Utilization of Cinnamon in Preparation and Preservation of Food Products from Microbial Contamination

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ABSTRACT

The aim of this study was to evaluate cinnamon's powder in terms of chemical composition and its content of dietary fiber, mineral, bioactive components, antioxidant activity and antimicrobial activity. Cinnamon has been used in different percentages to prepare bakery products such as bread, cake and biscuits, and find out its effect on microbial growth in products during the different storage period on the room temperature and rated it as a preservative.

The results of the present study showed that this powder contained protein, dietary fiber, carotenoids, the methanolic extract of this powder had antioxidant and antimicrobial activities. This study also showed that the products which as containing the high ratios of cinnamon's powder it's was effect on microbial growth during period storage, where we can used it as Preservative from Microbial Contamination. Also all the products prepared containing the different percentages of cinnamon's powder and storage were well accepted by the panelists.

Keywords: Cinnamon, foods products, antibacterial activity, save food.

INTRODUCTION

Antimicrobial are potential intervention to control foodborne pathogens contaminating food products (Higueras et al, 2013 , Wen *et al*., 2016). Natural antimicrobials have received particular interests because they are perceived by consumers to be safe and healthy. Examples of natural antimicrobials include essential oils such as eugenol, cinnamon oil, and thyme oil, which have shown great antimicrobial activities (Chen *et al*., 2015). Recently Studies on antimicrobial showed that the cinnamon oil had inhibiting activity gram-positive L. monocytogenes but had the antagonistic effect against gram-negative *Escherichia coli* O157:H7 and Salmonella Enteritis's (Ma and Davidson, 2013, Ma *et al*., 2016).

Cinnamon is one of the well-known, oldest and most flavor-filled spices. It belongs to the genus Cinnamomum of the Laurel family (Lauraceae). In Urdu, Persian and Hindi it is called as Darchini that means "China bark". Cinnamon has many species that differ in smell, taste and color depending upon the native area or land (Gul and Safdar2009).

The cinnamon includes the cinnamaldehyde (active component) which has health protecting effect that helps to prevent unwanted clumping of blood platelets by inhibiting the release of an inflammatory fatty acid called arachidonic acid which puts it in the category of an "anti-inflammatory" food that can be helpful in lessening inflammation(Gruenwald et al., 2010).

As consumers become incrementally aware of the relation between food and health, there has recently been a rapid increase in consumer interest in the health-enhancing roles of specific foods or physiologically active food components, so-called functional foods. Over the past few decades, a number of large non-nutrient molecules have been identified. These include secondary metabolites in plants that are used for defense, reproduction, and so on, but are not essential nutrients. Secondary metabolites such as phytochemicals were mostly ignored until recently when their potential metabolic effects were first detected (Pang *et al*., 2012). Antioxidants have an important role in preventing undesirable changes in food flavor and nutritional quality and protect the cells from damage (Alezandro et al., 2011& Kaskatepe *et al*., 2016).

Natural plant products have been used throughout human history for various purposes. It has been evident that a spice obtained are good sources of a wide range of pharmacological action which includes antitumor, antiviral, antibacterial, cardio-protective and antimutagenic activity(Newman *et al*., 2003& Ahmada *et al.,* 20-13). many of the plants from which these natural products are derived are billions of years old. Tens of thousands of these products are produced as secondary metabolites by higher plants as a natural defense mechanism against disease and infection. Many of these natural products have pharmacological or biological activity that can be exploited in pharmaceutical drug discovery and drug design. Medicines derived from plants have played a pivotal role in the health care of many cultures, both ancient and modern (Benzie and Wachtel-Galor 2011).

Food products can be vectors for many harmful microbial agents that can cause infections. Foodborne pathogens are responsible for infectious diseases that are a growing public health problem worldwide, especially

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in developing countries. Nevertheless, foodborne diseases are not limited to developing countries, and the research on preservatives able to inhibit bacterial degradation of food is important for the ongoing maintenance and improvement of public health. In recent years, many investigations have shown the antimicrobial activity of cinnamon essential oil against food poisoning bacteria in vitro. Other investigations have studied the protective effects of cinnamon in food matrices, and active packaging and their ability to inhibit pathogen growth without introducing chemical preservatives that consumers could find undesirable (Mith *et al*., 2014).

