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المجلة العراقية لبحوث السوق وحماية المستهلك

DEVELOPING SOFT CHEESE INDUSTRY SUPPORTED WITH MEDICINAL HERBS AS FUNCTIONAL FOOD

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ABSTRACT

Herbs and spices have long been used to support various food products, including dairy products because of their flavoring, taste, texture and general appearance as well as therapeutic properties such as antioxidant activities, infections, microbes, anti-diabetes and hypertension. Therefore, this study aimed to demonstrate the effect of adding ginger, cinnamon, lycopene extract and olive oil on the physiochemical properties, the quality of the soft cheese produced and the extent of its acceptance by the Iraqi consumer, who prefers this product in abundance to other types of cheese. So, this study was prepared with ten liters of fresh cow's milk used in the manufacture of soft cheese by the dairy factory/ Abu Ghraib/ Baghdad. Standard soft cheese was processed by filtering raw milk first, heating, cooling, adding rennet, incubating, cutting, drainage the whey, salting and supplementing with different addition. Five treatments of soft cheese were made by regular method and supplemented as follows: The control treatment is to make white soft cheese without adding anything other than the basic ingredients for making soft cheese. While adding 2.5% of each of the ginger, cinnamon, lycopene and olive oil for each of the second, third, fourth and fifth treatment, to the curd of milk and supplement its manufacture from squeezing and preserving it until the necessary analyzes were done. The results of the study showed a clear and significant variance (P<0.05) of the percentage of fats, total solids, ash contents and calibrated acidity as the storage period of the soft cheese product increased to 21 days. The results of the statistical analysis also showed that ginger, cinnamon, lycopene and olive oil with certain concentrations had a positive effect (p<0.05) on the physiochemical composition of cheese and on all sensory properties. It was founded that supported cheese with cinnamon had the highest concentration in phenol contents follow: cinnamon cheese> lycopene cheese> olive oil> ginger cheese>control cheese which was 643, 564, 497, 424 and 213 mg\ kg respectively. Also, It was found that lycopene cheese appeared highest scavenging activity for free radical produced from DPPH followed by lycopene cheese, Olive oil cheese, Ginger cheese and Cinnamon cheese were 96, 94, 91 and 88% respectively. Consequently, the study concluded the importance of producing milk products fortified with medicinal plants and spices and their availability to many consumers who want to consume these fortified products to improve and preserve their health.

Keywords: Vital ingredient, physicochemical composition, HPLC technique.

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تطوير صناعة الأجبان الطرية المدعمة بالأعشاب الطبية كغذاء وظيفي

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الخلاصة

منذ فترة طويلة تستخدم الأعشاب والتوابل لدعم المنتجات الغذائية المختلفة، بما في ذلك منتجات الألبان بسبب النكهة والذوق والملمس والمظهر العام وكذلك الخصائص العلاجية مثل أنشطة مضادات الأكسدة، والالتهابات، والميكروبات، ومرض السكري وارتفاع ضغط الدم. لذلك، تم تصميم هذه الدراسة لإظهار تأثير إضافة مستويات مختلفة من الزنجبيل والقرفة والليكوبين وزيت الزيتون إلى خثارة حليب البقر على جودة الجبن الطري الأبيض لتحسين جودته وقيمته الغذائية والصحية، تم الحصول على عشرة لترات من حليب البقر من المزرعة المحلية في كلية الزراعة/ جامعة بغداد. تم تصنيع الجبن الطري القياسي عن طريق تصفية الحليب الخام أولاً، التسخين، التبريد، إضافة المنفحة، الحضن، التقطيع، العصر للتخلص من مصل اللبن، إضافة الملح، والتدعيم بإضافات مختلفة. بعد ذلك، تم إجراء خمسة معاملات على النحو التالي: المعاملة الأولى هي معاملة السيطرة جبن حليب البقر الذي لا يحتوي على أي مادة مضافة، في المعاملات الثانية والثالثة والرابعة والخامسة، تمت إضافة 2.5٪ من الزنجبيل والقرفة والليكوبين وزيت الزيتون إلى الخثارة بعد التخثر، على التوالي، أشارت النتائج إلى أن الدهون، والمواد الصلبة الكلية، ومحتويات الرماد والحموضة لها تأثير معنوي($P<0.05$)فترة التخزين، أظهر التحليل الإحصائي أن تدعيم التوابل بنسبة كبيرةللجبن الطري يؤثر معنويا($P<0.05$) بالتركيب الكيميائي للجبن، وقد وجد أن الجبن الطري الذي دعم بالدارسين محتواه عالي بالفينول<الجبن المدعم بالليكوبين<ثم الجبن المدعم بزيت الزيتون<الجبن المدعم بالزنجبيل<جبن السيطرة التي كانت 643، 564، 497، 424 و 213ملغم /كغم على التوالي، أيضا، تم إثباتأن الجبن المدعم باللايكوبينيمتلك أعلى نشاط في عملية التخلص منالجذور الحرة المنتجة من DPPH واعلى تثبيط للاكسدة، يليه الجبن المدعم بالزيتون ثم الجبن المدعم بالزنجبيل ثم الجبن المدعمبالدارسين إذ كانت96، 94، 91و88 ملغم/ مل، وبالتالي، خلصت الدراسة إلى أهمية إنتاج هذه المنتجات المدعُمة بالنباتات والأعشاب الطبية للعديد من المستهلكين الذين يرغبون في تناول هذه المنتجات الغذائية المدعُمة بمكوناتها الحيوية والمحسنة لصحتهم.

