

Using Lemongrass in Functional Food Production

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ABSTRACT

Children suffer from malnutrition and mineral deficiency, which leads to many diseases, the most important of which is a lack of growth and concentration. Children love cookies because they are easy to carry as a daily breakfast in schools. Therefore, we tried to fortify the cookies with lemongrass because of its health benefits, it contains 1607.545 (mg GAE/100 g) phenols, which can fight free radicals resulting from exposure to various types of environmental pollution. A percentage of crude fibers, protein and carbohydrates were 27.38%, 7.92% and carbohydrates 53.68%, respectively.

Or

A percentage of crude fibers 27.38%, protein 7.92% and carbohydrates 53.68%.

Lemongrass contains many minerals, of which are aluminum 95.75 mg/100 g, calcium 804.5 mg/100 g, copper 18.76 mg/100 g, iron 71.54 mg/100 g, magnesium of 267.7 mg/100 g, manganese 4.5 mg/100 g, silicon 89.61 mg/100 g, strontium 8.55 mg/100 g, and zinc 11.78 mg /100 g. The sensory evaluation of prepared cookies was evaluated in terms of its sensory properties. The results showed that adding the following concentrations of lemongrass powder at 5%, 10% and 15% and comparing them with the control improved the flavor. That is the general approval of the arbitrators for the control, then the concentration of 5%, then 10%, then 15%, respectively.

Keywords: Lemongrass, total phenols, minerals, cookies.

INTRODUCTION

Humans are constantly exposed to a complex blend of toxicants and carcinogens. Neutralization of such substances is a basic hepatic function, during which large amounts of reactive oxygen intermediates are produced. Natural compounds with antioxidant properties can scavenge the free radicals which damage lipids, proteins, cell membranes and DNA. Removal of free radicals could prevent the development of such diseases (Stavric, 1994). Frequent consumption of fruits and vegetables reduces the risk of chronic diseases due to their high contents of dietary fibers and functional compounds (Larrauri, 1999).

Cymbopogon citrates known as lemongrass from the family Poaceae, an evergreen herb, is native to South India and Sri Lanka (Ravinder *et al.*, 2010), and now is

cultivated all over the world. Lemon grass contains essential oils, phenolic compounds, flavonoids and citral, which are used in medicine as antioxidants character, anti-inflammatory effects, antibacterial, anti-fungal, and anti-diarrheal (Blanco *et al.*, 2009; Sforcin *et al.*, 2009; Ranade and Thiagarajan, 2015).

Members of the Cymbopogon genus produce volatile oils and also are known as aromatic grasses (Kumar *et al.*, 2009 and Adhikari *et al.*, 2013). Adding lemongrass powder to cookies is a better way to provide nutritional differ from other baked products such as bread and cakes because they have low moisture content which ensures comparatively free from microbial spoilage and the result is the long shelf life of the product (Wade, 1988). Lemongrass is famous for its medicinal effect, nutritional value and flavoring industry. People prefer powder-dried leaves to fresh ones because their shelf life is longer and suitable to prepare cookies in rural and urban areas for people of all ages (Thorat *et al.*, 2017).

Despite the health benefits of lemongrass, the present study was conducted to investigate the properties of lemongrass and its utilization for preparing and evaluating cookies as a functional food.

MATERIAL AND METHODS

Materials

Lemongrass Sample preparation

Lemongrass was cultivated at Mariout Research Station in Alexandria, the Desert Research Center, Arab Republic of Egypt, and a quantity of about 20 kg was collected., cleaned, washed several times with tap water followed with rinsing with distilled water, and then cutten into small pieces, and dried in an air electric oven at 60 °C for 48 h. The dehydrated lemongrass was ground using a laboratory grinder (Moulinex- AR1044), sieved through 60 mesh sieves, packed in bags and stored in a deep freezer at -18°C for analysis.

Cookies ingredients

Wheat flour (72% extraction ratio), powdered sugar, shortening, baking powder, salt and vanilla were all purchased from Fathallah markets in Alexandria, Egypt.

