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# EVALUATION OF ANTIOXIDANT AND ANTIBACTERIAL PROPERTIES OF CINNAMON ON CHOCOLATE CAKE BATTER USING SENSORY METHOD

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## ABSTRACT

Cake is one of the products of baking, which has a porous texture with fine holes on it with thin wall and spongy structure. Cake can be considered among confectionery products and has different types with different calories. At the present study, effect of adding cinnamon (1-3%) and sorbate o physicochemical properties, improvement of sensory properties, some rheological and microbial properties in chocolate cake has been investigated. after baking chocolate cake, humidity and organoleptic tests were performed on the batter. Obtained results from the tests on batter samples indicate that farinographic properties like water absorption and loosening degree in batter treatments containing cinnamon was more than control sample and treatment "B" has the highest level of farinographic properties compared to other treatments. In addition, obtained results from extensograph test conducted on batter samples indicate that extensography property such as energy rate and tensility are in maximum level in treatment "D" and tensile strength and maximum strength has been in maximum range in treatment C and maximum strength and ratio value has been in maximum level in treatment B. in terms of obtained results from evaluating organoleptic properties, treatments containing cinnamon are in higher level in regard with smell and taste properties. The best treatment in all tests is also treatment B (1% cinnamon).

**Keywords: Cinnamon, Sorbate, Rheological Properties, Microbial, Qualitative Properties, Chocolate Cake**

## INTRODUCTION

Cake is a kind of sweet that has European origin. Although archeologists believe that this food has been existed since ancient times, current imagination of cake can produce image of a food with three features including sweetness, lightness and spongy texture can make. In fact, currently it is being considered as a kind of sweet that has been created since mid 18th century. Cinnamon chocolate cake is a kind of cake, which its formulation includes flour, sugar, egg, oil, chocolate and cinnamon (Chen S, Liu JY, Tsaikh. 2008).

Cinnamon, from bay leaf strain, is a popular flavoring that has antioxidant and metal chelating activity in addition to have flavoring property. Among phenolic and non-phenolic compounds of cinnamon that have antioxidant properties, one can refer to Cinnamaldehyde that forms major part (75%) of essential oil and flavor and sweetness of cinnamon is also because presence of the substance. These compounds act as counteractive of peroxide radicals and chelating metals and can also prevent oxidative reactions (Starvic, B, 1994).

Cake is one type of sweets that has European origin. Cake in English has several meanings and can be also considered as a small and flat piece of baked dough (Sharif, KM, 2009).

According to the definition, archeologists state that this kind of food has been existed since ancient times; although current imagination of cake can make considering three properties of sweetness, lightness and spongy texture. This kind of sweet has been produced since mid 18th century (Sharma,H.R. and Chauhan .G.S.2002).

Origin of cake is bread and hence, history of cake has been integrated with bread. The most important factor for separation of bread and cake is elimination of yeast from bread. By 177, for the first time a recipe was observed in cooking book that had used only egg for foaming the cake. By that time, it was found that using several eggs in cake can eliminate need for yeast. Advancement in cooking oven industry had also significant effect on quality of cake. By 1780, ovens were produced and it became possible to bake lighter cakes than before (Tzortzakis ,N.G. 2007).

By early 19th century, a new type of cake became common named pound cake. In this cake, all used materials were weighted to 1pound (453gr) and 8 eggs were required to make weight of eggs equal to other materials. The last advancement for baking light cakes like current ones was using chemical foaming materials. In 1970s decade, using first type of these materials named potassium carbonate in cake was

began. In 1980s decade, sodium bicarbonate was produced. Production of these chemicals, which had better action than yeasts, decreased required time for baking bread and cake compared to before. By 1850, baking powder was generated, which could cause spongy texture in cake. As a result, current cakes were emerged (Jonson et al, 1979). Cake industry has been developed over the years around the world and manipulation of ingredients for purpose of improving product durability can be a powerful instrument in hands of manufacturers (Zaika, LL, 1988). Numerous studies have been so far conducted in field of modifying and changing components of cake (Shahzadi et al.,2001).