الكلمات المفتاحية: المكونات الحيوية، التركيب الفيزيائي والكيميائي، تقنية HPLC.

INTRODUCTION

Since the pre-historical era, the milk industry has developed the cheese industry with many aspects, such as introduction of mechanization, the discovery of heat pasteurization for milk intended for the manufacture of dairy products, and the addition of pure colonies of lactic acid bacteria to milk prepared for the manufacture of soft and ripe cheeses.The food was processed with the addition of probiotic bacteria as functional foods. It was widespread popularity and acceptance for its therapeutic benefits, as it exceeded the digestive system. It also included improving immunity, its anti-cancer properties, dyspepidemia, heart disease, diarrhea and lactose intolerance **(Vasiljevic&Shah, 2008)**.Cheese is one of the products made from raw milk and using the starter of cheese leading to the curd of the milk and then, pressing it to get rid of the excess water and then cut it and save it until it reaches the consumer and is characterized by its high content of protein, fats and calcium.Also, cheese is rich in mineral elements and vitamins that necessary for human health and for the construction of strong and healthy boon when phosphorus is available beside calcium **(Chapman, 2011)**.The process of manufacturing cheese from cow's milk, sheep, goats, etc., and from other types of animals, is a series of processes, including the preparation of raw materials, pasteurization, coagulation, acidification, synthesis, dehydration,and moldings, compressing and salting**(Effat, 2012)**.Since ancient times, medical and spicy plants have been used to enhanced flavor as well as therapeutic factors of most different foods, including different cheeses**(Alsoufi& Aziz, 2019;**

Samah&Ahmed, 2019).Many studies have shown that cheeses are fortified with herbs and spices have a significant inhibitory effect on many pathogenic microbes**(Naveed*et al.*, 2013; Youssef & El-Sayed,2018)**, which lead to food damage and oxidation by ingesting free radicals with their biochemical compounds **(Bakheit&Foda, 2012)**. Because cheeses are characterized as easy to digest and absorb, they are included in the numbers of many diets,its consumption rate is great for most people and it is used in all daily meals, cheese are consumed all without any residue and the average selling price is suitable for everyone. Soft cheese is the only type available and desirable to most people in general in our country Iraq, as well as the manufacture of soft cheese is the main way to preserve excess milk in rural areas of the outskirts of Baghdad and in other provinces as well as the lack of dairy plants to use that excess milk. Previous studies have proved that herbs and spices can be added as flavoring agents, preservative, as well as their therapeutic properties as antioxidants, pressure-reduced, anti-inflammatory agents, and many other microbes.So, the wise use of medicinal herbs and nutritional spices to support soft cheese products leads to an increase in their nutritional and medicinal values and against many pathogenic microbes and as antioxidants as well as the ability to develop different dairy products of vital value added to which the consumer and eager for new products always aspires.So soft cheese was chosen in this study tosupplemented with ginger, cinnamon, lycopene and olive oil rich in antioxidants, phytochemicals and micronutrients, with enhanced sensory propertieswhich qualify it to give us the qualities of therapeutic and functional foods in improving the functions of the body organs and treat a number of diseases and make the human health better.

MATERIALS AND METHODS

Primary raw material

Fresh cow milk, low-fat pasteurized, lactic acid bactericidal strains, microbial cheese bran that used in The State Company for Dairy Products\ Abu Ghraib\ Baghdad\ Iraq. Ginger powder, Cinnamon powder, olive oil, tomatoes, and edible salt were bought from local super market, Al-Warda in Baghdad city.

