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## **BRAN AND TORTILLA BREAD FORTIFIED TO DAMSISSA**

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### **ABSTRACT**

Damsissa is one of medicinal herbs which growing in Egypt.also,its rich of several type of antioxidants. The present work was conductedto evaluate the influence of functional propertiesof Damsissa leaves powder in bran and tortilla bread.

Chemical contents, total polyphenols and its fractions, total flavonoids and its fractions, chlorophyll, carotenoids, vitamin C, volatile oil, antioxidant activity in dried Damsissa were evaluated.Bran breadwere made from wheatbran ,wheat flour and supplemented with different ratios of Damsissa powder at 0.5; 1.0 and 1.5% respectively) by partially replacing the wheat flour by Damsissa powder. Also, Tortilla breadwas made from Corn flour and supplemented with different ratios of Damsissa powder at 0.5;1.0 and 1.5% respectively) by partially replacing the Corn flour by Damsissa powder.

Results indicated that, no significant differences ( $P < 0.05$ ) among all the fortified bran bread at 0.5% of the Damsissa leaves powder and control sample with regarding to the overall acceptability.Fortified bran bread with 0.5 % of Damsissa leaves powder showed no significant differences ( $P < 0.05$ ) for color (outer layer); color (inside layer); crust and Taste compared to the control sample and bread sample fortified at 0.5 % of the Damsissa leaves powder.Replacing up to 1.5% of the Damsissa leaves powder with bran reduced general appearance; color (outer layer); color (inside layer); crust; loaf texture and taste.Concerning, the odor, there

was significant differences in bran bread containing 1.5% compared with control bread and bread containing 1.0%.

Tortilla bread showed that bread containing 1.0% and 1.5% Damsissa leaves had higher dietary fiber content but lower sensory scores such as General appearance; color (outer layer); color (inside layer); odor, Taste and overall acceptability. Tortilla bread containing 0.5%, 1.0% and 1.5% compared with control bread made from normal corn flour without any fortified with Damsissa leaves powder. Conclusively, we can use Damsissa as a medicinal herbs to improve bran and tortilla bread to use as diabetic or celiac diseases food.

**Key Words:** antioxidant, chlorophyll, Damsissa, diabetic, polyphenols, vitamin C, volatile oil, Tortilla bread.

## INTRODUCTION

Damsisa or *Ambrosia maritima* L. belongs to subfamily *Tubuliflorae* that represent a branch of family *Compositae* from flowering plants (*Evans, 1996*). It is a widely distributed weed in southern parts of Egypt, Sudan, Senegal, and neighboring countries.

Damsissa contains flavonoids, coumestans and isoflavones as other phytoestrogens. Phytoestrogens are defined as any plant substance or metabolite that induces biological responses in vertebrates and can mimic or modulate the actions of endogenous oestrogen by binding to oestrogen receptors; the majority of phytoestrogens belong to large group of substituted phenolic compounds known as examine their flavonoids. Three classes of flavonoids, isoflavones, coumestans and prenylated flavonoids are phytoestrogens that possess the most potent oestrogenic activity (*Knight and Eden, 1995*).

Research was carried out by *Das et al., (2012)* to evaluate the effects of the addition of coriander leaves powder on the antioxidant activity, shelf life and physical characteristics of the bread. Bread enriched with powder coriander leaf into wheat flour will have beneficial in many aspects such as high antioxidant content, increase moisture retention capacity, efficiency baking characteristic and improved sensory characteristic in aspects of colour aroma and taste.

Herbal fortification of white bread is a new trend to improve its nutritional value. Herbs are rich in minerals, vitamins, flavouring agents and natural antioxidants. Roots, stems, leaves or seeds of

herbal plants have long been used in cooking and in naturopathy all over the world. In a recent communication, we have reported the fortification of white bread with coriander leaf powder. This supplementation imparted a spicy flavour, greatly improved taste and sensory properties, and enhanced the level of natural antioxidants. Bread with fennel seed content between 0.5 and 7.0 % showed the highest acceptability among the fortified bread samples (*Das et al., 2012*).

Wheat bran is a by-product of wheat milling industry. It has been recognized as an excellent source of proteins, dietary fiber and bioactive compounds. It is cheap and readily available. Wheat bran consists of multiple layers of the outer part of wheat kernel accounting for 10–15% of kernel weight. The use of wheat and other cereal bran in various food formulations has gained remarkable interest in recent years due to versatile health benefits associated with consumption of high fiber food. (*Mateo Anson, et al., 2012*).

