Research Article

The Health Benefits of Pectin Added To Monterey Jack Cheese and A Study Of Its Chemical and Microbiological Properties

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Abstract:

The given research was based on the need to find out the influence of the addition of pectin on the quality attributes of Monterey Jack cheese made using whole cow milk with the addition of 1.0 percent of pectin (T). One of the chemical tests involved estimating percentage of moisture, protein, fat, ash, carbohydrates, total acidity and pH. The findings revealed that moisture content and protein content are lower and higher respectively when compared to the control treatment. The processes in the treatments were a greater increase in ash content, acidity and carbohydrates, and decrease in pH with increasing acidity. This was also able to add to the microbiological properties of the Monterey Jack cheese.

Keywords: Pectin, Monterey Jack cheese, chemical and microbiological properties.

Introduction

Monterey jack cheese is a mature American cheese which is categorized as a semi- dry cheese with a moisture content of 40-50%. It is produced utilizing a hundred percent cow milk and was firstly produced in 1915 in California by a merchant known as Jack David. Its production began in Iraq more than ten years ago, and in recent years, its production has been developed, with cow's milk being replaced with buffalo milk in varying proportions (Feldman, 2006).

Pectin: Pectin is used in the manufacture of medical and pharmaceutical products. It can be used to treat gastrointestinal disorders (diarrhea - constipation), especially in children. Pectin helps increase the viscosity of excreted substances, facilitating their excretion (Alwan et al., 2016). It also helps lower blood cholesterol levels by increasing the excretion of fats. This is because pectin is not digested in the intestine, and the bacteria present there break down the substance.

Pectin is important from a health perspective as a colloidal substance capable of absorbing water from the intestine, increasing the viscosity of excreted matter, and treating both constipation and diarrhea. Consuming foods containing soluble fiber has a positive effect against colon cancer. It is also used in human tissue regeneration and as a supportive material in the treatment of bone (varicose veins) and cartilage due to its ability to bind growing cells together. Studies indicate the possibility of combining pectin with corn protein to form a compound that only decomposes in the large intestine for the purpose of treating the colon and other diseases (Panchev; 2011, Malviya and Srivastava(

Therapeutic properties: These are a variety of criteria that must be met to achieve the desired effect, such as: antimicrobial activity, reducing high blood pressure, and controlling infections in the urinary system.

Materials and Methods:

Materials

Raw milk was collected in one of the fields near Al-Qasim Green University. The rennet supplied was that of the Danish company Chris Hansen and the aboadi was that of the Danish company. Lactococcus lactis spp. lactis and Lactococcus lactis spp. cremoris were utilized in the Danish company Chris Hansen.

Methods:

Monterey Jack cheese production: It was done in the direction of methodology presented by Al-Dahan (1983). An amount of whole cow milk was picked and its acidity was identified to be 0.16%. Pasteurization was then performed at 62.8 ◦C and a duration of 30 minutes. The milk was left to cool down to 32 ◦C and a culture of 1 percent of starter was added to it. This was also left at 30 minutes with the level of acidity at 0.18 percent. Rennet was then included in the needed amount and was combined with the milk taking 5 minutes. Then the

formation of cheese was awaited, and it took place after 30 minutes. Knives were then used to cut the curd lengthwise and crosswise and it was allowed to rest without any disturbance in 5 minutes. It was then cooked by increasing the temperature to 39 ◦C in steam in a cheese vat in 30 minutes. Once this had been done, and the whey had acquired a pH of 0.2 at 90 min, it was emptied up to 2.5% above the surface of the curd and cold water then was added at room temperature and pressed into molds lined with clean cloth.

Chemical Tests:
The moisture percentage was computed in accordance with the method presented in Ling (2008). The results of the amount of fat were estimated by the method that was described by Min (2010) and Ellefson (2005). The direct combustion method calculated the ash concentration as per A.O.A.C. The amount of carbohydrates was determined based on the procedure indicated by Ihekoronye and Ngoddy (1985). The pH of the cheese was approximated as was described by Ling (2008). The overall acidity was measured based on the procedure described by A.O.A.C. (1980).

Microbiological Tests:
Microbiological tests were conducted on cheese samples that received the highest sensory evaluation scores at 1, 45, and 90 days of ripening, according to the APHA (1978) method.

Total Coliform Count:
The total number of coliform was calculated following the procedure outlined in the APHA (1978) using MacConkey agar and incubating at the temperature of 32 ◦C over a period of 24-48 hours.

Mold and Yeast Count:
The method described in APHA (1978) was used using potato dextrose agar and incubating at 22°C for five days..

Estimation of Staphylococcus aureus:
With the help of the Mannitol Salt Agar, the method was done following the description described by Harrigan and McCance (1976). Plates with the incubation were placed at 37 °C after 24 hours and the golden colonies with a yellow halo were counted, which represented staphylococcus aureus.