Experimental design

Chemical analyzes of raw milk and processed cheese was performed, and cheese was also manufactured in laboratories and dairy plant\ Abu Ghraib\ Baghdad in June 2019. Fivetreatments of soft and processed cheese were made by regular method and support as follows: First the control treatment (Cheese Control=ChC) was to make white soft cheese without adding anything other than the basic ingredients for making soft cheese. While the other four treatments were added 2.5% of each of the Ginger (Cheese Ginger= ChG), Cinnamon (Cheese Cinnamon= ChCi), Lycopene (Cheese Lycopene= ChL) and Olive oil(Cheese Olive oil= ChO) to the curd of milk, it was lifted for 20 minutes, thenafter coagulationand completed manufacture then squeezing and preserving it until the necessary analyzes were doneas shown in.

Manufacturing of soft, fortified cheese with different spices

The improved method **(Felix *et al.*, 2013)** in making soft white cheese was followed in this study. Ten litters of fresh Cow's milk used for processing the soft cheese which were supplied from Animal farm of dairy plant\ Abu Ghraib\ Baghdad. 1.2% skimmed milk powder was added to raw milk with good stirring to homogeneity in order to obtain the desired percentage of protein\ fat to produce the soft cheese desired by the consumer. Then filtered and heated over a good pasteurization temperature of 83°C for 10 minutes, cooled to 30-40°C. Then, it was added 0.5% rennet with good stirring, and then incubated at 30°C\ 40-45 minutes until it wascoagulated completely. Then the cheese curd was quietly stirred with a special knife

and the whey was removed, 1.0% NaCl was added to the curd to get the desired taste from the consumer. At this point, four treatments were made by adding 2.5% fine powdered of ginger, cinnamon, tomato lycopene extracts and olive oil were to the curd with an initial pH of 5.6. The dried spice mixes were added to the curds and kneaded for 4-5 minutes until the complete homogenization of ginger and cinnamon into the dough by kneading. Curds were squeezing for 5 hours then, each sample was divided into five almost equal cut of 250 gm each and under clean sterile conditions. Then, each piece was kept under vacuum-packaged and was storage at 7°C\ 1-21 days until it was used for analysis and sensory evaluation.

Chemical analysis

Fat and the ash contents of milk and cheese were determined according to **(AOAC, 1990)**. While, protein was determined by Kjeldahl method as mentioned by **(AOAC, 2000)**. Total solids and acidity were determined according to**(AOAC, 2000)**. All the chemical analysis was measured in duplicates at 1and 21 days of storage for each treatment.

Sensory evaluation

The quality of the fortified cheese samples was assessed with 2.5% of Ginger powder, Cinnamon, lycopene extract and olive oil stored for 1 and 21 days by 10 members trained for sensory evaluation of each of the following characteristics: color, flavor, texture, aroma and taste using the sensory evaluation paper according to**(Larmond, 1987)**.

Lycopene Purification

Lycopene purification method was installed by the research team. The silica gel was filled with a column with a distance of 1.5×10 cm. The lycopene extract was transferred to prepared column and the removal process was carried out using a solvent mixture (benzene: isopropanol 9: 1) and flow rate was 1mL\ minute **(Hyeon*et al.*, 2017)**.

Lycopene determination

HPLC was used to estimate the lycopene content in soft cheese by taking 2 gm of sample cheese fortified with lycopene and adding 40 mL of distilled water to the sample and mixed well, after that 40 mL of ethanol and hexane mixture were added (4:3, v\v).The pre-stagnation solution was left\ for 30 minutes again, then the supernatant was collected and the collected residue extracted again using the same procedure described above.Likewise, the supernatants were collected again, and the supernatant solution combined with another mixture other than the previous was suspended and extracted with 10 mL of 10% NaCl solution and 15 mL of distilled water.The mixture was also left for stagnation for the fourth time for 5 minutes until the mixture was separated into two transparent layers and then the top layer was collected as mentioned above. Then all the top layers of the above extracts were collected and assembled again, vaporized under vacuum, dissolved in 1mL of hexane and filtered through 0.2 µm membrane filter, then analyzed by using HPLC (Agilent Technologies 1200 series, USA) which is equipped with UV detector and C18 column (5 µm, 4.6 mm×250 mm) (Sunfire^{TM}C18, Water Ltd, Ireland). The homogeneous mobile phase was examined after mixing it with acetonitrile (solvent A), n-butanol (solvent B), and methyl chloride (solvent C), with quiet and homogeneous stirring and then the readings were taken using the following gradient coil: 0 minutes: 69.3% A, 29.7% B, and 1% C; 10 minutes: 67.2% A, 28.8% B, and 4% C; 20 minutes: 61.6% A, 26.4% B, and 12% C; 40 minutes: 49% A, 21% B, and 30% C; 50 minutes: 69.3% A, 29.7% B, and 1% C with flow rate 1 mL / minutes. The absorbance was measured by detection at wave length on 472 nm. The identification of lycopene was completed by comparing the peak area and retention time with a reference lycopene standard. The calibration was linear in the concentration range of 10-100 µg/mL (R^2=0.9991) **(Heyeon*et al.*, 2017)**.