Cinnamon chocolate cake is a combination of flour, oil, egg, sugar and salt, which cinnamon and chocolate have ben also added to it. Cinnamon contains various antimicrobial antioxidants. Many antioxidants are anticancer. Antioxidants usually can be added to food materials, so that they can prevent chain reactions of oxidation radical. Through such prevention, they act from beginning and distribution step and lead to end of the reaction and delay in oxidation process (Sudha et al, 2007). However, commonly applied artificial antioxidants like BHA and BHT have been restricted legally because of their toxic and cancerous effects (Weining,H.Kim,Y. 2008). Therefore, there is considerable interest in food industry to find natural antioxidants instead of artificial compounds in food applications. Also, an increasing process for preferring natural antioxidants can be also observed by consumers, which can provide more motivations for discovering natural resources of antioxidants.

Since ancient times, vegetables and additives have been added to foods to make them tasty and delicious and also improve storing durability of foods. Using vegetables and additives can transfer antioxidant impacts to food and active parts are same phenols (Tanabe et al.,2002).

Lauraceae is an important economic family that can form majority of trees or bushes. Cinnamon includes about 250 species, which have been distributed in Asia and Australia. These trees grow in South of India in height of 500m. However, mostly they can be observed in height below 200m (Koca A.F., ANIL M.2007). Hexane extract of cinnamon tree crust and cinnamon oil has antioxidant activity (AA) (Badei et al., 2002).

Cinnamon is secret of remaining young and daily use of cinnamon can keep human young and healthy. Cinnamon can be also applied for purpose of renewing and enhancing sex power. It can heat kidney and can also decrease weakness of feet and back

and can treat anemia. Cinnamon is the best medicine for muscular pains. Another important effect of cinnamon is lowering fever. Today, cinnamon is also being supplied in form of tablet and capsule as febrifuge (Chen et al, 2008).

**Research literature**

SU l et al (2007) have investigated enervation activity of free radicals (ABTS), (DPPH), PEROXYL and hydroxyle using plant extracts of cinnamon, black pepper, nutmeg, rose and oregano leaf. They were extracted using 50% acetone and 80% methanol. 50% acetone extract in cinnamon indicated highest rate of enervating peroxyl, DH and ABTS radicals compared to extracts of other plants and methanol extract indicated also highest capacity of enervating DPPH compared to other extracts (Su L et al, 2007).

Tzortzakis (2007) found in a study that fruits exposed to cinnamon steam (strawberry and tomato) have lower intensity of corruption compared to other fruits, which were not exposed to cinnamon oil steam.

Manici et al (1998) has proved antioxidant property of cinnamon crust extract and numerous studies were also conducted after that on cinnamon crust extract for purpose of proving its antioxidant property.

Mathew, Abraham et al (2006) expressed in their study that cinnamon crust extract has recovery property, enervation property of free radicals and chelating metals.

Abraham and Mathew et al (2006) studied antioxidant activity of methanol extract obtained using cold solvent extraction of cinnamon crust in 5 different densities using linoleic acid emulsion system. Percent of preventing peroxidation in this system in densities of (25, 50, 75, 100 and 200mg/ml) of methanol extract was in different densities during 48hrs; although percent of preventing synthetic antioxidant oxidation of BHA in density of 200mg/ml reported to 89.8%.

Gomez et al (2010) studied effect of fiber rate, size and type of particles on quality of cake layer. In this study, it was found that all 3 mentioned factors can have impact on qualitative properties of cake and adding different types of fiber to certain amount and with medium size can improve quality of cake.

Kim (2004) has indicated in a study that cinnamon extract can prevent growth of *A.parasiticus*, *Clostidium* and *Escherichia Coli*. This can be because of Cinnamic. Aldehyde extracted from cinnamon tree crust.

Murica et al (2004) have compared antioxidant properties of 7 different additives (cinnamon, Roman Pimpernel, ginger, licorice, mint, nutmeg and vanilla) with common food antioxidants including

BHA, BHT and PG. among thee mentioned additives, cinnamon and mint indicated higher resistance against oxidation compared to other analyzed additives and food antioxidants. This was resulted from section of lipid peroxidation. In addition, cinnamon was found in this study as the best enervate for superoxide radicals compared to other additives analyzed here.

