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Production of Functional Spreadable Processed Cheese Supplemented with Sweet Red Pepper Paste

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ABSTRACT

Sweet red pepper is a natural source of phenol compounds and ascorbic acid that contributes to its high antioxidant potential. It could be used as a material to enrich different food systems such as soft and processed cheeses. The current study evaluates the effect of supplementation with 10% and 20% of sweet red pepper paste (SRPP) on the physicochemical, textural and sensory traits of spreadable processed cheese during storage at 7±1°C for three months. The addition of SRPP increased the total solids, fiber, protein, ash, fat, pH, potassium, and total phenolic contents of spreadable processed cheese, as compared with the control. Besides, the firmness, chewiness, and springiness of processed cheese supplemented with SRPP were lower than the control. Sensory evaluation scores revealed that the panelists accepted processed cheeses containing SRPP with slight differences scores between all treatments and control. The addition of SRPP in preparation of spreadable processed cheese could be recommended to produce an acceptable product with high nutritional and health properties containing antioxidants and dietary fiber.

Keywords: Phenolic compounds, sweet red pepper, dairy products, spreadable processed cheese, natural antioxidant.

INTRODUCTION

Among different types of cheese, processed cheese has become very popular with growing market demand all over the world. Processed cheese is produced by heating a blend of shredded natural cheeses of different types and degrees of maturity with emulsifying salts (ES), coloring agent and water, under reduced pressure with constant agitation till a homogeneous mass is obtained and then packaged (Awad *et al*., 2004; Morsy *et al*., 2015). The popularity of processed cheese is due to many factors, including diversity in flavor, texture and cooking qualities, in addition to the possibility to use it in fast meals, applications of cheese ingredients, and attractive forms as a result of its good packaging. This diversity can be controlled through changes in manufacturing, composition and formulation processes (Chambre and Duurelles, 2000; Solhi *et al*., 2019).

Vegetables and fruits are healthy foods, potentially preventing or delaying the occurrence of chronic diseases and meeting basic nutritional needs. Currently, functional plant foods have been developed to improve healthy eating habits (Mohamed and Shalaby, 2016; Mohamed *et al*., 2016). Peppers are good sources of vitamin C and antioxidant activity (Nadeem *et al*., 2011).Sweet red pepper is among the essential functional vegetables that are consumed fresh or processed or used as a spice all over the world. Red pepper is used as a flavoring and natural coloring agent, or as a source of bioactive substances (Luis Ángel *et al*., 2012).

The current study aimed to produce spreadable processed cheese supplemented with sweet red pepper paste to improve its nutritional value and consumer acceptability

MATERIALS AND METHODS

Materials

Sweet red pepper (*Capsicum annuum* L.), had been chosen as natural additives. About two kilograms have been obtained from the local market (Zagazig, Egypt). Ras cheese (1-month-old) was obtained from Domety Company (6th October City, Egypt). Ripened Cheddar cheese (10 months old) was obtained from Milky Land Company (10th Ramadan City, Egypt). JOHA emulsifying salts (commercial blends of phosphatase) were purchased from BK-Ladenburg corp. Gmbh (Germany). Unsalted butter was purchased from Dina farm (Sadat city, Egypt). Skim milk powder was obtained from the Irish Dairy Board, Grattan House, and Lower Mount St. (Dublin, Ireland). 1,1-diphenyl-2-picrylhydrazyl (DPPH·), gallic acid were obtained from Sigma (St. Louis, MO, USA).

Ingredients used in the preparing of spreadable processed cheese

The chemical composition of the ingredients used in the preparation of spreadable processed cheese is given in Table 1.

Table 1. Total solids and fat content of ingredients utilized in the manufacture of spreadable processed cheese

Ingredient	Total solids (%)	Fat (%)
Cheddar cheese	64	32.6
Ras cheese	52	20.40
Skim milk powder	96	0.9
Unsalted butter	84.5	83
Red pepper paste	7.96	2.14

Methods

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Preparation of sweet red pepper paste (SRPP)

Sweet red pepper fruits were washed with tap water, seeds were removed, the flesh was blended using an electric blender, and the prepared paste was stored at 4˚C (Kuleaşan and Okur, 2012).