Determination of total phenols content

The total phenols were estimated by mixing 0.5 mL of plain soft cheese extracts and fortified cheese with different medicinal plants extract with 2.5 mL 10% Folin-Cioalteu. Add 2 mL of 7.5% sodium carbonate and keep the reaction tubes in the dark place for 40 minutes. Then measured on an appropriate wavelength of 765nm to measure the free radical **(Ismail*et al.*, 2013).**

Free radical scavenging activity (DPPH assay)

Free radical scavenging activity was determined as **(Le, *et al.*, 2007)**. It was determined by displacement of generated free radical with 1, 1-diphenyl-1-2- picrylhydrazyl (DPPH). It was poured 100 µL of DPPH into methanol (126 µM) in 96 mL well micro plates, as well as direct addition of 100 µL of ethanol extract at five concentrations 0, 100, 200, 300 and 400 µg/mL and then was incubated for 30 minutes at room temperature. The absorbance was measured at 517 nm using micro plate reader. As for the control sample, it was measured by using the reaction mixture with ethanol only instead of the materials that support the cheese samples.Then, DPPH assay was measured by the following equation:

$$\text{Scavenging activity } (\%) = \frac{\text{Absorbance control} - \text{Absorbance sample}}{\text{Absorbance control}} \times 100$$

Estimation the scavenging activity of any extract measured by the concentration needed to inhibit the free radicals by 50% (IC50). In other word, the concentration of extracts necessary to scavenge 50% of the produced nitric oxide (EC_{50}) was obtained from a graph of scavenging activity (%) against a plant extract concentrations.

Determination of cinnamon acid and methyl eugenol

The concentration of cinnamaldehyde and methyl eugenol is concentrated at a concentration of 1 - 200 µg\ mL in methanol according to **(Akarca*et al.*, 2016)**.

Statistical analysis

It was used a statistical analysis program **(SAS, 2012)** to demonstrate the effect of the different parameters difference on the composition and sensory properties of fortified cheese by adding a specific concentration of spices used daily and healthy plants by the consumer, using the LLD test - which shows the least important difference and compares it with big differences Among the different coefficients in this study.

RESULTS AND DISCUSSION

Chemical composition of milk

Basic chemical composition in cheese and raw milk from which cheese was made was presented in (Table 1). It was found the percent of fat, protein, ash, total solid and titratable acidity content were 3.20, 3.50, 2.30, 9.90 and 0.13% respectively. While, it was found all that percentages increased significantly ($p<0.05$) to 12.50, 12.60, 2.82, 39.55 and 0.17 respectively in soft cheese due to its concentrated milk in cheese process.

Table (1): Chemical composition of fresh cow's milk and soft cheese.

Chemical composition (%)	Milk	Cheese	LSD value
Fat	3.20	12.50	2.95
Protein	3.50	12.60	2.88 *
Ash	2.30	2.82	0.31 *
Total Solid	9.90	39.55	5.622 *
Acidity	0.13	0.17	0.044 NS

* ($P \leq 0.05$), NS: Non-Significant.

Effect of storage period (days) on the chemical composition of the soft cheese

The main effect of the long storage period (days) on the chemical composition of soft, spiced fortified white cheese was presented as in (Table 2). It was foundthat fat contents of the cheese was decreased significantly ($p<0.05$) by increasing the time of storage. This decrease in the fat content during the storage periods of the cheeseat 14 and 21 days is due to the vital activity of microorganism enzymes on the fats, which led to the breakdown of lipid molecules into fatty acids, other small fats molecules to the whey formed as a result of chemical reactions and dissolution of many different molecules according to **(Kumar*et al.*, 2013)**.The results of this study also showed a significant decrease ($p<0.05$) of the total solids contents of soft cheese significantly, as it was 41.25% on the first day and decreased to 38.55% for day.The results were identical to that founded by **(Bin*et al.*, 2011; Landge*et al.*, 2011**; **Bhattacharyya *et al.*, 2017)**,Also, a previous study attributed the reason for the decrease in the ratio of total soluble solids to the enzymatic degradation of proteins and fats available in cheese due to milk bacteria forming lactic acid and participation in making soft cheese by**(Kumar *et al.*, 2013).**Ash content of the cheese samples significantly increased ($p<0.05$) from 2.82on the first day and increased to 3.62for day 21. The increased ash content in this study came close to that founded by **(Hamid& Abdel rahmanm, 2012)** who attributed the reason for increasing the ash content with increasing the storage time, due to a decrease in the moisture contentor increased penetration of water and serum formation due to added salt during the formation of fresh cheese curd.While, protein contentwas increased significantly ($p<0.05$) from 12.60 to 13.05%by increasing the time of storage from 1 to 21 days respectively.The results of this study were identical to what **(Bin*et al.*, 2011)** founded, which explained the reason for the decreased moisture during the storage period due to the decrease in the percentage of moisture in cheese and the increase in the amount of whey.While other previous results demonstrated a significant decrease in the percentage of protein with increasing the storage period to 21 days for soft cheese, and attributed the reason to the breakdown of the enzymatic protein into water-soluble compounds, which increased the ratio of total soluble solids **(Akarca*et al.*, 2016)**.As for the acidity of the cheese, there was a marked increase and a significant difference ($P<0.05$), as it was on the first day 0.17 and reached 0.34 after 21 days after storage, as is evident in Table 2.The reason for the high acidity of the cheese produced is due to the formation of lactic acid by increasing the growth of lactic acid bacteria while storing the cheese for longer periods of time, with appropriate conditions for growth in terms of temperature, pH and humidity for the growth of these bacteria and the formation of acidity **(Atanu, 2017).**