## METHODS AND MATERIALS

Specifications of applied devices in this study have been described in table 1.

**Table 1: specifications of applied devices in the study**

| Device name | Model and producer/country |
|---|---|
| Farinograph | Brabender/Brabender |
| Extensograph | Brabender/Brabender |
| Volumeter | Henry Simon/England |
| Instron | Brabender/Germany |
| Oven | Brabender/Germany |
| Soxhlet extractor | Takator/USA |
| Kjeldahl | Takator/USA |
| Erlenmeyer flask | Brabender/Germany |
| Shaker | Brabender/Germany |
| Desiccator | Brabender/Germany |
| Electric oven | Sybron/UK |
| Electric stove | Brabender/Germany |
| Calibrated stopper tube | Iran Azma/Iran |
| Ben Mary | Iran Azma/Iran |
| Digital scale | Perten/Swedish |
| Polarimeter | Optical Activity/UK (AA-55 Model) |

### Sample size

According to the method, the study has been conducted on wheat flour, cinnamon and cocoa powder samples and samples of produced chocolate cake through considering 4 treatments and 3 iterations.

### Research scope

All chocolate cakes applied in this study were produced in Dorna Company located in Tehran-Karaj Road. Chemical examinations performed on wheat flour and cocoa powder and also examination done on product size were implemented in Dorna Co. Rheological tests (farinograph and extensograph) were conducted in Tara Bread Improvement Co located in Shahriar; modification of seed and plant was conducted in Mohamad Shahr; oxidation test was conducted in Oghab Sweet Halva Co located in Shahriar and finally, microbial and antioxidant tests were also performed in Iran's Institut Pasteur.

### Evaluation of chocolate cake using sensory method

For purpose of determining staling rate of produced cake treatments, sensory method (National Standard of Iran/ No.2553) was applied. The test was implemented in intervals of 24, 48 and 72hrs after baking samples. Samples were separately placed in

plastic packets under ambient temperature beside each other. Then, all treatments were given to sensory panelists and they scored cake samples based on relevant form.

Obtained results from variance analysis and descriptive statistics (mean ± SD) for specifications of chemical tests of chocolate cake treatments have been respectively presented in tables 2 and 3 in terms of sensory properties (smell, texture, taste and color).

**Table 2: results of variance analysis of sensory test (smell, texture, taste and color) in chocolate cakes**

| Variation source | df | Mean squares (MS) | | | | |
|---|---|---|---|---|---|---|
| | | Color | Smell | Texture | Taste | Total |
| Treatment | 3 | 0.111ns | 1.611* | 0.278ns | 4.167* | 13.611ns |
| Deviation | 20 | 0.850 | 0.450 | 0.538 | 0.867 | 5.650 |
| Total | 23 | — | - | - | - | - |

**ns: no significant difference**
***: significant difference in p-value of 5%**

**Table 3: obtained results from descriptive statistics (mean ± SD) of sensory test (smell, texture, taste and color) in chocolate cakes**

| Property | Mean | SD |
|---|---|---|
| Color | 1.33±0.177 | 0.868 |
| Smell | 2.92±0.158 | 0.776 |
| Texture | 3.25±0.150 | 0.737 |
| Taste | 2.92±0.232 | 1.139 |
| Total score | 12.42±0.528 | 2.586 |