Chemical composition of sweet red pepper paste

Total solids, fat, total protein, carbohydrate, crude fiber, ash, calcium, phosphorus, manganese, potassium, and sodium contents were measured according to AOAC (2007), while iron and zinc content was determined according to Page *et al*. (1992).

Manufacture of spreadable processed cheese containing SRPP

Processed cheese was made according to Mayer (1973). The composition of control processed cheese has been modified to contain 60% moisture and 51.2% fat in the dry matter, and making with Ras cheese, Cheddar cheese, skim milk powder, and butter as a base blend. The processed cheese treatments prepared by adding RPP in the base blend at ratios of 10% (T1) and 20% (T2). All blends were mixed, placed in the processing kettle (Stephans Universal machine, Switzerland) of 2.5 kg capacity. They were cooked with controlled agitation for 8 min at 85-90°C using direct injection steam at 1.5 bar. The hot processed cheese product was filled into 150 g sterilized glass jar, covered with aluminum foil, and then cooled to 7±1°C. The obtained processed cheese was analyzed when fresh, and after 1, 2, and 3 months of storage at 7°C. The composition of different blends of processed cheese is given in Table 2.

Table 2. Formulations of the blends used for preparing of spreadable processed cheese treatments

Ingredient (g)	Control	T1	T2
Cheddar cheese	370	370	370
Ras cheese	150	150	150
Skim milk powder	50	50	50
Unsalted butter	100	100	100
Emulsifying salt	30	30	30
water	300	200	100
red pepper paste	---	100	200
Total	1000	1000	1000

Total phenolic content (TPC)

The concentration of TPC in red pepper extract and processed cheese were measured according to Skerget *et al*. (2005) for red pepper extract and Reis *et al*. (2012) for processed cheese using Folin-Ciocalteu reagent and expressed as mg GAE/100g.

Determination of radical scavenging activity (RSA%)

RSA of red pepper extract and processed cheese were measured by bleaching of the purple-colored solution of DPPH·, according to Brand-Williams *et al*. (1995). Percentage of antioxidant activity of DPPH· was calculated as follows:

$$\mathbf{RSA\ (\%) = [(A_0 - A_1)/A_0] \times 100}$$

where

A_0 is the absorbance of the control reaction, and A_1 is the absorbance of the extract. Samples were analyzed in triplicate.

Chemical analysis of processed cheese

Processed cheese was analyzed for total solids contents, total protein, fat, ash, crude, and titratable acidity, as mentioned by AOAC (2007). pH values were determined using a digital pH meter (HANNA, Electric Instruments Limited). Mineral composition of fresh cheese was used to determine K, Na contents using a flame photometer (Corning Medical and Scientific Instrument, MA, USA) as reported by AOAC (2007).

Textural measurements of processed cheese

Texture profile analysis of processed cheese samples (firmness, chewiness, and springiness) were evaluated according to Lobato-Calleros *et al*. (1997) using a texturometer (Model Mecmesin Emperor, TMLite 1.17, USA).

The sensory traits of processed cheese

The sensory attributes of processed cheese was executed by ten panelists of the staff members of the Dairy Sci., Dep., Fac. Agric., Zagazig, Univ, according to Meyer (1973). The organoleptic scores consisted of appearance and color (20 points), body, and texture (40 points), flavor (40 points).

Statistical analyses

The experiment was performed in triplicate, and the data were transferred to the SPSS (2007) version 16 program. Data were statistically analyzed using one-way ANOVA.

RESULTS AND DISCUSSION

Chemical composition and antioxidant properties of sweet red pepper paste

The proximate macronutrient contents of sweet red pepper paste (RPP) are illustrated in Table 3. Moisture, fat, total protein, crude fiber, carbohydrate, and ash contents of SRPP were 90.04, 1.0, 2.14, 2.12, 5.96, and 0.86 g/100g, respectively. These results agree with those obtained by Esayas et al. (2011).

