage of total acidity, it is noted from the results that it is higher in the cheddar cheese produced from goat's milk compared to the cheese produced from cow's milk. The reason for this may be due to the goat's milk containing a higher percentage of protein and fats that turn into proteinic acids and fatty acids as the ripening period advances, and this is close to What was found by Al-Badrani **(**2023) What explained the reason for the difference in acidity values between the two treatments is the differences in chemical composition and protein content, as can be seen from the results, is an increase in the total acidity percentage as the ripening period advances in the cheese of both treatments. The reason for this increase in the total acidity percentage as the ripening period advances may be due to the conversion of remaining lactose in the cheese into lactic acid by the starter bacteria. This increase is caused by lactic acid bacteria present in the product (Buriti et al., 2005). The statistical analysis results indicate no significant differences (P≤0.05) between the treatment of cheddar cheese produced from cow's milk and the treatment of cheddar cheese produced from goat's milk.

Rheological tests:

Hardness: The results shown in Figure (1) show the results of the hardness test one day after manufacturing and during the period of ripening at a temperature of (13°C) for a period of 6 months for both treatments T1 and T2, where it was 462.7 g immediately after manufacturing for treatment T1 and for treatment T2 it was 423.6 g, which is consistent with what was found by (Brown et al., 2003).

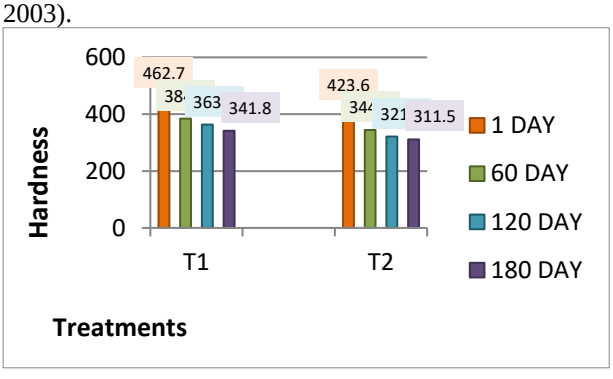

Figure (1) Hardness values for cheddar cheese

treatments one day after manufacturing and during the ripening period at a temperature of (13°C) for 180 days, where: T1 is the treatment of cheddar cheese produced from cow's milk, and T2 is the treatment of cheddar cheese produced from goat's milk. LSD value = 48.276.

It is noted from the results that the hardness values of cheddar cheese produced from goat's milk are lower compared to the cheese produced from cow's milk. The reason for this may be due to the decrease in the goat's milk content of alpha-casein proteins, and this decrease causes the formation of soft curds with larger pores in this cheese, and this is consistent with what was mentioned. Haenlein (2004). As the ripening period advances, a decrease in the hardness values is observed for both treatments. The reason for this decrease in the hardness values as the ripening period advances is due to the decomposition of both proteins and fats as the ripening progresses, which results in short-chain amino and fatty acids that improve both the texture and flavor, in addition to the fact that the fat, when decomposed, becomes more It is able to enter between the folds of casein and makes the protein matrix more flexible and less rigid(Aljaafri,2023). The statistical analysis results indicate no significant differences (P≤0.05) between the treatment of cheddar cheese produced from cow's milk and the treatment of cheddar cheese produced from goat's milk.

Elasticity**:**

It is evident from Figure (2) the results of examining the flexibility of the previously mentioned treatments, where it was immediately after manufacturing for the treatment T1 is 3.2 mm and for the treatment T2 is 3.6 mm, respectively, and this is consistent with what was found by (Haenlein, 2004). It is noted from the results that the values of elasticity increased in cheddar cheese produced from goat's milk compared to cheese produced from cow's milk. The reason for this may be due to the decrease in the content of goat's milk from alpha-casein proteins, and this decrease causes the formation of a soft curd with larger pores in cheese produced from goat's milk (Haenlein, 2004)

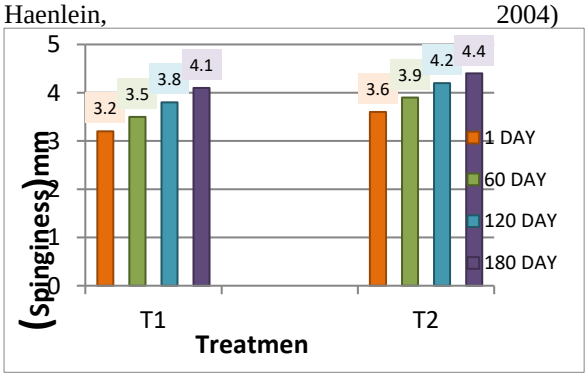

Figure (2) Elasticity values for cheddar cheese parameters one day after manufacturing and during the ripening period at 13°C for 180 days. LSD value=0.738.