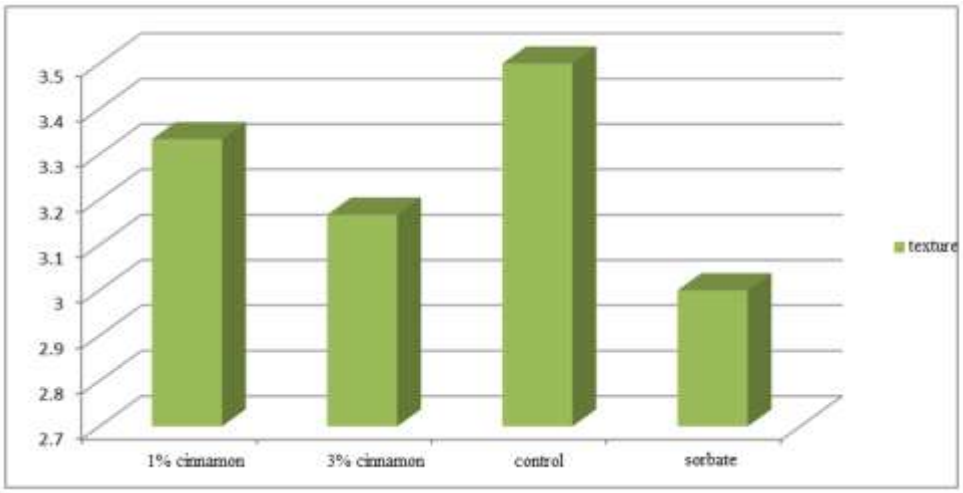


**Figure 1: diagram of texture variations (sensory test) in chocolate cake treatments containing different percentages of cinnamon and sorbate (1% and 3%)**

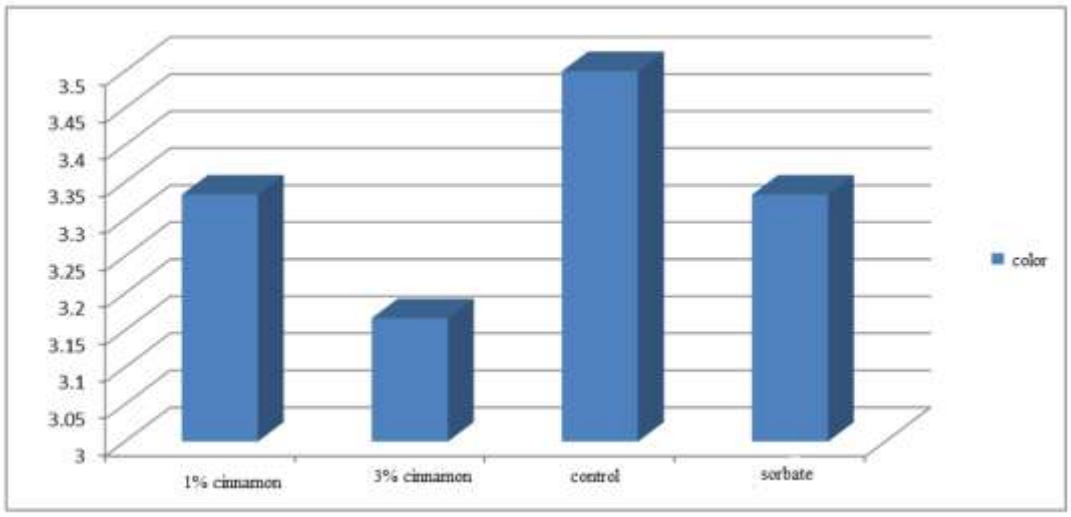


**Figure 2: diagram of color variations (sensory test) in chocolate cake treatments containing different percentages of cinnamon and sorbate (1% and 3%)**