Major element levels (mg/100 g on a dry weight basis) in SRPP are presented in Table 3. Calcium, phosphorus, magnesium, potassium, sodium, iron, and zinc contents of SRPP were 140.20, 240.18, 182.60, 2320.72, 12.40, 8.44, and 2.11 mg/100g respectively. The results are in line with those obtained by Bernardo *et al*. (2008).

Sweet red pepper paste (SRPP) was investigated for total phenolic content (TPC) (Table 3). The results showed that the TPC of SRPP was 220.32 (mg GAE /100g DW). The radical scavenging activity (RSA%) of SRPE was 90.20 %. The results agree with that previously reported by Zhuang *et al*. (2012); Sora *et al*. (2015); Shaimaa *et al*. (2016) and Nicácio *et al*. (2019). Therefore, SRPP could be a good source of bioactive compounds with high antioxidant potential.

Table 3. Chemical composition, total phenolic content and antioxidant properties of sweet red pepper paste (SRPP)

Item	Concentrate
Chemical composition (g/100g)	
Moisture	90.04
Fat	2.14
Total protein	1.00
Crude Fiber	2.12
Carbohydrate	5.96
Ash	0.86
Minerals content (mg/100g on dry weight)	
Calcium	140.20
Phosphorus	240.18
Magnesium	182.60
Potassium	2320.72
Sodium	12.40
Iron	8.44
Zinc	2.11
Total phenolic content and antioxidant activity	
Total phenolic compounds (mg GAE /100g DW)	220.32
Radical scavenging activity (RSA) %	90.20

GAE: Gallic Acid Equivalent DW: a dry weight

Gross chemical composition of spreadable processed cheese supplemented with sweet red pepper paste (SRPP)

Chemical analyses were assessed by determining total solids, total protein, fat, ash, fiber and contents, acidity, pH, and sodium and potassium contents.

Total solids, fat, total protein, ash, and fiber content

Table (4) shows that control cheese had the lowest TS content, with 44.10% at the end of the storage period (3 months). Cheese with sweet red pepper paste (SRPP) at different concentrations 10 and 20% showed the TS content with 44.50 and 45.28% at the end of the storage period. The TS content of all cheese treatments significantly ($P \leq 0.05$) increased during the storage period for three months at refrigerator temperature. The decrease in the moisture content of produced cheeses along the storage period might be due to loss of moisture during the storage period (Salem *et al*., 2010).

Table 4. Chemical composition of spreadable processed cheese supplemented with sweet red pepper paste (SRPP) during storage at 7°C for three months

Component	Treatment	Storage period (month)			
		Fresh	1	2	3
Total solids (%)	C	41.92 ^{c}	42.50 ^{c}	43.20 ^{c}	44.10 ^{c}
	T1	42.48 ^{b}	43.20 ^{b}	43.78 ^{b}	44.50 ^{b}
	T2	43.86 ^{a}	44.32 ^{a}	44.84 ^{a}	45.28 ^{a}
LSD		0.15	0.09	0.10	0.09
Protein/DM (%)	C	28.50 ^{b}	28.70 ^{c}	29.16 ^{b}	30.00 ^{b}
	T1	28.99 ^{a}	29.32 ^{b}	30.04 ^{a}	31.16 ^{a}
	T2	29.08 ^{a}	30.02 ^{a}	30.64 ^{a}	31.22 ^{a}
LSD		0.33	0.11	0.13	0.15
Fat/DM (%)	C	51.19 ^{a}	51.29 ^{a}	51.85 ^{a}	52.15 ^{a}
	T1	50.20 ^{b}	50.74 ^{b}	51.14 ^{ab}	51.78 ^{b}
	T2	49.79 ^{c}	50.10 ^{b}	50.75 ^{b}	51.22 ^{b}
LSD		0.077	0.072	0.077	0.077
Ash (%)	C	5.14 ^{c}	5.32 ^{c}	5.58 ^{c}	5.86 ^{c}
	T1	5.36 ^{b}	5.63 ^{b}	5.94 ^{b}	6.24 ^{b}
	T2	5.98 ^{a}	6.12 ^{a}	6.58 ^{a}	6.82 ^{a}
LSD		0.081	0.092	0.121	0.077
Fiber %	C	ND	ND	ND	ND
	T1	0.232 ^{b}	0.270 ^{b}	0.310 ^{b}	0.360 ^{b}
	T2	0.241 ^{a}	0.286 ^{a}	0. 342 ^{a}	0.432 ^{a}
LSD		0.0065	0.006	0.161	0.007
Acidity (%)	C	1.58 ^{a}	1.62 ^{a}	1.68 ^{a}	1.74 ^{a}
	T1	1.56 ^{a}	1.60 ^{a}	1.65 ^{ab}	1.70 ^{a}
	T2	1.54 ^{a}	1.58 ^{a}	1.60 ^{b}	1.65 ^{a}
LSD		.0847	0.070	0.070	0.093
pH	C	6.12 ^{b}	6.0 ^{b}	5.94 ^{b}	5.90 ^{b}
	T1	6.14 ^{b}	6.07 ^{b}	5.98 ^{ab}	5.95 ^{ab}
	T2	6.25 ^{a}	6.18 ^{a}	6.04 ^{a}	6.00 ^{a}
LSD		0.078	0.081	0.083	0.063