There are many uses of cinnamon in the kitchen, and cooking with it makes food a very tastier. It is used often to flavor rice dishes, chicken, or it can be added to hot chocolate to give it cinnamon flavor. In addition, uses of dried cinnamon leaves and inner bark for flavoring cakes and sweets. It can be used as an alternative to traditional food preservatives.

The aim of this study was the evaluation of cinnamon's powder in terms of chemical composition and its content of dietary fiber, mineral, Also bioactive components, antioxidant activity and antimicrobial activity. It also uses different percentages to some bakery products such as bread, cake and biscuits, and find out its effect on microbial growth in products during the different storage period on the room temperature and rated it as a preservative.

MATERIALS AND METHODS

Materials:

cinnamon (*Cinnamomum verum*) Cinnamon was purchased from different local markets in Alexandria. Wheat flour (72%), baking ingredients (including milk, sugar, butter, eggs, vanilla, baking powder, instant yeast, salt, dried milk), were obtained from local market in Alexandria .

Bacterial and fungal strains including: *Staphylocoous aerus* 29123, *Escherichia coli* 3518 , *Rhizopus spp* and *Aspergillus niger* CAIM 147.were obtained from Dairy Science and Technology Department, Faculty of Agriculture ,Alexandria University Alexandria, Egypt.

Preparation of cinnamon

Grinding :

The bark of cinnamon was taken and ground to powdered form by using a grinder.

Technological processes

Traditional methods were applied to prepare the following products including powdered of cinnamon as follows:

Bread containing 1.0, 1.5 and 2.0 % cinnamon powder.

Cake containing 1.0, 1.5 and 2.0 % cinnamon powder.

Biscuits containing 1.0, 1.5 and 2.0 % cinnamon powder.

Analytical methods

Proximate chemical composition .

Moisture, crude protein, crude ether extract and total ash of cinnamon powder were determined according to AOAC (2006) unless otherwise stated. Carbohydrate content were calculated by difference.

Extraction of total phenolic compounds from cinnamon

Add 70% ethanol (1:40, w/v) to Cinnamon powder for 72 h at room temperature with shaking. The extract was filtered and the precipitate was re-extracted by the same process and solvent until the extraction was exhausted. The combined extracts were separately filtered through a filter paper. The filtered was dried under reduced pressure at 50 0C using a rotary vacuum evaporator. The crude extract was weighed and kept in a tightly closed container protected from light (Klejdus *et al*. 2016).

Determination of total phenolic compounds

Total phenolic content

Total phenolic content of Cinnamon powder extract was determined using folin Ciocalteu reagent. The extract was mixed with 5 ml folin – Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 4 ml of sodium carbonate (75 g/l). The mixture for 15 s and allowed to stand for 30 min at 40 0C for colour development. Absorbance was then measured at 765 nm using Optizen pop uv- vis spectrophotometer. Total phenolic content was expressed as mg gallic acid equivalent (Li *et al*,.2008).

Total flavonoid content

Total flavonoid content of Cinnamon powder extract was determined used a 2 ml of the sample solution was transferred into a 10 ml flask and 0.6 ml of 5% sodium nitrite (NaNO2) was added before the mixture was shaken and left for 6 min Secondly, 0.5 ml of 10% aluminum nitrate (Al(NO3)3 solution was added to the volumetric flask, shaken, and was left to stand for 6 min. add, 3.0 ml of 4.3 sodium hydroxide (NaOH) solution was added to the volumetric flask, followed by addition of water up to the scale, shaken, and left to stand for 15 min before determination. Absorbance was then measured at 500 nm using Optizen pop uv- vis spectrohpotometer. Total flavonoid content was calculated as mg rutin equivalent /g (Yang et al. 2012).

Mineral determination

Mineral contents of cinnamon were determined by atomic absorption spectrometry, flame photometry and spectrophotometry according to the methods of AOAC (2006).