Many bioactive compounds found in the grain, especially antioxidants (phenolic compounds), are particularly concentrated in the bran and aleurone layer (*Mateo Anson et al., 2010*).

*Filipčev, et al., (2017)* study was intended to explore the possibility of fat replacement by finely ground wheat bran at 30, 40 and 50% level in a formulation of special biscuit enriched with herbal blend vital plant. This special biscuit was previously shown to possess high antioxidative and antimicrobial potential as well as longer shelf life due to presence of phenolic compounds in the Vital plant herbal blend, specifically tailored to metabolism stimulation and body weight regulation.

Gluten, a vital structure-binding protein, is the principle wheat part that contributes to bread quality. However, increasing number of people is not able to digest gluten present in the wheat-based cereal products and suffer from diseases like Celiac disease. It is an autoimmune system disorder influencing the gastrointestinal framework and distinguished by long-lasting intolerance to the intake of gluten, a term used to cover prolamins (specific storage ethanol-soluble proteins) in wheat gliadin, rye secalin and barley hordein (*Catassiet al., 2008*).

Nowadays, there is a growing interest in gluten-free products as celiac disease is increasing. Many commercially available gluten-free

bread is of lower quality than their counterparts containing gluten (*Sakač et al., 2011*).

The aim of this investigation, Evaluation of bran bread and tortilla bread supplemented with Damsissa leaves powder at fortified to damsissa as a functional food for diabetic and celiac patients.

## MATERIALS AND METHODS

### Materials:

Egyptian cultivar of Damsissa (*Ambrosia maritima, L.*) was obtained from Horticultural Research Institute, Agricultural Research Center. Giza, Egypt.

Leaves were washed by using tap water several times to remove possible potential pathogenic microorganisms and dust, and then dried in oven under vacuum, then ground well.

### Methods:

#### Phytochemical analyses:

Moisture, protein, ash, crude fiber, fat and tannins content were determined according to the method outlined in *A.O.A.C. (2007)*. Total carbohydrates were determined by difference as mentioned by *AbdEl-Latif (1990)*.

Phenolic compounds determined by HPLC according to method *Goupy et al., (1999)*. Flavonoid compounds determined by HPLC according to method *Mattila et al., (2000)*.

The content of total phenols in the ethanol extract was determined according to the procedure described by *Amarowicz et al., (2004)* using the Folic- Ciocalteu's phenol reagent. Flavonoids were determined according to the methods of *Chang et al., (2002)*. DPPH scavenging activity tests were carried out according to the method of *Brand-Williams et al., (1995)*. The total ascorbic acid content was estimated by *Hassimotto et al. (2008)*,

chlorophyll *a*, *b* and total chlorophyll were described according to the method of *Wettstein (1957)*.  $\beta$ - carotene was determined according to the method of *Nagata and Yamashita (1992)*. Determination of the volatile oil determined according to (*ISO 6571: 2009*).

***Bran bread preparation:***

Different formulas of bran bread (wheat bran ,wheat flour and different

ratios of Damsissa leaves powder ) are presented in **Table (1)**.

**Table (1): Different formulas of Bran bread(normal and fortified %)**

<i>Preparation of bran bread</i>	<i>Wheat flour(g)</i>	<i>Bran (g)</i>	<i>salt (g)</i>	<i>Sugar (g)</i>	<i>Yeast (g)</i>	<i>Damsissa powder(g)</i>	<i>Water (ml)</i>
<i>Normal bran bread ( control)</i>	500	200	5	2.5	10	—	375
<i>Fortified bran bread with (0.5%) Damsissa powder</i>	497.5	200	5	2.5	10	2.5	375
<i>Fortified bran bread with (1.0%) Damsissa powder</i>	495	200	5	2.5	10	5	437.5
<i>Fortified bran bread with (1.5%) Damsissa powder</i>	492.5	200	5	2.5	10	7.5	437.5

**Tortilla bread preparation:**Were prepared with Corn flour and supplemented with different ratios of Damsissa powder at 0.5; 1.0 and 1.5% respectively) by partially replacing the Corn flour by Damsissa powder, as shown in **Table (2)**.