Means followed by different small letters in the same column are significantly different ($p \leq 0.05$).

L.S.D: Least significant difference ND: Not determined

C: Control spreadable processed cheese T1- spreadable processed cheese containing 10% sweet red pepper paste.

T2- spreadable processed cheese containing 20% sweet red pepper paste.

Total protein on a dry matter (TP/DM %) in cheese samples gradually increased up to the end of the storage period. The addition of SRPP increased TP/DM content for experimental cheese, and there were no significant differences in TP /DM % or storage period due to high protein content and lower proteolysis in all treatments. Similar results were reported by Salem *et al*. (2010) and Mehanna *et al*. (2016).

Concerning fat content, the addition of SRPP decreased fat/DM content for experimental cheese. It might be observed that the fat/DM content of experimental cheese samples slightly increases up to the end of the storage period, depending on the loss of moisture. The fat content of all treatments increased along the storage period up to the end of the storage period.

Concerning ash content, processed cheese containing SRPP showed the highest ash content compared to control cheese. The ash content of all cheese treatments slightly increased during the storage period for three months at refrigerator temperature. The results agree with those reported by Mehanna *et al.,* (2016), who reported that the addition of tomato juice to processed cheese increased its ash content

As for fiber content, spreadable processed cheese containing SRPP at two concentrations 10 and 20% showed the fiber content with 0.360 and 0.432% at the end of the storage period, respectively. The fiber content of all cheese treatments containing SRPP slightly increased during the storage period for three months at refrigerator temperature. These results agree with those reported by Mohamed *et al*. (2016), who manufacture processed cheese using carrot paste as natural antioxidants. Also, Mehanna *et al*. (2016) found that the addition of tomato juice to processed cheese increased its TS and fiber contents.

Acidity and pH

There was a significantly increasing trend ($P \leq 0.05$) in the acidity of all processed cheese treatments throughout the storage period. Titratable acidity slightly increased in all cheese samples with the progress in the storage period. SRPP supplemented cheese at a rate of 10, and 20% had lower acidity than control cheese. The trend of the changes in pH values of all treatments was opposite to that of acidity (Table 4). The values of pH decreased in all treatments with the progress in the storage period. Similar results were obtained by Abd El-Aziz *et al*. (2012), Ruben *et al*. (2013), and Mehanna *et al*., (2016).

Mineral profile of spreadable processed cheese containing SRPP

Data presented in Table 5 showed that the fortification of processed cheese with SRPP increased its K contents, and decreased the ratio of Na/K .The control sample had 34.60 mg K/100 g, while increased to 198.4 and 220.8 mg K/100 g in processed cheese supplemented with 10 and 20% SRPP, respectively, at the end of the storage period. From the results of Na and K, it might be said that this product can be a healthy product for children, and any person with high sodium content that causes health problems like hypertension. These results are in agreement with those found by Mohamed and Shalaby (2016), who found that the addition of apricot pulp to processed cheese increased its K content than control cheese.

