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Study The Storage Quality Of Supplemented Bread With Different Levels Of Anise Powder

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ABSTRACT

This study was conducted to study the storage quality of supplemented bread with different levels of anise powder (5%, 10% and 15%) at room temperature and at the refrigerator. The control and supplemented bread were stored at the room temperature and in the refrigerator at 4 C. The mold has grown after two days at room temperature on the control bread sample, while the mold appeared on the supplemented bread with 5% anise powder after three days and the mold appeared on the supplemented bread with 10% and 15% anise powder after six and eight days of production respectively. The storage results in the refrigerator at 4 C showed that the mold grown on control bread after ten days of production, while the supplemented bread samples with 5% anise powder showed the growth of the mold and appearance of green mold in large quantities after 2 weeks, in contrast the supplemented bread samples with 10% anise powder showed the growth of the white mold in little quantities after three weeks, but the supplemented bread samples with 15% anise powder showed also the growth of white bread mold in very little quantities after 1 month of production. The results of chemical analysis showed that anise contains high protein, fat, carbohydrate, fiber, moisture and ash content (14.075 ± 0.13 , 14.325 ± 0.02 , 38.32 ± 0.03 , 16.53 ± 0.01 , 9.88 ± 0.05 and 6.87 ± 0.1), respectively, also it contains vitamin B complex (B1, B2, B5, B6), A and C vitamin, (0.332 ± 0.01 , 0.340 ± 0.04 , 2.789 ± 0.5 , 0.58 ± 0.02 , 15.56 ± 0.75 and 19.89 ± 0.12), respectively and minerals Ca, Fe, Mg, P, K, Na and Mn (42.171 ± 0.002 , 2.453 ± 0.003 , 53.432 ± 0.001 , 0.385 ± 0.001 , 536.312 ± 0.672 , 11.155 ± 0.085 and 8.981 ± 0.005), the fats content (total saturated, monounsaturated, polyunsaturated and cholesterol) in anise are (0.578 ± 0.1 , 8.985 ± 0.58 , 3.071 ± 0.1 and 0.00 ± 0.001), also anise contains essential oil such as transanethole and oleoresins, it is considered the major component in anise oil while oleic acid is considered the major compound in all the oleoresins, so anise has antioxidants properties and can be utilized for protecting fat-containing foods because of volatile oils.

Key words: Storage quality, bread, supplementation, anise seed, nutritional value of anise, antifungal, antimicrobial.

Introduction

Nature has provided an important source of medicines to cure the human diseases. In recent years, the used medicines are from natural source such as plants (**Singh, 2011**), for example, medicinal and aromatic plants are a gift of nature, and used against various infections and diseases in the world (**Lalitha et al., 2010**), also the interest of the herbs species and various plant extracts increased to use it as a replacement to medicine (**Hertrampt, 2001 and Revington, 2002 and Huyghebaert, 2003**), and used as a natural feed additives in animal diets and many studies interests in the antioxidant properties of plants (**Botsoglou et al., 2002 and Giannenas et al., 2005 and Florou-Paneri et al., 2006**). In addition to their antimicrobial activity (**Soliman and Badea, 2002 and Govaris et al., 2007 and Botsoglou et al., 2010**), Herbs formed the main source of therapeutics that has been used in the treatment of many illnesses (**Kosalec et al., 2005**). Plants extracts are considered as a potential source for bioactive compounds (**Kareydiyyeh et al., 2003**). The World Health Organization mentioned that, 80% of the earth's inhabitant's use traditional medicine and most of these medicines involves the use of plant extracts (**Ciftci et al., 2005**). Among herbs plants *Pimpinella Anisum L* (Aniseed) is called locally as aniseed and yansoon, from Apiaceae family, this family is known by its distinctive flavors, which come from essential oils and a mix of volatile fragrant compounds, the essential oil content is 1.5–5.0%, compound trans-anethole provides anise the sweet herbaceous odor and taste, anise is an annual plant indigenous to Iran, India, Turkey and Egypt and many other warm regions in the world as a medicinal plant, it has been used as stimulating effect of digestion and antiparasitic, also it is cultivated near East, and in the Mediterranean, its principal contents are volatile oil, fatty acids, coumarins, flavonoids, glycosides, proteins and carbohydrates (**Cabuk et al., 2003 and Kreydiyyeh et al., 2003 and Al Mofleh et al., 2007 and Al-Beitawi et al., 2009 and Ullah and Honermeier 2013 and Hussain et al., 2014 and Al-Juhaimi, 2014**). Anise contains 2-6% essential oils, phenolic acids, eugenol, estragole and transanethole – a powerful phytoestrogen which is the main component of the oil 80-95% (**Gulcin et al., 2003 and Franz et al., 2005**). Aniseed oil is used as antioxidants and antispasmodic (**Bown, 2001 and Kreydiyyeh et al., 2003 and Gulcin et al., 2003 and**