Antioxidant activity

The principle of antioxidant activity is based on the availability of electrons to neutralize free radicals. the antioxidant activity of the various extracts from Cinnamomum was tested by the DPPH radical.

DPPH Free Radical Scavenging Ability

The effect of antioxidant on DPPH radical scavenging was to be due to their hydrogen donating ability or radical scavenging activity. When a solution of DPPH is mixed with a substance that can donate a hydrogen atom, it then leads to a loss of this violet color.

The effect of cinnamon extract on (DPPH) radical was estimated using a solution of DPPH (0.135 mM) was prepared and 1 ml of this solution was mixed with 1 ml of the extract. The reaction mixture and left in the dark at room temperature for 30 min. The absorbance of the mixture was measured at 517 nm using butylated hydroxyanisole (BHA) as a control .The radical scavenging activity was calculated as follows:

$$\% \text{ scavenged DPPH} = \frac{Ao - A1 \times 100}{Ao}$$

where, Ao - Absorbance of control, A1 - Absorbance in the presence of bark extract.

The half maximal inhibitory concentration (IC_{50}) values denoted the concentration of sample required to scavenge 50% of DPPH free radicals is calculated (Yang et al. 2012).

Antimicrobial activity

One of the most well established properties of cinnamon extracts, essential oils and their components is the antibacterial activity responsible for human infectious diseases and degradation of food .

Antibacterial activity of the Cinnamon extract was determined using the disk expansion assay. For this study, isolates were cultured at 37◦C for 24 h in Nutrient Agar and bacterial suspensions were prepared with Nutrient Broth to match McFarland standard No. 0.5 turbidity (Kaskatepe *et al*., 2016). The antimicrobial activity was performed by agar well diffusion method a well was prepared in the plates with the help of a cork-borer (0.85cm). One hundred µl of the extract (500 mg/ml) was introduced into the well. The plates were incubated overnight at 37 0C for bacteria and 25 0C for fungal. Microbial growth was determined by measuring the diameter of zone of inhibition. The result was obtained by measuring the zone diameter (mm) (Miller et al., 2015). Measured antimicrobial activity of cinnamon extract against on selected some pathogenic bacteria, molds and yeasts. Was determined using disk diffusion and macro dilution methods. All the tests were carried out in duplicates and the results are average of these values.

Sensory evaluation

Colour, taste, odour, texture, (consistency) and overall acceptability of acc the products prepared containing the different percentages of cinnamon were assessed using 15 panelists of food science and Technology Department, Faculty of Agriculture, Alexandria university. The panelists were asked to score the above attributes according to a standard hedonic rating score from 9 (like extremely) to (dislike extremely): 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = like/dislike, 6 = like slightly, 7 = like moderately, 8 = like very much, 9 = like extremely. as described by (Wichchukita and O'Mahony, 2014).

Statistical analysis:

The data were analysed using SPSS statistical analysis software package (Version 21).

RESULTS AND DISCUSSION

Chemical composition and dietary fiber content of cinnamon

Consumer has being more conscious of food related health troubles and interest in using healthy food. Table (1) shows the proximate chemical composition as well as dietary fiber content of cinnamon.

Table 1.Proximate Composition of the Cinnamon

Component	%Value**
Moisture	5.0 ± 0.38
Crude protein	3.22 ± 0.14
Crude Fat	3.44 ± 0.43
Total ash	2.20 ± 0.43
Crude fiber	31.57 ± 0.36
Carbohydrate*	50.89 ± 0.24

* calculated by difference

** Mean value ± S.D. on dry weight basis

The Table 1 shows that proximate analysis of cinnamon revealed that it contained ash (2.2 %), crude protein (3.22 %), crude fat (3.44.0%), crude fiber (31.57 %); moisture (5.0%) and carbohydrate (50.89 %). This data was the average of the three determinations and the result obtained showed that cinnamon has high carbohydrate content. It was low in fat and protein contents as compared to carbohydrate content. It also provided dietary fiber. The moisture

content is lower than the values reported by (Gul *et al*.,2009). However, the ash content, fat content, crude fiber, are almost close to the values reported by (Gul *et al*., 2009).

Inorganic constituents

The mineral contents of the cinnamon spice were determined and presented in (Table 2).

