

Effect of Adding Tomato Juice (*Solanum lycopersicum*) on the Quality of Functional Mozzarella Cheese

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ABSTRACT

Mozzarella cheese was made by using tomato juice. It could be noticed that free radicals scavenging activity (RSD %) increased by increasing tomato juice. Total Phenolic compounds (T.P.C) [mg (Gallic acid equivalent) GAE/100mg] took the same trend of RSA, compared with control (made by using starter) which, had the lowest content of free radicals scavenging activity and phenolic compounds. The treated variants and the control of cheese was made by the conventional method. Chemical, microbiological or rheological as well as organoleptic properties were carried out. Cheese with tomato juice was the best treatment from the chemical, microbiological, rheological and organoleptic properties.

Keywords: Mozzarella cheese, *Solanum lycopersicum*, RSD % and T.P.C

INTRODUCTION

Scientific improvement in understanding the correlation between nutrition and human health has a progressive effect on consumer attitude to nutrition, which resulted in the enhancement of the functional food concept (Bhat and Bhat, 2011).

Functional dairy products could be identified as the dairy stuff containing considerable concentration of active components that extend a positive effects of consumer health beyond the primary other nutrients (Drozen and Harrison, 1998).

Innovation strategies of food industries play an important role in translating input of dietetics and nutrition into functional food products for consumers (Hsieh and Ofori, 2007). Modern society, consumers working to promote health by increasing demand for functional food, as compared with basic food products in order to enhance their wellbeing, enjoyment and healthy lifestyle (Hsieh and Ofori, 2007).

In recent decades, there has been a developing interest in using multi-use plants. One of these plants is tomato (*Solanum lycopersicum*). Tomato confines high concentration of lycopene (70-130mg Kg⁻¹), the concentration of lycopene is depending on cultivation technique, variety, degree of tomato ripeness, weather condition and geographic location (Takeoka *et al.*, 2001). Lycopene has an antioxidant and reducing power activities. The lycopene plays a critical role in decreasing the risk of some cancer types Takeoka *et al.*, 2001). The aim of this research was to evaluate the effect of tomato juice on the sensory, chemical and texture profile characteristics of a mozzarella cheese.

MATERIALS AND METHODS

Cow's milk (3%fat) (was obtained from Agricultural Research and Experiments center, Faculty of Agriculture, Mansoura Univ). The Starter was obtained from Agricultural Research and Experimental unit, Faculty of Agriculture, Mansoura Univ. which consisted of:

Streptococcus Thermopiles & *Lactobacillus delbruekii Sub.sp. bulgaricus*

Commercial liquid rennet was obtained from local market. It was added to the milk at a rate of 25 m/100 kg milk. Edible salt was obtained from El-Nasr Company for salt, Alexandria, Egypt. Tomato used as an acidulate was obtained from local market. Acidulates

were directly added to the milk to reach pH value of 5.8. Tomato juice was contented of water ranges from 93-95%, the total solid from 5.5-9.5% and about 1% is seed and skin. For the preparation of tomato juice, tomatoes was washed with water then cut into slices and blend in electric blender.

Fat and Total solids (T. S) were estimated by the method described in the British Standard Institution's (B. S. I) Method (1955).

PH was measured by a digital pH-meter Janway 3010 – England.

Total nitrogen (t. n), and titratable acidity (t. a) were estimated as described by Ling (1963). Total phenolic compounds (TPC) were determined according to Zheng and Wang (2001).

Antioxidant capacity: Free Radical Scavenging Activity (RSA%) assay of the samples was measured using the method of Brand-Williams *et al*(1995). And expressed as percentage inhibition of the DPPH (2,2-diphenyl-1-picryl-hydrazyl-hydrate) free-radical. And was determined by the following:

$$RSD = \frac{Abs\ control - Abs\ sample}{Abs\ control} \times 100\%$$

Total bacterial count (T. C), moulds and yeasts (M & Y), Coliform bacteria (*E. coil*) and staphylococci (*Staph spp.*) were determined as recommended in standard methods for examination of Dairy Product (1985). Lipolytic and Proteolytic bacterial count were carried out as described by Chalmers (1962).

For examining the rheological properties, cheese Meltability was determined by the meltability test apparatus as outlined by Olson and Price (1958). Mozzarella cheese stretchability was measured using an iron bar test as reported by Davis (1966). Oiling off (fat leakage %) was determined as suggested by Nilson and Laclari (1976). Curd tension was determined by using the method of Chandrasekhara *et al* (1957).

RESULTS AND DISCUSSION

Table (1) reveals that all samples were almost similar in their PH values. This result agreed with that reported by Kosikowski, (1982), who reported that the PH of mozzarella cheese ranged from 5.2 to 5.3, while, sample by using tomato juice had the highest acidity being 0.46% followed by control sample (0.44%). On the other hand, sample with added tomato juice had the

highest total solids, followed by control sample 54.8%, and 53.1% respectively. All samples disagreed with those reported by Davis (1966), who mentioned that the moisture content ranged from 52 – 60%. (Total solids ranged from 48-40%), while all samples confirmed the levels of low moisture mozzarella cheese (45 – 52%) as reported by Breseman (1973). Results in Table (1) show that control sample had the highest fat content of 25.5%, while sample with added tomato juice had the lowest

fat content of 24.8%. Fat/dry matter content ranged between 48.02 and 45.25%. The highest value of (48.02%) was obtained when starter was used, while the lowest was recorded in sample with added tomato juice. Total nitrogen content ranged from 2.40 to 2.60%. These results are in disagreement with those recorded by Dermott (1983). Total protein content ranged from 15.26 to 16.53%. The highest total protein value of 16.53% was recorded in control treatment.