**Table (2):Composition of different formulas of Tortillabread (normal and fortified)**

<i>Preparation of bran bread</i>	<i>Corn flour(g)</i>	<i>Yeast (g)</i>	<i>Sugar (g)</i>	<i>Salt (g)</i>	<i>Damsissa powder(g)</i>	<i>Water (ml)</i>
<i>Normal Tortilla bread (Control)</i>	500	20	2.5	2.5	---	250
<i>Fortified Tortilla bread with (0.5%) Damsissa powder</i>	497.5	20	2.5	2.5	2.5	250
<i>Fortified Tortilla bread with (1.0%) Damsissa powder</i>	495.0	20	2.5	2.5	5	250
<i>Fortified Tortilla bread with (1.5%) Damsissa powder</i>	492.5	20	2.5	2.5	7.5	250

***Sensory evaluation of Bran and Tortilla bread:***

Sensory evaluation were carried out by 20 panelists from both: Department of Nutrition and Food Science, Faculty of Home Economics, Helwan University and from Food Technology Research Institute Agriculture Research Center; according to *A.A.C.C. (2002)* to evaluate the characteristics which include General appearance, Color (top layer), Color (inside layer), Area, Loaf texture, Odor, Taste and Overall acceptability. The average of total score was converted to a **descriptive category as follows:**

General appearance	15
Color (top layer)	10
Color (inside layer)	10
Area	10
Loaf texture	15
Odor	20
Taste	20
Over all acceptability	100

**Statistical analysis:**

Results are expressed as mean  $\pm$  SD. Data were statistically analyzed for variance using one-way analysis of variance "ANOVA" according to *Armitage and Berry, (1987)*. Computer software system SPSS (version 15) was used for these calculations.

## **RESULTS AND DISCUSSION**

**Chemical constituents of raw materials**

Chemical constituents of Damsissa leaves powder (DLP) were investigated on dry weight basis. The following parameters in **Table (3)** mentioned moisture, carbohydrate, protein, oil, ash and crude fibers, the ratios were 5.70, 53.2, 31.3, 4.9, 4.9 and 16.4 g/100g dry weight basis, respectively.

**Table (3): Chemical constituents of Damsissa leaves powder g / 100g dry weight basis**

<i>Component (%)</i>	<i>Damsissa leaves powder</i>
Moisture	5.70
Carbohydrate	53.2
Protein	31.3
Oil	4.9
Ash	4.9
Crude fibers	16.4

The present results are in agreement with *Julie et al., (2001)* and *El-Kamali and El-Amir (2010)*, They published that Damsissa powder contained carbohydrates, flavonoids, tannins, triterpens and alkaloids, while Ethanol extract of Damsissa contains alkaloids, flavonoids, volatile oil, 20% moisture and 20% total ash (2.5% oil Sulfated ash and 10% insoluble ash)

The previous results of *Abdelgaleil(2010)* and *Saxena et al., (2013)* reported that the flavonoids appear to have a major role in successful medical treatments of ancient times, and their use has persisted up to now. Confirmed by *Helal et al., (2015)* that the phytochemical screening of confirmed *Ambrosia maritima* is due to, the presence of alkaloids, flavonoids, saponins and terpenes.

***Total antioxidant content and its activity of Damsissa leaves powder:***

Medicinal plants are of great importance to the health of individuals and communities. The medicinal value of these plants based on some chemical substances that produce a definite physiological action on the human body. In view of the increasing interest in the use of medicinal plants as a natural antioxidant. The present study revealed in **Table (4)** that the Damsissa leaf powder has major source of various types of nutrients Phenols; flavonoids; carotenoids; chlorophyll; vitamin C; volatile oil and total antioxidant activity which were at concentrations of  $321.50 \pm 13.52$ ;  $100.03 \pm 7.90$ ;  $16.53 \pm 0.35$ ;  $31.67 \pm 0.60$ ;  $35.24 \pm 2.8$ ;  $0.30 \pm 0.08$  (mg/g dry) and  $92.00 \pm 2.00$  ( $\mu\text{g/ml}$ ), respectively. Many of these indigenous medicinal plants are used as spices and food plants, and also supplemented to foods for pregnant and nursing mothers for medicinal

purposes noticed by *Edeoga, et al., (2005)* and *El-Kamali and El-Amir (2010)*.