Giannenas et al, 2005 and Florou-Paneri et al, 2006 and Tirapelli et al., 2007 and Rajeshwari et al., 2011), it has anti-microbial properties such as *Escherichia coli* NCTC 5933 and *Staphylococcus aureus* NCTC6571 (**Minakshi et al, 2002 and Al-Kassie, 2008 and Toroglu, 2011 and Fatima et al, 2015**), antibacterial properties (**Singh et al., 2002 and Tabanca et al., 2003**) and antifungal properties (**Soliman and Badea, 2002**), because of these properties it used as natural food conservatives (**Milica et al, 2015**), also the study of (**Mehmet Musa Özcan and Jean Claude Chalchat, 2006**) about Chemical composition and antifungal effect of anise (*Pimpinella Anisum* L.) fruit oil at ripening stage, the results showed that anise oil serves the food against fungi and provides adequate shelf life of foods because the chemicals analysis showed that anise consists of major components as transeanethole (94.37%), methyl chevicol (1.82%) and cis anethole (1.59%). 15 components were identified from its acetone extract, accounting about 80.27% of the total amount. trans-Anethole (51.81%) was found as a major component along with linoleic acid (11.6%), 1-(4-methoxyphenyl)-prop-2-one (6.71%), foeniculin (5.29%) and palmitic acid (1.47%), the volatile oil has an effect for controlling the growth of *Aspergillus Niger* and *Aspergillus Flavus* (**Gurdip singh et al, 2006**), also anise oil inhibited production of aflatoxins, Ochratoxin A and Fumusin in inoculated wheat samples (**Soliman and Badeaa, 2002**). Anise has characteristic digestive stimulant, galactogogue (**Gulcin et al, 2003**), also some studies indicated that consumption of spices associate in lowering the incidence of cancer (**Bertuccio et al, 2009 and Zaid et al, 2010**) and (**Kadan et al., 2013 and Sleman Kadan et al, 2013**) studied anticancer activity of anise (*Pimpinella Anisum* L.) seed extract, they mentioned that anise could be one of the foods that attribute to cancer prevention and treatment and it is used as a natural source of anticancer compounds. Also anise has health benefits of diabetic patients, aniseeds showed hypoglycemic and hypolipidemic effect , reduce lipid peroxidation and effects on cancer cells , also anise seeds used as functional foods which contain many active phytochemicals which it have effect on the human health (**Asie Shojaii and Mehri Abdollahi Fard, 2012 and Nguyen et al., 2014 and Milica et al, 2015**). (**Vittorio Silano and Gioacchino Calapai, 2006**) mentioned that the medicinal use of aniseed is due to antispasmodic, secretolytic,