Radical Scavenging Activity (RSA %) of spreadable processed cheese containing SRPP

Results given in Table 5 showed that supplementation of processed cheese with SRPP increased the RSA% in cheese treatments in parallel with increasing the level supplementation compared with control cheese. It

was observed that RSA% of control cheese was 1.80%, while RSA% of cheese supplemented with 10 and 20% RPP were 27.70 and 31.6%, respectively, at the end of the storage period. However, RSA% gradually decreased during storage (three months) for all cheese treatments. The obtained results are in line as those stated by Mehanna *et al*., (2016), who found that the addition of tomato juice to processed cheese increased its RAS %. Solhi *et al*. (2019) reported that the addition of asparagus powder to processed cheese increased its RAS content.

Total phenolic content (TPC) of spreadable processed cheese containing SRPP

Table 5 showed a high increase in TPC in cheese treatments supplemented with SRPP in parallel with increasing the level supplementation compared with control cheese. This may be due to the fact that TPC of red pepper remained in cheese curd. The control sample had 8.70 mg /100 g and increased to 270.4, and 310.20 mg/100 g in cheese were supplemented with10 and 20% SRPP at the end of the storage period. The obtained results are following those mentioned by Mehanna *et al*. (2016), who found that the addition of tomato juice to processed cheese increased its TPC content. During storage, the TPC gradually decreased for all treatments. This might be due to the transformation of phenolic compounds, which is unstable compounds and exposed to chemical and enzymatic reactions during storage, as reported by Poncet-Legrand *et al*., (2006).

Table 5. Sodium and potassium content, radical scavenging activity and total phenolic content of spreadable processed cheese supplemented with SRPP during cold storage at 7°C for three months

Item	Treatment	Storage period (month)			
		Fresh	1	2	3
Sodium and potassium content of spreadable processed cheese					
Potassium mg/100 g	C	12.4 ^{c}	16.8 ^{c}	22.2 ^{c}	34.6 ^{c}
	T1	94.8 ^{b}	115.6 ^{b}	155.8 ^{b}	198.4 ^{b}
	T2	104.6 ^{a}	160.2 ^{a}	194.6 ^{a}	220.8 ^{a}
LSD		0.607	0.925	1.213	2.413
Sodium mg/100 g	C	172.3 ^{c}	212.2 ^{c}	270.8 ^{c}	329.6 ^{c}
	T1	174.6 ^{b}	236.3 ^{b}	260.2 ^{b}	315.8 ^{b}
	T2	180.2 ^{a}	280.5 ^{a}	298.4 ^{a}	360.5 ^{a}
LSD		0.765	0.732	0.765	1.191
Sodium/ Potassium ratio	C	13.89 ^{a}	12.63 ^{a}	12.20 ^{a}	9.52 ^{a}
	T1	1.84 ^{b}	2.04 ^{b}	1.67 ^{b}	1.59 ^{b}
	T2	1.72 ^{c}	1.75 ^{c}	1.53 ^{c}	1.63 ^{b}
LSD		0.077	0.096	0.084	0.077
Radical scavenging activity (RSA) and total phenolic content (TPC) of spreadable processed cheese					
RSA (%)	C	2.86 ^{c}	2.4 ^{c}	2.12 ^{c}	1.80 ^{c}
	T1	38.40 ^{b}	33.80 ^{b}	30.40 ^{b}	27.70 ^{b}
	T2	42.80 ^{a}	38.20 ^{a}	34.50 ^{a}	31.60 ^{a}
LSD		0.580	0.580	0.682	0.704
TPC (mg/100g)	C	20.00 ^{c}	14.60 ^{c}	10.50 ^{c}	8.70 ^{c}
	T1	350.6 ^{b}	320.7 ^{b}	290.8 ^{b}	270.4 ^{b}
	T2	390.4 ^{a}	370.6 ^{a}	340.5 ^{a}	310.2 ^{a}
LSD		11.78	40.86	8.91	8.58

Means followed by different small letters in the same column are significantly different ($p \leq 0.05$). L.S.D: Least significant difference
C: Control spreadable processed cheese
T1: spreadable processed cheese containing 10% sweet red pepper paste.
T2: spreadable processed cheese containing 20% sweet red pepper paste.