Table 1. the chemical properties of Functional Mozzarella cheese.

Properties	PH value	T.A%	T.S%	FAT%	FAT/DM	T.p%
Control(starter)	5.25	0.44	53.1	25.5	48.02	16.53
By Tomato juice	5.21	0.46	54.8	24.8	45.25	15.26

It could be noticed from the results in dictated in Table (2) it is that residual scavenging activate (RSD %) increased by increasing tomato juice. As compared with control which was of less RSA% another treatment. These results are consistent with those reported by Mohamed and Shalaby (2016), who detected that the RSA% of cheese analogue which fortified with an apricot pulp is directly proportional to the added concentration of fruit pulp. Also, these results are in agreement with those of Corbett *et al.* (2015). Phenolic compounds (mg/100 g): Phenolic compounds (mg/100 g) took the same trend of RSA. Phenolic compounds increased by increasing the concentration of tomato juice, compare with control. These results are consistent with those reported by O'connel and Fox (2001) who found that cheese contained less amount of phenols and also lacks of vitamin C and many important antioxidants.

Table 2. the Antioxidants activity of Functional mozzarella cheese

Properties	RSA%	TPC(mg GAE/100mg)
Control (starter)	1.9	3.8
By Tomato juice	73.6	6.2

RSA%: free radicals scavenging activity &TPC: Total phenolic contents & GAE: Gallic acid equivalent

Table (3) shows that using starter in making cheese from cow milk resulted in the highest cheese yield of 16.9%, while samples made with Tomato juice had the lowest values being 15.7%. These results disagreed with El-Zoghby (1994), who reported that the use of direct acidification led to an increase in the yield of mozzarella cheese.

Table 3. the rheological properties of Functional mozzarella cheese

Properties	Meltability	Stretchability	Oiling off	Yield %
Control (starter)	6.5	21.3	25.13	16.9
By Tomato juice	5.9	19.5	29.17	15.7

The mean values of the rheological parameters of mozzarella cheese as affected by the type of acidulates are given in Table (3).It is clear that direct acidification with Tomato juice slightly affected the meltability as it decreased by 1.4 cm. when compared with that of the control. These results are in not in agreement with Naresh Kumar *et al.* (1994), Tomato juice treatment was almost near to control , as it recorded 19.5 cm with a decrease value of to 1.8 cm. These results disagreed with those reported by Shukla and Lad Kani (1989b).On the other hand, the direct acidification by Tomato juice led to a considerable increase in cheese oiling off . The results disgreed with El-Zoghby (1994).

Table 4. Microbiological characteristics of Functional mozzarella cheese were.

Properties	Cow's	
	Control (starter)	By Tomato juice
T.Cx10 ⁶	55	22
Coli formx10 ³	N.D	N.D
Staph. Spp. x10 ³	N.D	N.D
Proteolytic x10 ³	N.D	N.D
Lipolyticx 10 ³	N.D	N.D
M & Yx 10 ³	N.D	N.D

Data presented in table (4) illustrate the microbial groups which could detected in the Functional mozzarella cheese. It seems that control had the highest total count ,followed by tomato juice sample being 55 and 22 X, 10³ respectively.

CONCLUSION

The addition of tomato juice was the most appropriate in making of functional mozzarella cheese. This treatment improves the sensory, nutritional value and chemically properties of resultant mozzarella cheese.

All samples were free from *coliforms*, *Staphylococcus* . Spp. Count, moulds and yeasts count, proteolytic, and lipolytic bacteria. This is due to the antifungal and antiseptic effect of tomato device and the antioxidant, carotenoids and lycopene.

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تأثير إضافة عصير الطماطم على جودة الجبن الموزاريلا الوظيفية محمد الدسوقي عبد العزيز محمد و محمود مصطفى محمد رفاعي قسم الألبان - كلية الزراعة - جامعة المنصورة - جمهورية مصر العربية

تم إنتاج جبن الموزاريلا باستخدام عصير الطماطم وبتقدير نشاط مركبات مضادات الأكسدة والمركبات الفينولية وجد أنها زادت بإضافة عصير الطماطم بالمقارنة بالجبن المنتج باستخدام البادئ الذي حصل على أقل نشاط من مركبات مضادات الأكسدة والمركبات الفينولية. وتم إجراء الاختبارات الميكروبيولوجية والكيميائية والريولوجية والحسية للجبن للتحكم والمعاملات المختلفة المنتجة بالطريقة التقليدية وقد وجد أن الجبن المنتج باستخدام عصير الطماطم أفضل من حيث الخواص الكيميائية والريولوجية والميكروبيولوجية والحسية.