secretomotor and antibacterial effects of its essential oil. In the food industry, anise is used in cooking and also as flavoring in candies or sweets, gums and as a flavoring and aromatic agent for fish products, ice cream and as dietary supplements (**De et al, 2001 and Özcan and Chalchat, 2006 and Salehi Surmaghi, 2010 and Milica et al, 2015**). Also anise has clinical properties of stomach problems solving by increasing secretion of the salivary glands, reducing the acidity of gastric juice, a laxative effect, a positive effect on the liver function, an effect on the nervous system, an impact on microorganisms that cause many diseases and it has a successful effects against bacteria and fungi (**Atapour et al., 2009 and Shojaii and Fard 2012 and Zaidi et al., 2012**), and (**Shaffie et al., 2010 and Asie Shojaii and Mehri Abdollahi Fard, 2012 and Shobha et al., 2013**) studied the pharmacological properties and chemical constituents of *Pimpinella Anisum* for example, in diabetic patients, aniseeds showed hypoglycemic and hypolipidemic effect and reduce lipid peroxidation, This could be due to the effect of increasing pancreatic secretion of insulin. The composition of anise varies considerably with origin and cultivation method, it contains moisture from 9-13%, Protein 18%, Fatty oil from 8-23%, Essential oil from 2-7%. Starch 5%, N-free extract from 22-28%, Crude fiber from 12-25% (**Pruthi, 1976**). According to (**El rasheed Ahmed Salem et al, 2016**) investigated the histology, Phytochemistry and bacterial activity of anise (*Pimpinella Anisum l.*) seed and essential oil, the phytochemical investigation of anise showed that moisture content was (6.7%) and oil content was (1.5 % v/w) and the microbiological activities of anise oil was against *Staphylococcus Aureus*, *Klebsiella Pneumoniae* and *Pseudomonas Aeruginosa* showed moderate antibacterial effect. And (**Der Marderosian and Beutler, 2002 and Madhu et al, 2014**) investigates the phytochemicals and mineral contents using hydro extract in anise. Hydro extracts showing presence of phytochemicals alkaloids, phenols, flavonoids and steroids. Proximate study showed the presence of protein, fat, ash , carbohydrates, moisture and fiber (4.25 % , 7.65%, 2.87%, 75.01, 10.22 and 11.12), respectively; also the presence of ash percentage highlights is considered a good percentage of minerals presented in anise (Ca 43.280 , Cu 2.594 , Fe 2.564 , Mg 55.543 , Mn 9.892 , P 0.397 , K 540.333 , Na 12.166 , Zn <0.001 , Cr 0.101 , Cd <0.001 , Ni 0.235 , Se <0.001) mg/100g, respectively. This search

carried out using anise seeds in supplement the bread because it is the main food for consumer in different parts of the World; it contains a high percentage of carbohydrate and fat to produce energy and other nutrients as vitamins, minerals and protein. Recently, interesting is increased with development of food products like bread by using wastes to supply it with different flavors (**McKee and Latner, 2000 and Young, 2001 and Zhou and Therdthai 2006**), which increase the consumption of bakery products (**Miller and Young, 2006**), The objective of supplementing bread is to improve the nutritional value of proteins, minerals, vitamins and dietary fiber (**Hallen *et al*, 2004**). Bakery products include muffin, biscuit, cake, bread, pies and pastries, which contains different amounts of flours and mixed with various ingredients, and then it is baked in the oven (**Cauvain & Young 2007**). Bread is produced mainly from wheat flour, water, yeast, and salt by processes involving mixing, kneading, proofing, shaping, and baking (**Kent and Amos, 2004 and Osuji *et al*, 2006 and Dewettinck *et al*, 2008**), because the majority of bakery products have high content in carbohydrate, fat and calorie and low in fiber content (**Mishra and Chandra, 2012**), so this research carried out to study the storage quality of supplemented bread with different levels of anise powder.

Materials and Methods

This research was carried out at Economics Department, Faculty of Specific Education, Fayoum University, to investigate the storage effect on supplemented bread with different levels of anise seed at room temperature and cooling in the refrigerator at temperature 4° C. Wheat flour, salt and yeast purchased from a local supermarket in Cairo. Sensory evaluation of control bread and supplemented bread with different levels of anise seeds are given in Table 2.

Preparation Of Anise:

Anise seeds were purchased from a local supermarket in Cairo; the seeds of anise were cleaned by using distilled water, dried in air and grinded by using electrical blender to get up powder, and then sifted through a 40-mesh sieve, the seeds powder were kept in airtight glass jar until required.

Preparation Of The Blends:

Wheat flour was supplemented with anise powder with (0%, 5%, 10% and 15%), and mixed well to achieve uniformity of flour blends.

Preparation Of Anise Bread:

The ingredients were weighed and the yeast was activated in warm water at temperature (37° C), control dough formatted by adding 100 g wheat flour extraction (70-72%), salt (1.5 g), powder yeast (3g) and the amount of water. The flour, salt, anise, active yeast, and water were optimally mixed in a vessel for 5 min in a mixer (Kitchen machine). The dough was left for 15 min to relieve the stress during mixing, The dough was left at 37° C for fermentation for (1 hour), then the bread was formed and left to fermentation again for (20 min), then it was baked in electric oven at 250° C for 20-25 min according to (Oladunmoye *et al*, 2010) method. After the baking, the bread was left to cool at temperature room, and then the bread was divided to two groups, the first group (bread control and supplemented bread 5%, 10% and 15%) was stored at room temperature and the second group (bread control and supplemented bread 5%, 10% and 15%) was stored in the refrigerator at temperature 4° C, where the bread was observed daily in the fridge until the appearance of mold.