Textural properties of spreadable processed cheese containing RPP

The compositional differences between the processed cheeses were in line with the expected differences from the formulations and the obtained cheeses that were unlike in some textural attributes, especially firmness. The decrease in firmness as a result of an expected decrease in moisture content of the treatments. It occurs due to the higher hydration and consequent weakening of the casein network (Pereira *et al*., 2001).

The supplementation with SRPP resulted in a significant ($p \leq 0.05$) decrease in the cheese firmness compared with the control cheese. Moreover, raising SRPP (20%) resulted in a tendency for an increase in firmness (Table 6). On the other side, Kaminarides *et al*. (2006) found that increasing the Halloumi cheese, salt, and ash levels of the blend increased the resulting processed cheese's hardness. Besides, the textural parameters included chewiness and springiness were increased by increasing the levels of SRPP. Korish and Abd-Elhamid (2012) reported that the lowest values of hardness, springiness, and chewiness in Kareish cheese, might be due to the increase in cheese moisture levels.

Table 6. Texture analysis of spreadable processed cheese supplemented with sweet red pepper paste during storage at 7°C for three months

Property	Treatment	Storage period (month)			
		Fresh	1	2	3
Firmness	C	8.12 ^{a}	8.84 ^{a}	9.22 ^{a}	9.60 ^{a}
	T1	6.74 ^{b}	7.12 ^{b}	7.74 ^{b}	8.20 ^{b}
	T2	6.28 ^{c}	6.84 ^{c}	7.30 ^{c}	7.92 ^{c}
LSD		0.155	0.133	0.352	0.655
Chewiness	C	6.40 ^{a}	6.84 ^{a}	7.20 ^{a}	7.62 ^{a}
	T1	5.80 ^{b}	6.14 ^{b}	6.50 ^{b}	6.94 ^{b}
	T2	5.48 ^{b}	5.82 ^{b}	6.10 ^{b}	6.42 ^{b}
LSD		0.435	0.542	0.541	0.583
Springiness	C	1.12 ^{a}	1.32 ^{a}	1.78 ^{a}	1.96 ^{a}
	T1	0.996 ^{ab}	1.12 ^{b}	1.30 ^{b}	1.52 ^{b}
	T2	0.968 ^{b}	0.994 ^{b}	1.18 ^{c}	1.34 ^{c}
LSD		0.117	0.125	0.101	0.095

Means followed by different small letters in the same column are significantly different ($p \leq 0.05$). L.S.D: Least significant difference
C- Control spreadable processed cheese
T1- spreadable processed cheese containing 10% sweet red pepper paste.
T2- spreadable processed cheese containing 20% sweet red pepper paste.

Organoleptic properties of spreadable processed cheese containing SRPP

The average score points given for appearance body characteristics and flavor of processed cheese as affected by adding SRPP are illustrated in Table 7. These results showed that there were significant differences between the control and all treatments when fresh and during the storage period. Cheese containing 20% SRPP recorded the highest score for appearance compared with other cheese. All cheese treatments had been acceptable by panelists; it is also that all additives improved cheese properties and overall acceptability. Also, organoleptic properties of all cheese treatment improved by the progress of storage period until the end of storage. These results are in agreement with the results obtained by Abd El-Aziz *et al*. (2012) who found that addition of ginger extract to

processed cheese increased its organoleptic properties and Mehanna *et al*. (2016) who found that addition of tomato juice to processed cheese increased its organoleptic properties.

Table 7. Organoleptic properties of spreadable processed cheese supplemented with sweet red pepper paste during cold storage at 7°C for three months