Statistical analysis:
The Statistical Analysis System (SAS) (2018) software was used**.**

Results and Discussions:

Table 1: pH, acidity and chemical analysis of Monterey Jack cheese of both control and pectin added Monterey Jack cheese treatment.

Tests / Treatment	Cheese age in days	Moisture%	Protein%	Fat%	Carbohydrates%	Ash%	pH	Acidity%
C	First day	43.00	25.25	26.4	4.1	1.25	6.5	0.34
	45	40.18	26.15	28.35	3.85	1.47	4.0	0.45
	90	38.85	28.78	29.32	1.45	1.60	3.0	0.49
T	First day	43.5	24.95	24.89	5.16	1.50	6.0	0.42
	45	39.21	26.44	26	6.8	1.55	5.25	0.61
	90	36.65	27.15	27.5	7.1	1.60	4.4	0.79
L.S.D value		4.593 *	2.351 *	3.574 *	1.638 *	0.349 *	1.084 *	0.407 *

*(P≤0.05)

* All the numbers in the table are mean of three replication.

Chemical Composition of Monterey Cheese

Moisture percentage:

Moisture Content: Table (1) indicates the values of moisture content of the Monterey cheese produced using whole cows milk and aged to three months. Three storage times (90, 45 and 1 days) were used to conduct the tests. On the first day, moisture content of the control C treatment was 43% and moisture content of the treatment that had pectin was 43.5%.

It is important to note that the values are more or less similar to the moisture content of the semi-dry cheeses according to the Iraqi specification (1988) of semi-dry cheeses since it falls between 40%-50. And they are in alignment with the similar results of the research conducted by Al-Obaidi and his colleagues (1988) in which the moisture content of the Monterey cheese made using fresh milk was 44.38%. This change in the amount of the moisture during the first days or stages of the ripening process might be explained by the pressing process and the heterogeneity of the many treatments (El-Soda and his group 1990). The moisture content also decreased with the storage period of the cheese as it decreased to 40.18 per cent in the control treatment and 39.21 per cent in T21 treatment. This is because the cheese is exposed to the evaporation process in its ripening process and that is what they have discovered (El-Sissi, Neamat-Allah 1996). These results are consistent with the results of Al-Badrani (2011) and this implies that the moisture content of the product on the first day was 43.02. Al-Shati (2012) concluded that the moisture content was 42.444 per cent in 45 days. On day 90, moisture content decreased to 38.85 and 36.65 in the control treatment and T treatment respectively. These results are related to the results of Al-Shawi (2019) The decreasing results can be attributed to the increased acidity, which promotes the maturation of whey (Jandal, 2008). This is also in line with the findings of El-Soda et al. (1990) and El-Sissi et al(1996) . There was a large difference at ($P \leq 0.05$) based on the statistically analyzed data.

Ash percentage:

This was done on the 90-day storage period, the percentage of the ash content of the Monterey Jack treatments (T, C) was determined. The difference in the percentage of ash was also highly remarkably when the control treatment had 1.25 on the first day, and T treatment had 1.50. The increase in the percentage of ash was also noted after 45 days, where the control treatment had reached 1.47 and the T treatment had reached 1.55After 90 days, the percentage of the ash had increased, as the control treatment had reached 1.60 and the T treatment had reached 1.60. These findings are fairly comparable with those of Habib (2020). This is due to the higher percentage of ash because during the course of ripening, some of the moisture content is lost and consequently the percentage of total solids, including the ash, increases. This is in line with the results of Aquilanti et al (2013) who reported that the percentage of ash grows as the ripening age of semi-dry cheeses increases. According to the statistically calculated results, we can state that there are significant differences that appear.

Acidity percentage:

The acidity percentage at the ripening periods, which was found that the acidity percentage appreciated with the progression of the age of the cheese as the acidity percentage rose to 0.34% percent in the control treatment and 0.42% percent in the T treatment. These results are similar to those that were reported by the one who reported that the cause of the increase of acidity as the ripening period advanced was due to the lactic fermentation, however, the results are opposite to the result obtained by (Al-Sharaji, 2002) who reported that the percentage of acidity was between 0.45% -0.61%. Khairi (2018) found the acidity to be between 0.79-0.49, which is higher than the Al-Zamli (2022) obtained the value of the acidity percentage of the treatments after processing and at the ripening time. It should be noted that acidity was found in correspondence to the moisture level and treatment T followed by treatment O had the highest level of acidity. This is due to the fact that the starter bacteria labor more and lactose is changed to lactic acid in the treatments with a high degree of moisture content. Observed in the statistically analyzed results is that there are significant differences at $P \leq 0.05$.