Table (1): The Components Of Bread Dough Preparation

Ingredient	Control	5%	10%	15%
Wheat flour (g)	100	95	90	85
Anise (g)	0	5	10	15
Water (ml)	50	64	72	80
Sugar (g)	10	10	10	10
Yeast (g)	3	3	3	3
Salt (g)	1.5	1.5	1.5	1.5

Chemical Composition Analysis Of Anise:

Anise is consisted of compounds identified in essential oils obtained by steam distillation, such as, Trans-anethole (76.7- 93.0%), Estragole (0.5- 6.1%), Anisaldehyde (0.1- 3.5%), Linalol (0.1- 1.5%), Alpha-terpineol (0.1-1.5%), Cis-anethole (< 0.5%), this method was characterized by (Kreydiyyeh *et al*, 2003 and Arslan *et al*, 2004). Table 2 shows the chemical composition of anise performed according to (AOAC, 2005).

Sensory Evaluation Of Bread Samples:

Sensory evaluation of supplemented bread with different levels (5%, 10% and 15%) of anise powder and control sample. Sensory evaluation of bread samples was carried out by 30 persons, using a 9-point hedonic scale (1 =dislike extremely, 2= dislike very much, 3=

dislike moderately, 4 =dislike slightly, 5 =neither like nor dislike, 6 =like slightly, 7= like moderately, 8 =like very much and 9 =like extremely) as described by (Meilgaard *et al*, 2007), and Scores were collated and analyzed statistically.

Study Sample:

Control bread samples and supplemented stored at room temperature and 4° C in the fridge .

The control bread sample which stored at room temperature showed the appearance of mold after two days, but when the same sample stored at 4° C the mold appeared after 10 days. The supplemented bread with (5%) anise powder showed the appearance of mold after three days at room temperature while the green mold appeared after 2 weeks when it stored at 4° C. The supplemented bread with (10%) anise powder showed the mold after 6 days, but when stored at 4° C the white mold appeared after 3 weeks in little quantities, and the supplemented bread with (15%) anise powder showed the appearance of mold after 8 days, but when stored at 4° C the white mold appeared after 1 month in very little quantities.

Statistical Analysis Of Data:

The data was subjected to ANOVA using randomized complete block design with statistical analyses system Anova procedure. (Püskülcü and I, kiz, 1989)

Results and Discussion:

Sensory Evaluation Means Of Supplemented Bread With Different Levels Of Anise Powder.

Table (2) shows the sensory evaluation of supplemented bread with different levels of anise powder, it shows that all supplement bread with anise was acceptable in sensory evaluation (taste, color, flavor, texture and overall acceptability) compared to the control bread, but the best results showed in the supplemented bread with low level 5% of anise powder (10, 10, 9.9, 10 and 9.98) compared to the control (9.8, 9.9, 9.7, 9.7, 9.78). These results agreed with (El Deek *et al*, 2003 and Ciftci *et al*, 2005 and Al Kassie 2008 and Soltan *etal*, 2008 and Al-Beitawi *et al*, 2009), These studies tested different levels of anise seeds powder added to the diet and (Mišan *et al*, 2009 and Psodorov *et al*, 2007) mentioned that Apiaceae seeds are used in products such as bread, cookies and biscuits and not affect the sensory quality but it provide a

specific aroma of the product . According to (Milica *et al*, 2015) who studied the medicinal uses and bioactive properties of selected plants from Apiaceae family such as anise seeds as functional foods and supplemented dietary in foods and as natural health foods treat of many diseases such as inflammations, hyperglycemia, hyperlipidemia .

Table (2): Sensory Evaluation Means Of Supplemented Bread With Different Levels Of Anise powder.

Bread samples Sensory evaluation	Control bread	Supplemented bread with anise powder		
		5%	10%	15%
Taste	9.8	10	9.7	8.7
Color	9.9	10	9.6	8.6
Flavor	9.7	9.9	9.6	8.7
Texture	9.7	10	9.5	8.5
Overall acceptability	9.78	9.98	9.6	8.63

Chemical composition analysis of wheat flour and anise.