Table (2): Effect of storage period on the chemical composition of soft cheese**.**

Storage period(days)	Chemical composition (%)				
	Fat	Total Solid	Ash	Protein	Acidity
0	12.50 a	41.25 a	2.82 b	12.60 a	0.17 b
7	12.50 a	40.15 ab	2.86 b	12.58 a	0.20 b
14	12.25 ab	39.50 ab	2.98 b	12.60 a	0.26 ab
21	11.30 b	38.55 b	3.62 a	13.05 a	0.34 a
LSD value	1.073 *	2.138 *	0.633 *	0.582 NS	0.115 *
Means having with the different letters in same column differed significantly . * ($P\leq0.05$), NS: Non-Significant.					

Effect of different spices addition on chemical composition of soft cheese

The effect of adding different spices on chemical composition of the soft cheese produced was presented as in (Table 3). The results of the study showed the significant increase ($P<0.05$) of the fat in cheese produced in all the different additions of ginger, cinnamon, lycopene and olive oil as shown in (Table 3).While, results of total soluble solid

indicated a significant increases (P<0.05) among all treatments. The ash content was increased significantlyin treated cheese with ginger and cinnamon 3.22, and 2.98% respectively.The increased ash content in these two treatments is probably due to the presence of fiber in the ginger and cinnamon flour that used in this study.While the percentage of ash decreased significantly in cheese treated with lycopene extract and olive oil olive oil 2.65 and 2.66%respectively.While the results of the study showed that there was no statistically significant difference in cheese content of protein and for all additions from ginger, learners, lycopene and olive oil. The results indicated a significant decrease in the acidity content among all treatments, except for the treatment of cheese with olive oil that led to high acidity, perhaps the presence of the oil led to the microbial inhibition of the acidity microbes.Previous studies found that the protein, fat and ash content of these cheeses fortified with spices would not be significantly affected by the storage period, but the total solids and acidity were significantly affected by the addition of spices **(Josipovic*et al.*,2015)**.

Table (3): Effect of different spices addition on chemical composition of soft cheese.

Treatments	Chemical composition (%)				
	Fat	Total Solid	Ash	Protein	Acidity
Ch C	12.50 b	39.55 a	2.82 b	12.60 a	0.17 ab
ChG	12.8 b	40.50 a	3.22 a	12.88 a	0.09 b
ChCi	12.55 b	41.15 a	2.98 ab	12.65 a	0.15 ab
ChL	13.30 ab	41.35 a	2.65 b	13.05 a	0.14 ab
ChO	14. 65 a	41.50 a	2.66 b	13.15 a	0.20 a
LSD value	1.769 *	2.366 NS	0.398 *	0.822 NS	0.089 *
Means having with the different letters in same column differed significantly . * (P≤0.05), NS: Non-Significant.					

*= (P≤0.05), NS: Non-Significant. Means within columns bearing different superscripts are significantly different (p≤0.05), S: Significantly different, NS: Not significantly different, ChC: Control soft cheese, ChG: Cheese with Ginger, Chci: Cheese with cinnamon, ChL: Cheese with Lycopen, ChO: Cheese with Olive Oil, LS: Level of significance.