According to *Saxena et al., (2013)* showed that phytochemicals have also been promoted for the prevention and treatment of diabetes, high blood pressure, and macular degeneration, while phytochemicals are classified by function, as an individual compound which have more than one biological function serving as both an antioxidant and antibacterial agent. Moreover, *Eman et al., (2015)* revealed that Damsissa contained Essential oils (volatile oils) like (carvone, camphor, caryophyllene and cineole) extracted from Damsissa. The most important of these bioactive constituents are alkaloids, tannins, flavonoids, and phenolic compounds.

**Table (4): Total antioxidant content and its activity of Damsissa leaves powder (mg/g dry)**

<i>Compounds</i>	<i>Damsissa leave powder (DLP)</i>
Phenols	321.50 ±13.52
Flavonoids	100.03 ±7.90
Carotanoids	16.53 ±0.35
Chlorophyll	31.67 ±0.60
Vitamin C	35.24 ±2.8
Volatile Oil	0.30 ±0.08
Total antioxidant activity by DPPH% (µg/ml)	92.00 ±2.00

These findings were in agreement with (*Helal et al., 2015*) who evaluated the antioxidant and hypoglycemic effects of aqueous extract of Damsissa in the alloxan induced diabetic rats. They revealed that no toxic signs were detected after oral administration of dried Damsissa leaves, and flavonoids such as "apigenin, and  $\beta$ -sitosterol" which are derived from the Damsissa exhibit antitumor activity; essential (volatile oils) like camphor and cineole were also extracted from Damsissa.



### ***5.1.2-Identification and quantitation of phenolic compounds in Damsissa leave powder:***

The results in **Tables (5)** indicated the types and concentrations of phenolic compounds of Damsissa leave powder. Data revealed that Damsissa has e- Vanillic; Salicylic; Benzoic; Chlorogenic and Catechein which were the abundant in Damsissa at concentrations of 549.15; 372.91; 214.34; 194.99 and 193.70 (mg/100g) respectively. On the other side, Pyrogallol; Ellagic; P-coumaric; Protocatchuic; Caffene; P-OH-benzoic; Epicatachin; Vanillic; Cinnamic and Coumarin were presented in moderates concentrations at 90.49; 85.99; 84.56; 68.02; 59.36; 45.96; 43.32; 41.14; 39.48 and 26.89 (mg/100g) respectively. While data in the same table revealed that 4-Amino benzoic and Gallic at concentration of 2.50 and 2.46 (mg/100g) respectively, were existed in the lowest abundant levels.

**Table (5): Identification and quantitation of phenolic compounds of Damsissa leaves powder**

<i>Phenolic compounds</i>	<i>concentration (mg/100g)</i>
Pyrogallol	90.49
Gallic	2.46
4-Amino -benzoic	2.50
Protocatchuic	68.02
Catechein	193.70
Catechol	20.06
Chlorogenic	194.99
Epicatachin	43.32
P-OH-benzoic	45.96
Caffene	59.36
Caffeic	14.95
Vanillic	41.14
P-coumaric	84.56
Ferulic	14.84
Iso-ferulic	15.32
e-Vanillic	549.15
Ellagic	85.99
Alpha-coumaric	11.96
Benzoic	214.34
3,4,5-methoxy-cinnamic	12.41
Coumarin	26.89
Salicylic	372.91
Cinnamic	39.48

Previous studies noticed that Phenolic phytochemicals are the largest category of phytochemicals and the most widely distributed in the plant kingdom. The three most important groups of dietary phenolics are flavonoids, phenolic acids, and polyphenols (*Saxena et al., 2013*). Confirmed by *Helal et al., (2015)*, phytochemical analyses on *Ambrosia maritime* extract have identified the presence of some pseudoguaianolidesesquiterpenes such as; neoambrosin, chloroambrosin, damsinic acid, hymenin. Two new sesquiterpene lactones, characterized as 1'-noraltarnisin and 13 dihydropsilostachyin, were isolated from *Ambrosia maritima*. Triterpenes like (samyrin) that is extracted from the Damsissa' leaves show molluscicidal activity against the intermediate hosts of shistosoma spp. Research reported the presence of some coumarins like scopoletin, and isoscopoletin in the *Ambrosia maritima* extract, in addition, many compounds such as; tannin, alkaloid, saponins, resins and hispidulin were isolated from the *Ambrosia maritime* extract.