Property	Treatment	Storage period (month)			
		Fresh	1	2	3
Appearance and color (20)	C	16.0 ^{b}	15.0 ^{b}	15.0 ^{c}	14.0 ^{b}
	T1	17.0 ^{ab}	16.0 ^{ab}	16.0 ^{b}	15.0 ^{ab}
	T2	18.0 ^{a}	18.0 ^{a}	17.0 ^{a}	16.0 ^{a}
LSD		1.09	1.04	0.99	1.04
Body texture (40)	C	37.0 ^{a}	37.0 ^{a}	35.0 ^{a}	34.0 ^{a}
	T1	35.0 ^{b}	35.0 ^{b}	34.0 ^{ab}	33.0 ^{ab}
	T2	34.0 ^{bc}	34.0 ^{bc}	33.0 ^{b}	32.0 ^{b}
LSD		1.02	1.09	1.04	1.02
Flavor (40)	C	38.0 ^{ab}	36.0 ^{b}	36.0 ^{b}	35.0 ^{b}
	T1	38.0 ^{ab}	37.0 ^{ab}	36.0 ^{b}	35.0 ^{b}
	T2	39.0 ^{a}	38.0 ^{a}	37.0 ^{a}	36.0 ^{a}
LSD		1.04	1.02	1.00	0.99
Total (100)	C	91.0 ^{a}	88.0 ^{b}	86.0 ^{ab}	83.0 ^{ab}
	T1	90.0 ^{ab}	88.0 ^{b}	86.0 ^{ab}	83.0 ^{ab}
	T2	91.0 ^{a}	90.0 ^{a}	87.0 ^{a}	84.0 ^{a}
LSD		1.07	1.04	1.09	1.04

Means followed by different small letters in the same column are significantly different ($p \leq 0.05$). L.S.D: Least significant difference
C- Control spreadable processed cheese
T1- spreadable processed cheese containing 10% sweet red pepper paste.
T2- spreadable processed cheese containing 20% sweet red pepper paste.

CONCLUSION

From the results obtained and primarily sensory tests, it can be concluded that the addition of 20% red pepper paste to spreadable processed cheese gave it a high degree of acceptance by the panelists and at the same time presented a healthy functional spreadable processed cheese with favorable properties .In addition, cheese supplemented with red pepper paste is a new product characterized by high antioxidant content, low sodium / potassium content, and high levels of minerals compared to regular processed cheese.

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انتاج الجبن المطبوخ الوظيفى سهل الفرد المدعم بعجينة الفلفل الأحمر الحلو

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يعتبر الفلفل الأحمر الحلو مصدر طبيعي للفينولات وحمض الأسكوربيك والتي تعرف بنشاطها المضاد للأكسدة. ويمكن استخدام الفلفل الأحمر في تدعيم أنواع مختلفة من الأنظمة الغذائية مثل الجبن الطري والجبن المطبوخ. أجريت الدراسة لتقييم تأثير التدعيم بعجينة الفلفل الأحمر الحلو على الخصائص الفيزوكيميائية والحسية للجبن المطبوخ الوظيفي سهل الفرد. حيث تمت إضافة عجينة الفلفل الأحمر الحلو بنسب ١٠ و ٢٠٪، وتم تقييم الخواص الكيميائية، التركيبية، الحسية, محتوى الفينولات الكلية ، والنشاط المضاد للأكسدة للجبن المطبوخ الوظيفي سهل الفرد خلال التخزين على درجات حرارة ٧ درجات مئوية لمدة ٣ أشهر. أوضحت النتائج أن إضافة عجينة الفلفل الأحمر نتج عنها جبن مطبوخ وظيفى سهل الفرد ذو محتوى عالي من المواد الصلبة الكلية ، الألياف، البروتين، والرماد، pH ,الدهون، البوتاسيوم و الفينولات الكلية، مقارنة بعينة المقارنة. علاوة على ذلك، فان الخصائص التركيبية للجبن المطبوخ سهل الفرد المحتوي على عجينة الفلفل الأحمر في جميع المعاملات كانت أقل مقارنة بجبن المقارنة. و أظهرت نتائج التقييم الحسي أن كل المعاملات المحتوية على عجينة الفلفل الأحمر كانت مقبولة بالنسبة للمحكمين، وكانت هناك اختلافات طفيفة بين جميع المعاملات. وان إضافة عجينة الفلفل الأحمر للجبن المطبوخ أدى إلى إنتاج جبن مقبول ذو قيمة غذائية وصحية عالية ومميز خاصة للأطفال بجانب احتوائه على مضادات الأكسدة وغناه بالألياف الغذائية التي تلعب دورًا هامًا في إحداث آثار صحية ملحوظة.