Data presented in Table (3): Shows the chemical composition analysis of anise and wheat flour. The levels of protein, fat, carbohydrates, fiber, moisture and ash in anise were (14.075±0.13, 14.325± 0.02, 38.32±0.03, 16.53±0.01, 9.88 ±0.05 and 6.87±0.1), respectively, these results agreed with (Christaki *et al*, 2011 and Madhu *et al*, 2014 and USDA, 2016), while the chemical analysis of wheat flour showed a decreasing in the levels of protein, fat, fiber and ash (12.04±0.1, 1.71±0.03, 2.67±0.15 and 0.76±0.3), respectively, but the level of carbohydrate is high (70.23±0.31) compared to anise powder (38.32±0.03), these results agreed with (Anil, 2007).Also according to (Aćimović, 2013 and Aćimović *et al.*, 2015) who said that the Plants from Apiaceae family are rich in fatty oil, proteins, crude carbohydrates and essential oil.

Table (3): Chemical Composition Analysis Of wheat Flour And Anise:

Nutrients	Wheat flour g/100g M±SD	Anise g/100 g
Protein	12.04±0.1	14.075±0.13
Fat	1.71±0.03	14.325± 0.02
Carbohydrate	70.23±0.31	38.32±0.03
Fiber	2.67±0.15	16.53±0.01
Moisture	12.59±0.25	9.88 ±0.05
Ash	0.76±0.3	6.87±0.1

Chemical Composition Of Vitamins And Minerals In Anise.

Data in Table 4 shows vitamins and minerals content in anise. The vitamins content C, B5, B6, Folate, A, B1 and B2 were (19.89±0.12, 2.789±0.5, 0.58±0.02, 11.12±0.35, 15.56±0.75, 0.332±0.01 and 0.340±0.04), respectively, these results agreed with (Madhu *et al*, 2014). Also the values of minerals Ca, Fe, Mg, P, K, Na and Mn were (42.171±0.002, 2.453 ±0.003, 53.432±0.001, 0.385±0.001, 536.312±0.672, 11.155±0.085 and 8.981±0.005), respectively, agreed with (USDA, 2016)

Table (4): Chemical Composition Of Vitamins And Minerals In Anise:

Vitamins/ 100g	Values	Minerals mg/ 100g	Values
Vit. C mg	19.89±0.12	Ca	42.171±0.002
Vit. B5 mg	2.789±0.5	Fe	2.453 ±0.003
Vit. B6 mg	0.58±0.02	Mg	53.432±0.001
Folate, DFE µg	11.12±0.35	P	0.385±0.001
Vit. A RAE µg	15.56±0.75	K	536.312±0.672
Vit. B1 mg	0.332±0.01	Na	11.155±0.085
Vit. B2 mg	0.340±0.04	Mn	8.981±0.005

Lipids Content In Anise.

Lipids content in Anise powder is shown in Table 5. The obtained results showed that the values of total saturated fat, total monounsaturated fat, total polyunsaturated fat and cholesterol were (0.578±0.1, 8.985±0.58, 3.071±0.1 and 0.001±0.00), respectively. These results agreed with (USDA, 2016).

Table: (5) Lipids Content In Anise

Lipids/ 100g	Values
Fatty acids, total saturated /g	0.578±0.1
Fatty acids, total monounsaturated /g	8.985±0.58
Fatty acids, total polyunsaturated /g	3.071±0.1
Cholesterol /mg	0.00±0.001

Storage Condition Of Control Bread Samples And Supplemented At Room Temperature And In The Refrigerator At 4° C.

Data in Table 6: shows the storage condition of control bread samples and supplemented at room temperature and in the refrigerator at 4° C. The control bread stored at room temperature showed the growth of mold after two days of production, but the control bread which stored at the refrigerator at 4° C showed the growth of mold after ten days of production. In contrast the supplemented bread with (5%, 10% and 15%) showed different results, the supplemented bread with 5% anise stored at room temperature showed the growth of mold after three days of production, in contrast with the stored bread in the refrigerator at 4° C showed the growth of green mold after two weeks of production in large quantities. The supplemented bread with 10% anise which stored at room temperature showed the growth of mold after six days of production, but the stored bread in the refrigerator at 4° C showed the growth of white bread mold in small quantities after three weeks of production. The supplemented bread with 15% anise stored at room temperature showed the growth of mold after eight days of production, but the stored bread in the refrigerator at 4° C showed the growth of white bread mold in very small quantities after one month of production. The best results to protect the bread of microorganism appeared in the supplemented bread with 15 % anise powder. These results agreed with **(El rasheed Ahmed Salem et al, 2016)** who investigated the histology, photochemistry and bacterial activity of anise (*Pimpinella Anisum l.*) seed and essential oil, the results showed antibacterial effect and microbiological activities of anise oil against *Staphylococcus Aureus*, *Klebsiella Pneumoniae* and *Pseudomonas Aeruginosa*, also the study of **(Soliman and Badea, 2002 and Gulcin et al, 2003 and Tabanca et al., 2003 and Amin, 2005 and Asie Shojaii and Mehri Abdollahi Fard, 2012)** about the pharmacological properties and chemical constituents of *Pimpinella Anisum*, they mentioned that there are different studies were performed on anise seeds, it has various properties like antimicrobial, antibacterial, antifungal, antiviral, antioxidant, addition to the star anise