### **5.1.3- Identification and quantitation of flavonoids in Damsissa leaves powder:**

are illustrated in **Table (6)** showed the types and concentrations of flavonoid compounds in Damsissa leaves powder. It obvious that Hisperidin and Hespirtin were the abundant flavonoid compounds in Damsissa leaves at concentration of 449.97; 126.13 (mg/100g) respectively while, Naringin; Acacetin; Apig.6- glucose 8-rhamnose; Apignin; Luteo 6-arbinose 8-glucose; Kaemp.3,(2-p-comaroyl) glucose; Luteo.7- glucose and Rutin were the moderate abundant flavonoid compounds in Damsissa leaves (33.92; 32.37; 30.51; 28.54; 27.43; 22.92; 17.76 and 11.76 mg/100g), respectively. Also, the lowest abundant were Rhamnetin; Quercetrin-3-o-glucoside; Apig.7- glucose; Apig.7-o- neohespiroside; Luteo.6-glucose 8-arbinose; Kampferol and Rosmarinic at concentration of 2.79; 2.56; 2.38; 2.20; 1.66; 0.87 and 0.48 mg/100g respectively.

**Table (6): Identification and quantitation of flavonoids compounds of Damsissa leaves powder**

<i>Types of Flavonoids</i>	<i>concentration (mg/100g)</i>
Luteo .6-arbinose 8-glucose	27.43
Luteo.6- glucose 8-arbinose	1.66
Apig.6-rhamnose 8-glucose	5.90
Naringin	33.92
Luteo.7- glucose	17.76
Apig.6- glucose 8-rhamnose	30.51
Hespridin	449.97
Rutin	11.76
Quercetrin-3-o- glucoside	2.56
Rosmarinic	0.48
Apig.7-o- neohespiroside	2.20
Apig.7- glucose	2.38
Kaemp.3,7dirhamoside	7.62
Quercetrin	7.63
Quercetin	11.34
Kaemp.3,(2-p-comaroyl) glucose	22.92
Naringenin	5.12
Hespiritin	126.13
Kampferol	0.87
Rhamnetin	2.79
Apigenin	28.54
Acacetin	32.37

***Sensory evaluation of bran bread supplemented with different ratios of Damsissa leaves powder.***

Sensory evaluation of fortified bran bread fortified with Damsissa leaves powder at (0.5 %; 1.0% and 1.5%) are presented in **Table (7)** to evaluate the General appearance; Color (outer layer); Color (inside layer); Crust; Loaf texture; Odor and Taste.

In the same **Table (7)** showed no significant differences ( $P < 0.05$ ) among all the fortified bran bread at 0.5% of the Damsissa leaves powder and control sample with regard to the overall acceptability.

Fortified bran bread with 1.0% of the Damsissa leaves powder showed no significant differences ( $P < 0.05$ ) for color (outer layer);

color (inside layer); crust and Taste compared to the control sample and bread sample fortified at 0.5% of the Damsissa leaves powder.

Replacing up to 1.5% of the Damsissa leaves powder with wheat flour reduced General appearance; color (outer layer); color (inside layer); crust; loaf texture and Taste, which were probably related primarily to the overall decrease in gluten content, confirmed by (*Kawka et al., 1999* and *Reda 2006*). Concerning, the odor, there was significant differences in bran bread containing 1.5% compared with control bread and 1.0%.