Sensory evaluation

Herbs and spices were used to add flavor, taste and good taste to dairy products, including cheeses, to overcome the known flavor of cheese that is not desired by many consumers. Well, you know herbs and spices with therapeutic properties such as antioxidants, anti-inflammatory, anti-diabetic, antihypertensive and anti-microbial properties. Therefore, it can supplement dairy products with herbs and spices to provide it active substances, as well as increasing nutritional and medicinal values.The effect of storage period (days) on sensory characteristics of soft control and supplemented cheese product was presented as in (Table 4). The results of this study indicated that there was no significant difference (p<0.05) on the color characteristic of soft cheese by increasing the length of the storage period up to 21 days with Lycopene and Olive oil addition. While there was a significant difference in color by increasing the period of time especially for 21 days of storage. But the color changed a little pit with ginger, cinnamon and lycopene addition compared with control sample. While, Olive oil addition did not affect the color character compared with control sample. Usually salt is added in a very small amount to produce a good texture, taste, flavor and odor which are desired by the consumer.The results showed that there was no significant difference (p< 0.05) for sensory characteristics such taste, texture and odor. The flavor character which decreased significantly with Ginger addition, but slight decreases with cinnamon, lycopene and olive oil addition compared with control treatment. Thus, positive effect of these spices probably due to its bioactive content that works as antioxidant and antimicrobial growth. The results of this study

were close to the results of **(Naveed*et al.*, 2013**;**Atanu,2017**).Results showed significant differences in taste by supplemented cheese with Ginger especially after 14 and 21 days of storage, while there were no significant difference in taste by supplemented with Cinnamon, Lycopene and Olive oil. These results came close to what he found **(Fabiola*et al.*, 2017)**, which he attributed the cause of change toeach of the characteristics of taste, texture, flavor and odor, may be due to protein decomposition and lipolysis processes and peroxide flavor and sour acidic taste that occurred during storage**(Josipovic*et al.*, 2015)**.So, it was concluded that the period from 1-14 days is the best period for storing cheese fortified with various spices in terms of most of the sensory qualities that the consumer aspires to.

Table (4): Effect of storage period on sensory evaluation of the supplemented cheese with different spices.

Parameters	Treatment	Storage periods (day)				LSD value
		1	7	14	21	
Color	ChC	10	9	9	7	2.18 *
	ChG	10	9	8	7	1.93 *
	ChCi	10	9	9	8	1.75 *
	ChL	9	9	9	8	1.06 NS
	ChO	9	9	9	9	0.50 NS
Taste	ChC	10	9	8	7	2.18 *
	ChG	9	9	7	7	1.79 *
	ChCi	9	9	8	8	1.15 NS
	ChL	9	8	8	8	1.08 NS
	ChO	9	9	8	8	1.15 NS
Texture	ChC	9	8	7	6	2.37 *
	ChG	9	8	8	7	1.74 *
	ChCi	9	9	9	9	0.50 NS
	ChL	9	9	8	8	1.15 NS
	ChO	9	9	9	9	0.50 NS
Flavor	ChC	9	9	8	6	2.04 *
	ChG	9	9	9	8	1.07 NS
	ChCi	9	9	8	6	2.04*
	ChL	9	9	8	8	1.15 NS
	ChO	9	9	9	8	1.06 NS
Odor	ChC	9	8	7	7	1.69 *
	ChG	9	8	8	7	1.75 *
	ChCi	9	8	8	7	1.75 *
	ChL	9	9	7	6	2.27 *
	ChO	9	9	8	8	1.15 NS

* (P≤0.05)= Significant NS= Not significantly different, ChC= Control soft cheese, ChG= Cheese with Ginger, ChCi= Cheese with cinnamon, ChL= Cheese with Lycopen, ChO= Cheese with Olive Oil, LS: Level of significance

Lycopene analysis

Partially purified lycopene, cinnamic acid and gingeriol from lycopene, cinnamon and ginger that fortified to the soft cheese were represented as in (Figure 1, 2 and 3). These results were identical to which founded by **(Hyeon-Ju*et al.*, 2017)**.

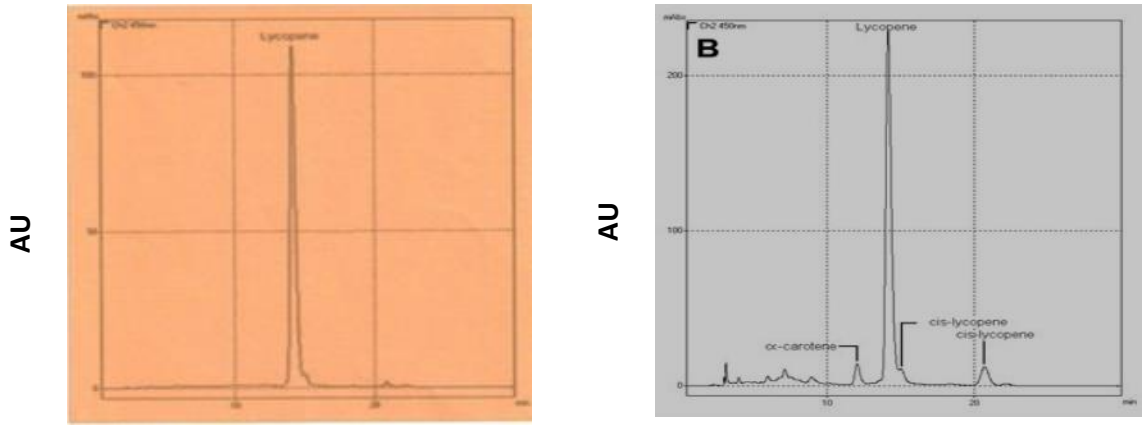

Figure (1): The diagnosis of pure lycopene A and partially purified lycopene B.