and anise have been used widely in Iranian traditional medicine because of its antimicrobial effects , also (Kabić *et al*, 2008) said that spices and herbs have been added to food not only as flavoring, but also as food preservatives. According to the study of (Arora and Kaur, 1999) reported that the phytochemical studies of anise oil is important for quality control and assurance and could be use the essential oil for medicinal and food purposes, also they reported that some spices have bactericidal or bacteriostatic activities and the inhibitory effects of spices are due to the volatile oils present in their composition.(Yazdani *et al*, 2009) studied the antifungal activity of dried extracts of anise (*Pimpinella Anisum L.*) and star anise (*Illicium verum Hook. f.*) against dermatophyte and saprophyte fungi, the results were the extracts of anise seeds inhibited only dermatophyte species, while extracts of star anise fruits inhibited growth of all dermatophytes and saprophytes, and these plants can be used for a number of studies due to their antifungal potencies.

Table (6): Storage Condition Of Control Bread Samples And Supplemented At Room Temperature And In The Refrigerator At 4° C.

Storage temperature Samples	Room temperature	4° C in the refrigerator
Control bread	The growth of bread mold after 2 days of production.	The growth of bread mold after 10 days of production.
Supplemented bread with 5% anise	The growth of bread mold after 3 days of production.	The growth of bread mold after 2 weeks of production with appearance the green mold in large quantities.
Supplemented bread with 10% anise	The growth of bread mold after 6 days of production.	The growth of white bread mold in small quantities after 3 weeks of production.
Supplemented bread with 15% anise	The growth of bread mold after 8 days of production.	The growth of white bread mold in very small quantities after 1 month of production.

Conclusion

In this study, wheat flour (WF) was replaced with Anise powder (AP) to make anise bread to produce bread with acceptable quality composite flours containing anise to use at industrial scale. Data of the present study indicated that supplemented bread with different levels of anise (5%, 10% and 15%) were delayed the appearance of the mold in the bread until a month from the date of production and showed that there was a significant improvement in the storage properties, nutritional value quality and gave products with high levels of protein, fat, fiber, ash and mineral, also it was acceptable to the consumers. In addition to antibacterial activity, the essential oil of aniseed showed significant inhibitory activity against fungi because of the active component (anethole). Generally, the addition of anise increases antioxidant activity. In this study, the supplementation of bread with different levels of anise powder improve the storage properties and decrease the growth of mold.

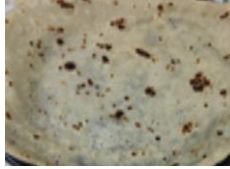
Recommendation:

This search was carried out to recommend by

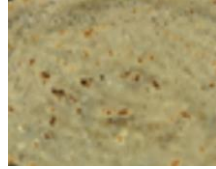
- 1- Addition the anise powder to bread increases the period of bread preservation and storage quality.
- 2-Addition anise powder to bakery products against the growth microorganisms as mold and fungi.
- 3- It is recommended to use the supplemented bread with anise powder for diabetics.

Bread samples:

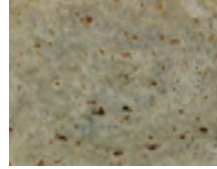
Bread samples (control and supplemented)



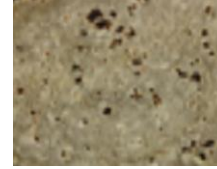
Bread control



Bread with 5% anise powder



Bread with 10% anise powder



Bread with 15% anise powder

Stored control and supplemented bread samples at room temperature.



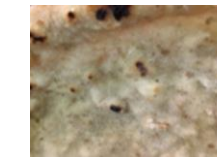
Control bread stored for 2 days.



Bread with 5% anise powder stored for 3 days.



Bread with 10% anise powder stored for 6 days.