**Table (7): Sensory evaluation of bran bread fortified with different ratios of Damsissa leaves powder.**

<i>Bread</i>  <i>Characters</i>	<i>Treatment</i>			
	<i>Control bread</i>	<i>Bread containing 0.5 % of Damsissa</i>	<i>Bread containing 1.0 % of Damsissa</i>	<i>Bread containing 1.5 % of Damsissa</i>
<i>General appearance (15)</i>	12.47 <sup>a</sup> ±2.13	12.13 <sup>a</sup> ±2.45	11.07 <sup>b</sup> ±2.02	10.93 <sup>b</sup> ±2.76
<i>Color (outer layer) (10)</i>	8.93 <sup>a</sup> ±1.03	8.67 <sup>a</sup> ±1.11	8.73 <sup>a</sup> ±1.28	7.87 <sup>b</sup> ±2.13
<i>Color (inside layer) (10)</i>	8.87 <sup>a</sup> ±1.30	8.60 <sup>a</sup> ±1.30	8.53 <sup>a</sup> ±1.06	8.20 <sup>a</sup> ±2.08
<i>Crust (10)</i>	9.07 <sup>a</sup> ±1.28	9.20 <sup>a</sup> ±1.08	9.20 <sup>a</sup> ±1.32	8.93 <sup>b</sup> ±1.67
<i>Loaf texture (15)</i>	12.13 <sup>a</sup> ±2.26	12.27 <sup>a</sup> ±2.09	11.73 <sup>b</sup> ±2.19	10.47 <sup>c</sup> ±2.03
<i>Odor (20)</i>	17.60 <sup>a</sup> ±2.85	17.33 <sup>a</sup> ±2.72	15.93 <sup>c</sup> ±2.03	16.13 <sup>b</sup> ±1.00
<i>Taste (20)</i>	18.67 <sup>a</sup> ±2.72	18.73 <sup>a</sup> ±2.79	18.00 <sup>a</sup> ±2.32	17.00 <sup>b</sup> ±1.36
<i>Overall acceptability (100)</i>	87.73	86.93	83.20	79.53

All results are expressed as mean ± SD.

Values in each column which have different letters are significantly different ( $p < 0.05$ ).

### ***Sensory evaluation of Tortilla bread fortified with different ratios of Damsisa leaves powder.***

The panelists were asked to indicate their general preferences for the effects of replacing corn flour with Damsisa leaves powder under different levels (0.5%; 1.0% and 1.5%) on sensory evaluation of tortilla bread by 20 panelists from both: Department of Nutrition and Food Science, Faculty of Home Economics, Helwan University and Food Technology Research Institute Agriculture Research Center;

according to *A.A.C.C. (2002)*. The characteristics evaluated shown in **Table (8)**.

Most of panelists were preferred the General appearance; Color (outer layer); Color (inside layer); Area; Loaf texture and Taste of Tortilla bread made from 0.5% of the Damsissa leaves powder and control bread more than 1.0% and 1.5% of Damsissa leaves powder. Higher overall score of 0.5 was shown more than Tortilla bread containing corn flour with supplementation 1.0% and 1.5% Damsissa leaves powder. These results are noticed that Damsissa leaves powder processing industries could be regarded as an excellent source of food ingredients with interesting technological functionality that could also be used in food as an important source of dietary fiber. However, Tortilla bread showed that bread containing 0.5% and 1.5% Damsissa leaves had higher dietary fiber content but lower General appearance; color (outer layer); color (inside layer); odor, Taste and overall acceptability sensory scores. Loaf texture, for tortilla bread made from 1.5% of the Damsissa leaves powder

Concerning, the General appearance; color (outer layer); color (inside layer); Area; Loaf texture and Taste of Tortilla bread there were significant differences in Tortilla bread containing 0.5%, 1.0% and 1.5% compared with control bread made from normal corn flour without any fortified with Damsissa leaves powder.

The results of tortilla bread showed that there were significant changes between control bread (100% CF) sample and tortilla bread containing (1.0% and 1.5%), Damsissa leaves powder confirmed by our results that the overall acceptability for Tortilla breads fortified with Damsissa leaves which can be a source of dietary fiber without any negative impact on sensory quality of end-products, and had good acceptance to most members compared to control bread.