As for the progression of the ripening period, an increase in the elasticity values for both treatments is observed. This increase in the elasticity values is due to the decomposition of proteins, fats and sugars into simpler compounds in the cheese produced with the advancement of the ripening period (Muresan, 2021). It also agrees with what was found by Al-Bedrani (2022), which indicated a decrease in hardness values and an increase in elasticity as the ripening period progressed for low-fat Monterey cheese partially fortified with sorted buffalo milk. The statistical analysis results indicate no significant differences (P≤0.05) between the treatment of cheddar cheese produced from cow's milk and the treatment of cheddar cheese produced from goat's milk.

Cohesion:

It is clear from Figure (3) the results of the cohesion test for the previously mentioned parameters, where immediately after manufacturing for treatment T1 it was 0.73 and for treatment T2 it was 0.66, respectively. This is consistent with what was found by Tunick et al. (2004). It is noted from the results that the cohesion values of cheddar cheese produced from goat milk are lower compared to cheese produced from cow milk. The reason may be due to the decrease in goat milk content of proteins called agglutinins, a type of protein that works to agglomerate and adhere fat molecules. As a result of this decrease, the homogeneity of the fats in the mixture decreases. Milk, which results in a decrease in the consistency of the cheese produced from it, and this is consistent with what was mentioned by Prosser et al. (2008).

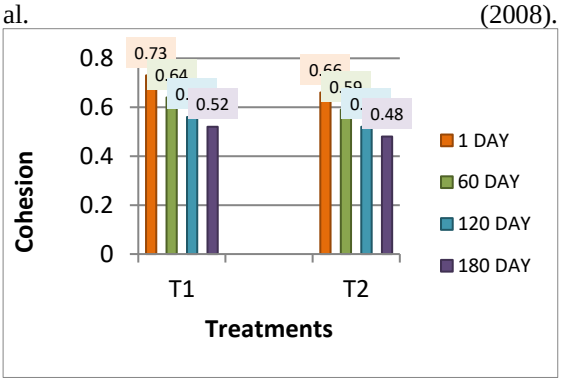

Figure (3) Cohesion values for cheddar cheese treatments one day after manufacturing and during the ripening period at 13°C for 180 days. LSD value = 0.184

As the ripening period progresses, a decrease in the cohesion values of both treatments is observed.

This decrease in cohesion values may be due to protein decomposition and a decrease in the strength of the internal bonds that maintain the ideality of the product (Tunick et al., 2004). The statistical analysis results indicate no significant differences (P≤0.05) between the treatment of cheddar cheese produced from cow's milk and the treatment of cheddar cheese produced from goat's milk.

Refining the cheese:

It is clear from Table (2) the percentage of purification of cheddar cheese treatments after one day of manufacturing and during the ripening period at a temperature of (13°C) for a period of 6 months. The rate immediately after manufacturing for treatment T1 was 8.5%, and for treatment T2 it was 8%, respectively, and this is consistent with what was found by Costa et al. (2010). It is noted from the results that the percentage of purification in cheddar cheese produced from goat's milk is lower compared to cheese produced from cow's milk. The reason for this may be because the moisture percentage in cheddar cheese produced from cow's milk is higher than the moisture percentage in cheddar cheese produced from goat's milk, and this is consistent with what was found by Standards. (2011).

Table 2. Percentage of net transactions of cheddar cheese produced from cow's milk and cheddar cheese produced from goat's milk directly after manufacturing and during ripening

Age of cheese (days)	1	60	120	180
Treatment				
T1	8.5	8.2	8.1	7.9
T2	8	7.6	7.5	7.3
LSD value	0.503	0.588	0.575	0.589
	NS	*	*	*

* (P≤0.05), NS :not significant .

As the ripening period progresses, a decrease in the clarification of both treatments is observed. The reason for this decrease in the clarification rate may be due to the evaporation of part of the moisture during the ripening period, in addition to the continued exudation of the whey leads to a decrease in clarification. This is consistent with what was mentioned by Standards (2011), who indicated a decrease in the clarification rate. For soft, low-fat cheese treatments as the storage period progresses, the reason is due to evaporation during refrigerated storage and the exudation of the whey. The statistical analysis results indicate significant differences (P≤0.05) between the treatment of cheddar cheese produced from cow's milk and the treatment of cheddar cheese produced from goat's milk.

References. All references must follow the example format at the end of this document, and the reference list must include all cited literature.

Acknowledgments. Acknowledgments should written in Time New Roman (body), 10pt.

Competing Interests

The authors should declare that there are no competing interests.

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