Table 2.Mineral content of cinnamon

Mineral*	Amount in "mg/g"
K	140.02
Ca	78.31
Fe	6.33
Mg	83.87
Zn	2.27
Mn	19.69
Na	10
P	40.72

The Table 2 shows that cinnamon contained iron (6.33mg/g), Zinc (2.27mg/g), Calcium (78.31mg/g), , Manganese (19.69mg/g), Magnesium (83.87mg/g), sodium (10 mg/g), Potassium (140.02mg/g) and Phosphorus (40.72mg/g). Among the minerals cinnamon contained the highest amount of potassium and sodium. The calcium, iron and phosphorus contents are lower than the values reported by (Gul *et al*., 2009). No other study has been found regarding mineral composition of cinnamon.

Bioactive components and antioxidant activity of cinnamon

Table (3) shows the bioactive components as well as the antioxidant activity of cinnamon .

Table 3. Bioactive components and antioxidant activity of cinnamon

Parameter	Value±
Total phenolics**	8.21 ± 0.14
Flavonoids***	1.26 ± 0.15
DPPH inhibition %	83.54± 2.96
IC_{50} (mg/ml)	0.208± 0.23

* Mean ± S.D. on dry weight basis
** Gallic acid equivalent
*** Rutin equivalent

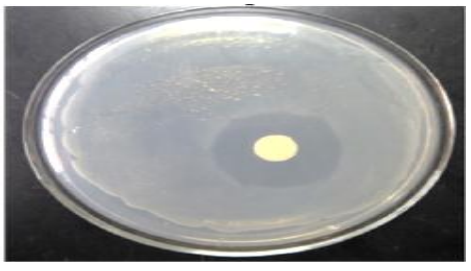
It can be noted that cinnamon contained 8.21 mg/100 g total phenolics as gallic acid equivalent. On the other hand, the results shown in Table (3) indicated that flavonoids as ruitin equivalent was 1.26 mg/100 g, accordance with the results obtained in the present study, these result are in agreement with those of Klejdus *et al.* (2015) found that the amounts of total phenolic in cinnamon are ranged from 6.313 to 9.534 mg /100 g, and total flavonoids content of the ethanol extracts was 3.348 mg/100 g.

The antioxidant activity (DPPH inhibition %) as well as IC_{50} (mg/ml) of cinnamon are shown in Table (3). These values were 83.54% and 0.208 mg/ml, respectively. These values are mainly due to its content of phenolic and flavonoids. In accordance with the results obtained in the present study, Varalakshmi *et al.,* (2012) and Yang *et al*.,(2012) extracted and identified phenolic compounds from cinnamon.

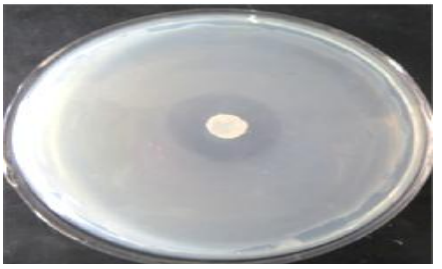
Antimicrobial activity of cinnamon extract

The methanolic extract of cinnamon had an antimicrobial activity against all tested bacterial strains (Fig. 1 and Table 4). The diameter of inhibition zone was 25.1 mm for *E. coli* 3518, 35.47 mm for *Staphylococcus aureus* 29123.

Interpretation of the observed zone diameters inhibition in Fig. (1) and the results are shown Table (4).



Staphylococcus aureus 29123



E. coli 3518

Fig. 1 Antimicrobial activity of cinnamon extract

Table 4. Antimicrobial activity of cinnamon extract

Pathogenic microbe	Inhibition zone diameter (mm) *
Staphylococcus aureus	30.48 ± 0.4
Esherichia coli	24.2 ± 0.36
Rhizopus spp	31. 5 ±0.46
Aspergillus niger	33.15 ± 0.21

* Average of triplicate determinations

Rhizopus spp ***Aspergillus niger***

Fig. 2 Antimicrobial activity of cinnamon extract

Inhibition zone diameter of cinnamon extract against *Staphylococcus aureus* 29123 and *E. coli* 3518 were determined 30.48 mm, 24.2 mm zone diameter for cinnamon extract respectively.