PH:

The PH of Monterey cheese treatments were monitored and the subsequent reduction was monitored. The pH on the first day ranged between 6.5 and 6.0. This ratio is quite similar to the one obtained by (Al-Zamli, 2022), yet higher than the one obtained by (Al-Kubaisi, 2001). This decrease progressively slowed down to 4.0 on day

45 in the control treatment and 5.25 on day 45 in the T treatment. It was 3.0 in control treatment and 4.4 in T treatment within 90 days. This reduction is caused by the transformation of lactose to lactic acid that results in a reduction in the pH values (Hofi et al., 199). Through the 90 days (ripening period), the pH levels were found to drop ranging between 3.0 and 4.4 which is in agreement with Moussa et al., 2019, who reported that The pH decreases towards the end of the ripening period. The results of the statistical analysis indicate that there are important differences with P= 0.05.

Protein percentage:

The results present data on the percentage of protein content of the above Monterey cheese a day later in the manufacturing process since it was 25.25 percent percent in treatment C and 24.95 percent in treatment T. Our percentages have been attained within the protein levels that are found in semi-dry cheeses as reported by Al-Zuhairi (1999), Al-Kubaisi (2001), and Al-Sharaji. .(2002) The results also suggest that protein content of all treatments rises as the ripening period increases. After 45 days, treatment T and C yielded the values of 26.15 and 26.44% percent, respectively. During the end of the ripening period, the values of T and C were 28.78 and 27.15% respectively. These findings agree with those mentioned by Mahmoud and his team (2013) since they reported that there was a rise in the protein content of the cheese that was like Oshari and produced using therapeutic bacteria. The results of the statistical analysis indicate that there were significant differences in the control treatment C and all pectin treatments one day after manufacturing and throughout the ripening period.

Fat percentage:

The findings indicate that the percentage of fat content in Monterey Jack cheese produced by the above treatments treatment C and treatment T was 26.4% and 24.89% respectively after 1 day processing. The findings reveal that the fat percentage of the control cheese and the cheese that was put in pectin was greater since they were prepared using milk. The findings indicate that the fat percent in the replacement treatment was more than the control cheese. This was because more concentration of solids was brought about by the addition of pectin to the milk used to produce this kind of cheese therefore the percentage of the fat in the cheese that was produced was also increased since the concentration of solids in the sample volume was very high, coupled with the low moisture level of such types. This is in line with the results of Abd El-Salam (2015). Fat content in the cheese was seen to increase with the process of the cheese rippling in all the treatments. T and C were 28.35 and 26.0 respectively after 45 days. When the ripening period was over, treatment T and C (29.32 and 27.5) had 29.32 and 27.5, respectively. This has been explained by the fact that moisture level decreased during storage leading to an increase in the percentage of total solids that contain fat. This finding can be explained by the fact that, according to Al-Badrani (2016), the percentage of fat in low-fat soft cheese increased in the storage period. It also concurs with findings of Mohammed (2017) who indicated that fat percentage content in Cheddar cheese rose over time during the period of ripening. The statistical result shows that there are significant differences between the control treatment C and all the pectin replacement treatments, 1 day manufacturing and ripening period.

Carbohydrate percentage:

The above table indicates the percentage of carbohydrates in the cheese of the different treatments above discussed. Percent of the cheese in Treatment C was 4.1 and the cheese in Treatment T was 5.16 the percentage of carbohydrates in the treatments where pectin was added was greater. This could be because the added ingredient (pectin) is a carbohydrate. The findings also indicate that the percentage content of carbohydrates was lower in all treatments with a passage of time as the fruits ripened. The carbohydrate percentage of Treatment C and T cheeses was 3.85% and 6.8 after 45 days of ripening, respectively. At the last day of ripening (90 days) carbohydrates content of Treatment T and C cheeses were 1.45 and 7.1% respectively. The fact that the microscopic starter cultures that start lactose to lactic acid are still active contributes to this reduction (McSweeny and Fox, 2013). Based on the findings of the statistical analysis, one can say that there are significant differences between the control treatment C and all treatments during the manufacturing period after one day and during the ripening period.

Table 2. Output of microbiological tests

CFU\g / Treatment	Days	E.coli count	fnng (yeasts and molds)	Staphylococcus aureu
control	1	----	----	----
	45	----	----	----
	90	----	----	----
with pectin	1	----	----	----
	45	----	----	----
	90	----	----	----

Based on the table above, all the Monterey cheese treatments were found to be contaminated since none of the treatments showed growth of coliform bacteria after the ripening period, and none of the treatments showed growth of Staphylococcus aureus. This is due to the pasteurization process that is being done to milk that eliminates micro organisms in the milk since the percentage of the yeast and fungi in the cheese produced using raw milk is high and is regarded as one of the causes of spoilage and also the cheese has got a bad taste and texture (Aly, Galal, 2002). These figures are in line with the figures established by (Central Agency for Standardization and Quality Control, 2000). No increase in yeast or mould growth or increase in the growth of S.aureus bacteria. This has been the same finding of Dosh.(2007)

Conclusions:

The study showed that adding pectin improves the texture and consistency of Monterey Jack cheese. The chemical and microbiological qualities of cheese produced were enhanced by the additives added to the milk that was used to prepare Monterey Jack cheese.

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