**Table (8): Sensory evaluation of Tortilla Bread fortified with different ratios of Damsissa leaves powder.**

<div style="text-align: center;"> <i>Bread</i>  <i>Characters</i> </div>	<i>Treatment</i>			
	<i>Control bread</i>	<i>Bread containing 0.5 % of Damsissa</i>	<i>Bread containing 1.0 % of Damsissa</i>	<i>Bread containing 1.5 % of Damsissa</i>
<i>General appearance (15)</i>	12.13 <sup>a</sup> ±2.50	12.67 <sup>a</sup> ±1.91	10.60 <sup>b</sup> ±2.72	9.93 <sup>c</sup> ±2.33
<i>Color (outer layer) (10)</i>	9.13 <sup>a</sup> ±1.06	9.07 <sup>a</sup> ±1.03	8.13 <sup>b</sup> ±1.30	7.40 <sup>c</sup> ±1.80
<i>Color (inside layer) (10)</i>	8.80 <sup>a</sup> ±1.32	8.80 <sup>a</sup> ±1.15	8.07 <sup>a</sup> ±1.39	7.53 <sup>c</sup> ±1.68
<i>Area (10)</i>	9.47 <sup>a</sup> ±1.13	9.53 <sup>a</sup> ±1.13	8.93 <sup>b</sup> ±1.58	8.47 <sup>b</sup> ±2.03
<i>Loaf texture (15)</i>	11.67 <sup>a</sup> ±2.66	11.73 <sup>a</sup> ±2.63	10.00 <sup>b</sup> ±2.59	10.00 <sup>b</sup> ±2.05
<i>Odor (20)</i>	16.07 <sup>a</sup> ±1.99	15.73 <sup>b</sup> ±1.15	14.33 <sup>c</sup> ±1.35	13.33 <sup>d</sup> ±2.92
<i>Taste (20)</i>	18.33 <sup>a</sup> ±1.09	18.67 <sup>a</sup> ±2.44	17.87 <sup>b</sup> ±1.02	16.20 <sup>c</sup> ±2.93
<i>Over all acceptability (100)</i>	85.60	86.20	77.93	72.87

*All results are expressed as mean ± SD.*

*Values in each column which have different letters are significantly different ( $p < 0.05$ ).*

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## تدعيم خبز النخالة والتورتيللا بالدمسيسا

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الدمسيسا هي واحدة من الأعشاب الطبية التي تنمو في مصر وهي غنية بالعديد من مضادات الاكسدة. ومن خلال هذه الدراسة تم تقييم تأثير الخصائص الوظيفية لمطحون اوراق الدمسيسا المجففة على خبز النخالة وخبز التورتيللا. وتم تقييم التركيب الكيميائى ومحتوى اوراق الدمسيسا المجففة على المركبات الفينولية وجزئياتها والفلافونويدات وجزئياتها، الكلورفيل، الكاروتينات، فيتامين ج، والزيوت الطيارة، ومضادات الاكسدة النشطة.

وتم اعداد خبز النخالة المدعم بدقيق القمح ونسب مختلفة من مطحون اوراق الدمسيسا (0.5% - 1.0% - 1.5% على التوالى ) عن طريق الاستبدال الجزئى لدقيق القمح بمطحون اوراق الدمسيسا وايضا تدعيم خبز التورتيللا الذى تم صنعه من دقيق الذرة بنسب مختلفة من مطحون اوراق الدمسيسا (0.5% - 1.0% - 1.5% على التوالى ) عن طريق الاستبدال الجزئى لدقيق الذرة بمطحون اوراق الدمسيسا.

أشارت النتائج إلي عدم وجود فروق معنوية ( $P < 0.05$ ) بين كل من الخبز المدعم بنسبة 0.5% من مطحون اوراق الدمسيسا مقارنة بالعينة الضابطة بالنسبة للقبول العام . بينما الخبز المدعم بإضافة 1.0% من مطحون اوراق الدمسيسا لم يظهر له اختلاف بالنسبة للون ( $P < 0.5$ ) في الطبقات الداخلية والقشرة الخارجية والطعم مقارنة بالعينة الضابطة ( بدون تدعيم ) والخبز المدعم 0.5% من مطحون اوراق الدمسيسا. استبدال نسبه من دقيق بمطحون اوراق الدمسيسا بنسبه 1.5% ادى الى التأثير علي خصائص الخبز من حيث اللون (الطبقة الداخلية والخارجية) والملمس والتذوق وقد يكون السبب في ذلك انخفاض محتوى الجلوتين في الخبز المدعم 1.5% بالمقارنة بالخبز غير المدعم والمدعم بنسبة 1.0% .

ارتفاع نسبة محتوى الالياف فى خبز التورتيللا المدعم ب 0.5% و 1.5% من مطحون اوراق الدمسيسا ادت الى حدوث نقص فى الخواص الحسية للخبز مثل المظهر العام واللون والملمس وحجم الخبز والطعم. وبشكل قاطع ، يمكننا استخدام الدمسيسا كأعشاب طبية لتحسين نخالة الخبز وخبز التورتيللا لاستخدامها كأغذية لمرض السكري أو مرض الاضطرابات الهضمية.