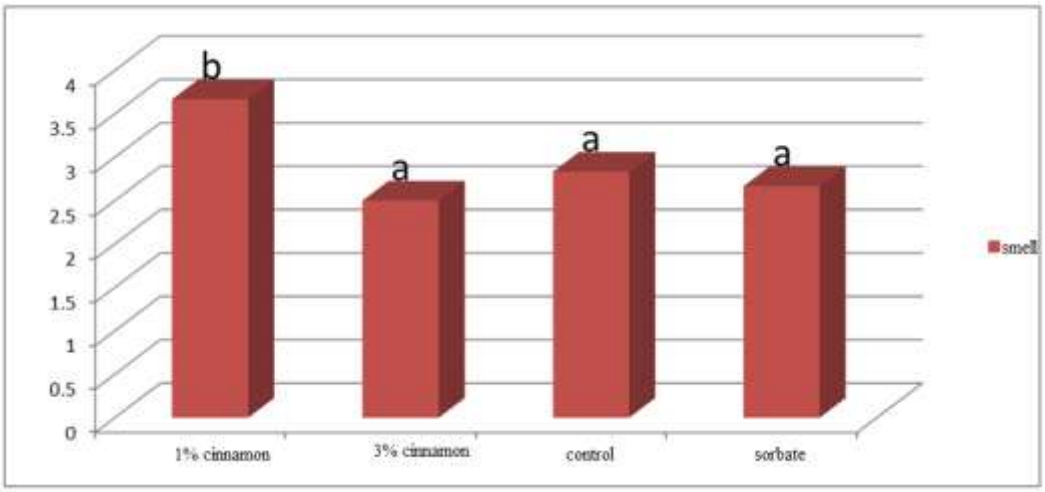


**Figure 3: diagram of smell variations (sensory test) in chocolate cake treatments containing different percentages of cinnamon and sorbate (1% and 3%)**

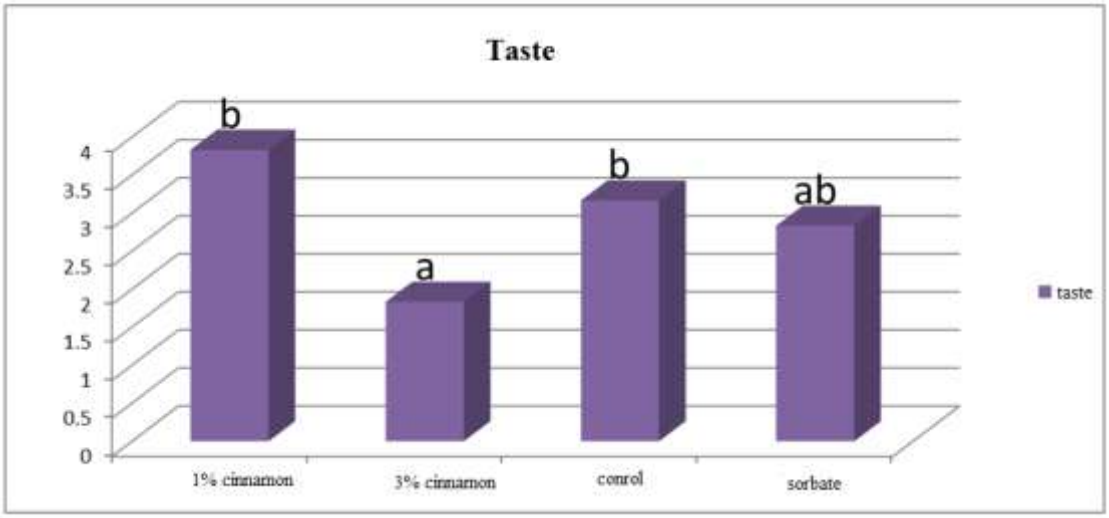


**Figure 4: diagram of texture variations (sensory test) in chocolate cake treatments containing different percentages of cinnamon and sorbate (1% and 3%)**