On the other hand, the results in Table (4) and Fig. (2) showed that the diameter of inhibition zones were 31. 5 mm for Rhizopus spp and 33.15 mm for Aspergillus niger CATM 147.

In accordance with the results obtained in the present study, Nabavi *et al*. (2015), Wen *et al*. (2016) found that cinnamon extract had a noticeable antimicrobial effect on growth of some pathogenic bacteria, molds and yeasts. On the other hand, Kaskatepe *et al*, (2016) found that showed antimicrobial activity against some strains of pathogenic microorganisms In 2011, the antibacterial activities of cinnamon bark extracts, obtained with different organic solvents, as ethyl acetate, acetone and methanol, were tested in vitro against Klebsiella pneumonia 13883, Pseudomonas aeruginosa ATCC 27859, Staphylococcus aureus 6538 P, Escherichia coli ATCC 8739, by the disk-diffusion method. The results showed that the antibacterial activity, expressed as inhibition zone, ranges from 7 to 18 mm for the application of 30 μL, suggesting a high antibacterial activity.

Effect of cinnamon on microbial activity of stored products

Food can be vectors for many harmful microbial agents that can cause infections. Foodborne pathogens are responsible for infectious diseases that are a growing public health problem worldwide, affecting about 2 million children every year, especially in developing countries. Nevertheless, foodborne diseases are not limited to developing countries; Table (5) shows the microbiological properties evaluation for food products containing cinnamon stored at room temperature.

Table 5 shows that growth of bacterial was inhibited in all food products with increased percentage of cinnamon during storage. In accordance with the results obtained in the present study Nabavi *et al*. (2015), found that the research on preservatives able to inhibit bacterial degradation of food is important for the ongoing maintenance and improvement of public health. In recent years, many investigations have shown the antimicrobial activity of cinnamon extract against food poisoning bacteria in vitro. other investigations have studied the protective effects of cinnamon in food matrices, and active packaging and their ability to inhibit pathogen growth without introducing chemical preservatives that consumers could find undesirable. For instance, a recent investigation showed that the essential oil obtained from the bark of C. cassia could control the growth of the spoilage microorganism L. monocytogenes in meat products contaminated at a concentration of 5 ppm, which did not change the sensorial properties of the products. In particular, cinnamon essential oil reduces the bacterial growth rate significantly in artificially contaminated samples when compared with an untreated control.

Table 5.microbiological properties evaluation for food products containing cinnamon stored at room temperature

product	test	time	Cinnamon Additive			
			0	% 1.0	% 1.5	% 2.0
cake	TVC (cfu/ml)	0	ND	ND	ND	ND
		7 day	10^2x2±0.1	10x8±0.1	10x2±0.1	ND
bread	TVC (cfu/ml)	0	ND	ND	ND	ND
		7 day	10x9±0.1	10x5±0.1	10 x1±0.1	ND
Biscuit	TVC (cfu/ml)	0	ND	ND	ND	ND
		30 day	10x9±0.1	10x7±0.1	10x1±0.1	ND
		60 day	10^2±0.1	10x7±0.1	10x4±0.1	10x2±0.1
		90 day	10^2±0.1	10x8±0.1	10x6±0.1	10x2±0.1

Table 6. Sensory properties evaluation of food products containing cinnamon stored at room temperature