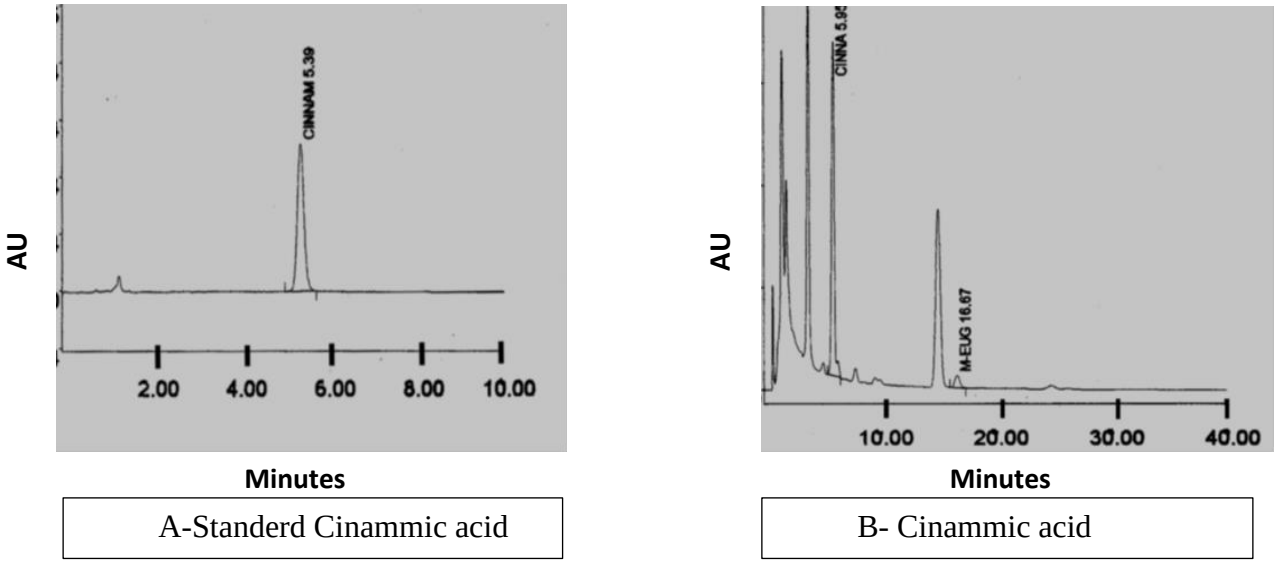

Figure (2): The diagnosis of Cinammic acid in soft cheese supported by cinnamon.

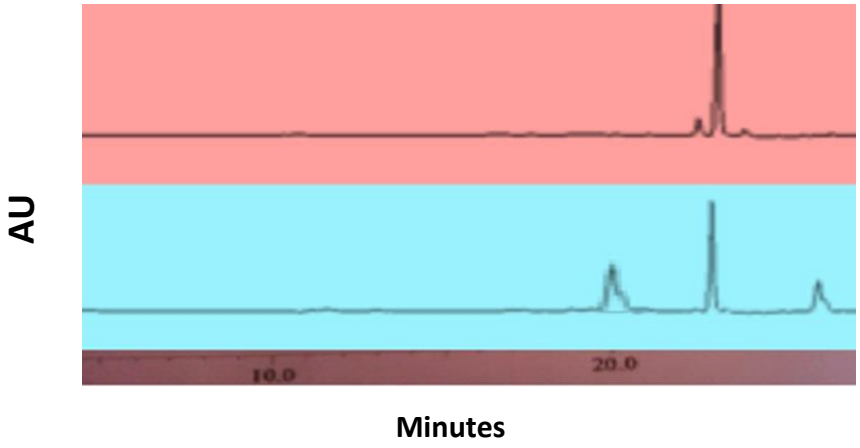

Figure (3): The diagnosis of Gingeriol in soft cheese supported by ginger, the upper shape is the standard and the lower shape is for Ginger cheese sample.