Bread with 15% anise powder stored for 8 days.

Stored control and supplemented bread samples in the refrigerator at 4° C for 15 days



Control bread.



Bread with 5% anise powder.



Bread with 10% anise powder.



Bread with 15% anise powder.

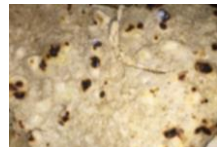
Stored control and supplemented bread samples in the refrigerator at 4° C for 21 days



Control bread



Bread with 5% anise powder



Bread with 10% anise powder

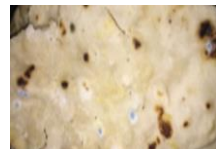


Bread with 15% anise powder

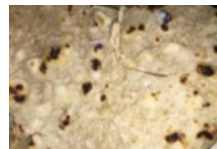
Stored control and supplemented bread samples in the refrigerator at 4° C for 30 days.



Control bread after 10 days.



Bread with 5% anise powder after 2 weeks.



Bread with 10% anise powder after 3 week



Bread with 15% anise powder after 1 month.

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دراسة الجودة التخزينية للخبز المدعم بمستويات مختلفة من مسحوق الياغسون

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الملخص العربي

نفذ هذ البحث لدراسة الجودة التخزينية للخبز المدعم بمستويات مختلفة من مسحوق الياغسون 5%، 10% و 15% على درجتى حرارة الغرفة والثلاجة، حيث تم تخزين عينة الخبز الضابطة والعينات المدعمة على درجة حرارة الغرفة وفي الثلاجة على درجة حرارة 4 درجة مئوية، وأوضحت نتائج التخزين على درجة حرارة الغرفة نمو العفن على عينة الخبز الضابطة بعد يومين من الانتاج، كما ظهر العفن على الخبز المدعم بمستوى 5% مسحوق الياغسون بعد ثلاثة أيام وأيضاً ظهور العفن على الخبز المدعم بمستوى 10% و 15% مسحوق الياغسون بعد ستة وثمانية أيام من الانتاج على التوالي، بينما أوضحت نتائج التخزين فى الثلاجة على درجة حرارة 4 درجة مئوية لعينات الخبز نمو العفن على عينة الخبز الضابطة بعد عشر أيام من الانتاج، فى حين أن عينة الخبز المدعمة بمستوى 5% مسحوق الياغسون ظهر عليها العفن ذات اللون الأخضر بعد أسبوعين، على عكس عينة الخبز المدعمة بمستوى 10% مسحوق الياغسون أوضحت نمو العفن ذات اللون الأبيض بكمية قليلة بعد ثلاثة أسابيع، لكن عينة الخبز المدعمة بمستوى 15% مسحوق الياغسون أوضحت نمو العفن ذات اللون الأبيض بكمية قليلة جداً بعد شهر من الانتاج، كما أوضحت نتائج التحليل الكيمائى أن الياغسون يحتوى على محتوى عالى من البروتين، كما يحتوى على الدهن، الكربوهيدرات، الألياف، الرطوبة و الرماد على التوالي 14.075، 14.325، 38.32، 16.53، 9.88 و 6.87، فيتامين ب المركب (ب1، ب2، ب5 و ب6)، فيتامين أ و ج على التوالي 0.332، 0.340، 2.789، 0.58، 15.56 و 19.89، معادن الكالسيوم، الحديد، الماغنسيوم، الفوسفور، البوتاسيوم، الصوديوم والمنجنيز على التوالي 42.171، 2.453، 0.385، 53.432، 536.312، 11.155 و 8.981، دهون (الدهون المشبعة الكلية، الدهون قليلة عدم التشبع، الدهون عديدة عدم التشبع و الكوليسترول) على التوالي 0.578، 8.985، 3.071 و 0.00، أيضاً يحتوى الياغسون على زيوت أساسية مثل الترانس أنيثول و الأوليوريسنس، كما يوجد مركبات أساسية فى الياغسون منها حمض الأوليك الذى يعتبر المكون الأساسى فى الأوليوريسنس، لذا يتميز الياغسون بخواص مضادة للأكسدة، كما يمكن استخدامه كمضاد للأحياء الدقيقة كالعفن، وذلك بسبب محتواه المرتفع من الزيوت الطيارة.

الكلمات المفتاحية: الجودة التخزينية، الخبز، التدعيم، القيمة الغذائية للياغسون، مضاد للعفن، مضاد للميكروبات.