product	Time	% cinnamon	color	Taste	Odor	Textures	General Acceptance
Biscuit	0	0	8.40 ± 0.10 [a]	8.32 ± 0.08 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]	8.40 ± 0.08 [a]
		1	8.37 ± 0.15 [a]	8.27 ± 0.06 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]
		1.5	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
	30 day	0	8.00 ± 0.15 [a]	8.00 ± 0.10 [a]	8.00 ± 0.10 [a]	8.00 ± 0.15 [a]	8.00 ± 0.15 [a]
		1	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.15 [a]
		1.5	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]
	60 day	0	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		1	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		1.5	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]
	90 day	0	6.35 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]
		1	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		1.5	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]
Cake	0	0	8.32 ± 0.10 [a]	8.32 ± 0.08 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]	8.40 ± 0.08 [a]
		1	8.37 ± 0.15 [a]	8.27 ± 0.06 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]
		1.5	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
	7 day	0	6.35 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]	6.00 ± 0.20 [c]
		1	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]
		1.5	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]
Bread	0	0	8.40 ± 0.10 [a]	8.32 ± 0.08 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]	8.40 ± 0.08 [a]
		1	8.37 ± 0.15 [a]	8.27 ± 0.06 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]	8.37 ± 0.15 [a]
		1.5	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.37 ± 0.15 [a]	8.40 ± 0.10 [a]
	7 day	0	5.35 ± 0.20 [d]	5.00 ± 0.20 [d]	5.00 ± 0.20 [d]	5.00 ± 0.20 [d]	5.00 ± 0.20 [d]
		1	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]	6.35 ± 0.20 [c]
		1.5	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]	7.35 ± 0.20 [b]
		2	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	8.40 ± 0.10 [a]	7.35 ± 0.10 [b]	8.40 ± 0.10 [a]

Means within a column not sharing the same letter are significantly different at p≤0.05

Sensory evaluation of some traditional food products containing cinnamon

Table (6) shows sensory attributes of some traditional food products such as biscuit, cake and bread containing different ratios of cinnamon**.**

As it can be shown from Table (6), no significant differences were noted in the organoleptic contributes of Biscuit containing the different ratios of cinnamon comparing with the control sample in zero time but there were significant differences between the control sample and the organoleptic contributes of biscuit containing the different ratios of cinnamon during the storage period. On the other hand, degree of sensory properties given increased with the increase in the percentage of cinnamon with the length of storage period.

In case of cake and bread, it can be noted that the percentages of cinnamon added were significantly affected all the sensory attributes in comparison with the control sample. Where the scores of organoleptic attributes given for cake and bread increased with increasing the % of cinnamon as well as the length of storage period. In general, all the organoleptic attributes were still over 7.0, which means that all the bread and cake samples prepared containing less than 2% cinnamon are still accepted by the panelists.

As a conclusion, cinnamon can be used as a functional ingredient in preparing some traditional food products such as cake, biscuit, and bread. This is because the cinnamon can be considered as a source of bioactive components, dietary fiber, antimicrobial and antioxidant agents.

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الملخص العربي

استخدام القرفة في إعداد وحفظ بعض المنتجات الغذائية من التلوث الميكروبي

جيهان إبراهيم صابر

كان الهدف من هذه الدراسة تقييم مسحوق القرفة من حيث التركيب الكيميائي ومحتواه من الالياف الغذائية والمعادن وكذلك من المركبات الحيوية وتأثيره كمضاد للنشاط التأكسدي ولبعض الميكروبات وكذلك استخدامه بنسب مختلفة لإنتاج بعض المخبوزات (خبز، كيك، وبسكويت) ومعرفة تأثيره على نمو الميكروبات في المنتجات الغذائية خلال فترات التخزين المختلفة على درجة حرارة الغرفة وتقييمه كمادة حافظة.

حيث أظهرت نتائج الدراسة أن مسحوق القرفة يحتوي على كمية من البروتين والألياف الغذائية والكربوهيدرات والفينولات والفلافونويدات وكان لمستخلص الميثانول من هذا المسحوق نشاط مضاد للأكسدة ومضاد للميكروبات.

كما اثبتت الدراسة ان المنتجات المحتوية على نسب مرتفعة من مسحوق القرفة له تأثير على نمو الميكروبات حيث كلما زادت نسبة الإضافة أدت الى خفض العدد الكلى للبكتريا خلال فترات التخزين المختلفة لذلك من الممكن اعتبار مسحوق القرفة مادة لحفظ الأغذية من التلوث الميكروبي.

كما أن جميع المنتجات التي تم إعدادها والمحتوية على نسب مختلفة من مسحوق القرفة والمخزنة كانت مقبولة بشكل جيد من قبل المحكمين والحفاظ على خصائصهم الحسية بشكل جيد.

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