Total phenols content

Total phenolic content and anti-oxidant activities measured with DPPH from the use of dried spices and used domestically and on a large commercial scale such as ginger and cinnamon, as well as the use of lycopene extract for tomato and olive oil presented in (Table 5). It was founded that Gingerol is the active content in ginger with 250mg\ kg concentration. While, the active content in cheese was 97mg\kg. Cinammic acid, is the active content in ginger plant extract with 125mg\kg concentration. While, the active content in cheese was 65mg\kg. Lycopene is the active content in tomato plant with 368mg/kg concentration. While, the active content in cheese was 91mg/kg. Results showed the highest total phenol content in cinnamons cheese was 643mg\kg, then decreased significantly ($p \leq 0.05$) to 564mg\kg in lycopene cheese, 497mg\kg in olive oil, then 424mg\kg in ginger, and the lowest content was 213mg\kg in control treatment.From that, we conclude that it is possible to increase the biological value of cheese by strengthening food products, including the manufacture of soft cheese**(Story*et al.*, 2010;Kumar *et al.*, 2013)**which is consumed heavily by most people and its preference over other types of cheese with types of spices and plant extracts rich in phenolic compounds, and these results were identical to what he found**(Samah& Ahmed,2019)**.

Table (5): The concentration of active ingredients in cheese supported by the active ingredients of medicinal plants.

Treatments	Bioactive content in plant	Bioactive content in plant extract (mg\kg)	Bioactive content in supplemented soft cheese (mg\kg)	Total phenols content in all treatments (mg\kg)
Ch C	-	-	-	213 d
ChG	Gengerol	250 b	97 a	424 c
ChCi	Cinnamic acid	125 c	65 b	643 a
ChL	Lycopene	368 a	91 a	564 b
ChO	Olive oil	182 c	80 a	497 a
LSD value	--	42.385 *	8.736 *	71.024 *
Means having with the different letters in same column differed significantly. * ($P \leq 0.05$).				

Means within columns bearing different superscripts are significantly different ($p \leq 0.05$), S: Significantly different, NS: Not significantly different, ChC: Control soft cheese, ChG: Cheese with Ginger, Chci: Cheese with cinnamon, ChL: Cheese with Lycopen, ChO: Cheese with Olive Oil, LS: Level of significance

Effect of active group on removal of free radicals

These supplemented cheeses have an effective role in the removal of free radicals as founded in (Table 6). Results of this study showed, Lycopene was the most effective in removing free radicals, followed by olive oil cheese, ginger cheese and finally cinnamon cheese. While, the inhibition concentration on 50% in Cinnamon extract was the highest 27, followed in Ginger and olive oil 22, then followed to Lycopene extract 18 mg\mL. Olive oil is known to contain a good percentage of fatty acids rich in omega-3 fatty acids, which have a great effect on reducing fat oxidation, and it has been effectively applied to protect against fat oxidation in cheese during storage **(Shan *et al.*, 2011)**.Previous studies were conducted in vitro with the high potential of plant extracts as a natural preservative and antioxidants **(Singh*et al.*, 2011;Youssef& El-Sayed, 2018)**.

Table (6): The ability of the models under study to remove free radicals generated from DPPH.

Treatments	Dpph(%) needed to remove free radicals	Concentration inhibiting 50% (mg\mL)
Control cheese ©	63 e	29 a
Ginger extract	76 d	22 bc
Ginger cheese	91 ab	15 de
Cinnamon extract	69 dc	27 ab
Cinnamon cheese	88 bc	11 e
Lycopene extract	82 cd	18 cd
Lycopene cheese	96 a	9.6 e
Olive oil	74 d	22 bc
Olive oil cheese	94 ab	15 de
LSD value	7.952 *	5.478 *
Means having with the different letters in same column differed significantly. * (P≤0.05).		

CONCLUSION

From the results obtained,many studies have found that fortification of dairy products, including soft cheese, which is desirable to be consumed by most segments of human societies with medicinal plants and spices, has an important role in improving food produced with active biological components to treat many common diseases currently including malnutrition.This study demonstrated that the chemical composition of soft cheese was significantly affected ($p<0.5$) by increasing the storage time of soft cheese for more than 14 days.The study also demonstrated a decrease in the percentage of fats, total solids, ash and acidity in all types of cheese supported with different spices significantly with an increase in the storage period for more than 14 days.While, protein was not affected by different spices addition.Sensory evaluation results showed that addition of each ginger, cinnamon, lycopene and olive oil enhanced the color, flavor and odor of the white soft cheese. In addition, Ginger, Cinnamon, Lycopen and Olive oil gives a bioactive components such as gengerol, cinnamic acid, lycopene and total phenol respectively which acting an important role as highest antibacterial activity, antioxidant.

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