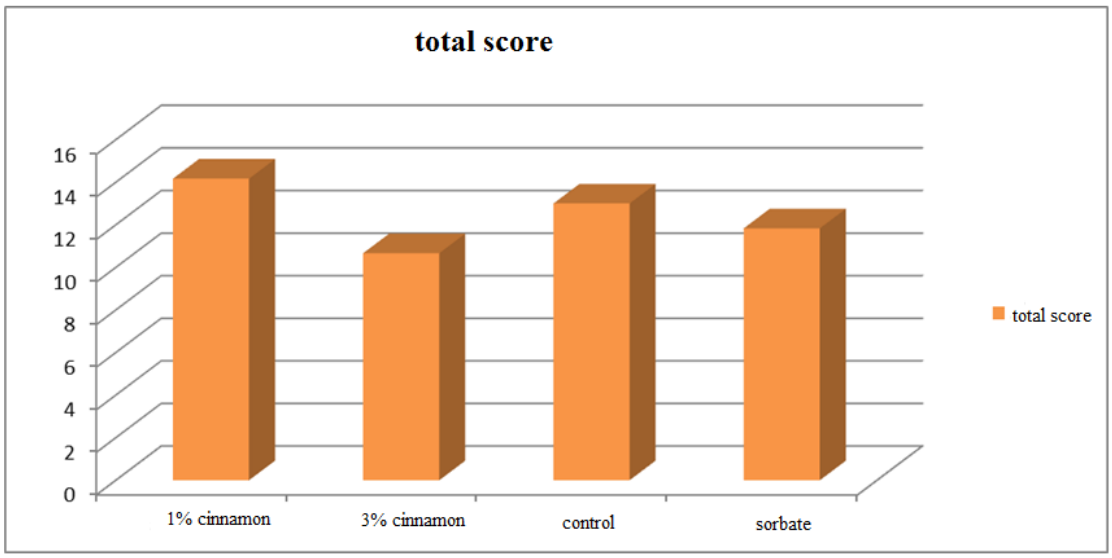


**Figure 5: diagram of total score variations (sensory test) in chocolate cake treatments containing different percentages of cinnamon and sorbate (1% and 3%)**

## DISCUSSION AND CONCLUSION

Effect of adding different percentages of cinnamon (1% and 3%) and sorbate on sensory properties of chocolate cake treatments are presented as follows:

According to obtained results from mean comparison, it could be found that increase in percent of replacing cinnamon and sorbate with used wheat flour, control treatment has the highest score for the mentioned property and has no significant difference with other treatments. Also treatment "D" has also lowest level of score in terms of texture. On the other hand, no significance difference was also observed among all treatments ($p>0.05$).

Effect of adding different percentages of cinnamon (1% and 3%) and sorbate on color of chocolate cake treatments are presented as follows:

According to obtained results from table 3, it could be found that increase in levels of replacing cinnamon and sorbate with wheat flour could cuase highest score in the mentioned property in control treatment. It had also no significant difference with other treatments. Treatment "C" had also lowest score in terms of color. On the other hand, no significant difference was observed among all treatments ($p>0.05$).

The reason for clear decline of sensory score (color) of treatments with higher percent of cinnamon was dark color of cinnamon and its effect on color of cake treatments.

Obtained results have been in consistence with obtained results from study of Peyghambar et al (2012), which has confirmed that because of dark color of Purslane, color of produced bread had low score.

According to obtained results from comparing mean values in table 3, it could be found that increase in replacement percent of cinnamon with wheat flour and sorbate, smell

was firstly increased in treatment "B" and then it was decreased in treatments "C" and "D". In addition, no significant statistical difference was observed between control treatment and C, D treatments. However, treatment "B" was significantly different from other treatments statistically ($p<0.05$).

Effect of adding different percentages of cinnamon (1% and 3%) and sorbate on taste (sensory test) of chocolate cake treatments have been presented as follows:

According to obtained results form comparing mean values in table 3, it could be found that increase in percent of replacing cinnamon with wheat flour can cause significant increase of taste in treatment "B"; although it has been decreased in treatment "C".

In addition, through adding sorbate, the taste has been increased, so that no significant difference was observed between control treatment and B, D treatments. Also, treatment "C" was also significantly different from control treatment statistically ($p<0.05$).

Effect of adding different percentages of cinnamon (1% and 3%) and sorbate on total score of chocolate cake treatments has been presented as follows:

According to obtained results form comparing mean values in table 3, it could be found that increase in percent of replacing cinnamon with wheat flour can cause significant increase of total score in treatment "B"; although it has been decreased in treatment "C". In addition, through adding sorbate, the total score has been increased, so that no significant difference was observed among treatments.

**Suggestions**

-Producing chocolate cake containing cinnamon in industrial form and investigating chemical, microbial and sensory properties

-Using aromatic additives applied in this study in other flour products and investigating its properties

-Encapsulation of cinnamon extract applied in this study and using it in food products

-Using cinnamon in package of foods and investigating its antimicrobial impacts

-Using other levels of cinnamon in chocolate production

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