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Table 1. The cookies formula prepared using different treatments

Component (g)	Control	Powder LG 5%	Powder LG 10%	Powder LG 15%
Wheat flour	200	190	180	170
Lemongrass	0	10	20	30
Sugar powder	50	50	50	50
Whole egg	100	100	100	100
Shortening	100	100	100	100
Baking powder	10	10	10	10
Vanillin	1	1	1	1
Salt	1	1	1	1

LG: Lemongrass

Analytical methods

All tests were done in triplicate and the results are represented on a dry weight basis.

Proximate chemical analysis

Proximate chemical composition including moisture, crude ether extract, crude protein (N*6.25), crude fiber and total ash were determined according to the AOAC (2000) methods unless otherwise stated. Total carbohydrate was calculated by difference (by subtracting the sum of crude ether extract, crude protein and total ash contents from 100).

Total polyphenols analysis

Total polyphenol contents (TPC) of lemongrass samples was determined using a modified Folin-Ciocalteu colorimetric method at 765 nm (UV-Vis spectrophotometer, Jenway, Staffordshire, UK) as described by Gao *et al.* (2000). The total phenolics content was expressed as mg gallic acid equivalent per 100g of sample from the calibration curve of gallic acid.

Minerals analysis

Minerals (Ca, Mg, Mn, Fe, Zn and Cu) were determined in dried lemongrass powder by mixing 0.2 gm sample. with 9ml concentrated nitric acid +1ml hydrogen peroxide in a vessel., closed and, put it in a digestion microwave for 2 h. Cooled and diluted to 25 ml using distilled water. The minerals were determined using Inductive Coupled Argon Plasma iCAP 6500 Duo, Thermo Scientific, England. 1000mg/L multi-element certified standard solution, Merck, Germany was used as stock solution for instrument standardization.

pH value determination:

The pH value was measured using a Systronic 324-combination glass electrode pH meter at 25°C, 5 grams sample of dried lemongrass powder was mixed with 95ml distilled water and left for 10 minutes before the determination of the pH.

Technological methods:

Cookies preparation

The butter and powdered sugar were mixed in a bowl then the egg and vanilla were added and mixed again for two minutes. The baking powder was added to the flour and lemongrass of 0%, 5%, 10%, and 15%. The flour and lemongrass mixture was added to the butter and sugar mixture and formulated after homogenization then baked for 20 minutes at 180 °C (Table 1).

Sensory evaluation:

Color, odor, taste, texture and overall acceptability of cookies were assessed using 10 panelists. Cookie samples of different treatments were subjected to sensory evaluation at the same time according to the method described by Hooda and Jood (2005). The panelists were asked to score the above attributes according to a standard hedonic rating scale from (like extremely) to 1 (dislike extremely).

Statistical analysis:

The data of organoleptic properties were analyzed by using analysis of variance (ANOVA) using IBM SPSS software package versions 20.0. Standard deviations of the mean values were calculated for each test and treatment. The values were also compared for the significant difference using least significant Difference (LSD) at $P \geq 0.05$ according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Chemical composition and mineral contents of lemongrass:

The results in Table (2) show that dry matters, ash and value of pH for lemongrass sample were 90.57%, 7.98%, and 6.94 respectively. Total Carbohydrate, Crude fiber, crude protein and ether extract were 53.68 %, 27.38 %, 7.92 %, and 3.04 % on a dry weight basis. These results are in agreement with those reported by Shruti and Thiagarajan (2015); Thorat *et al.* (2017);

Naguib (2002) and Omer *et al.* (2010). The obtained results indicated that the total phenols of dried leave of lemongrass were 1607.55 mg GAE/100 g (gallic acid equivalents per100g) which agrees with Yoo *et al.* (2008) but was not in agreement with Assous *et al.* (2013) who reported phenol concentration of 3760 mg GAE/100 g on a dry weight basis.

Table 2. Proximate analysis, total phenols and pH value of powdered lemongrass on a dry weight basis

Components (%)	Value*
Total ash	7.98±0.27
Crude Ether extract	3.04±0.003
Crude protein	7.92
Crude fiber	27.38±0.14
Total Carbohydrates**	53.68
Total phenols (mg GAE/100g)	1607.55
Dry matters	6.94±0.08
pH value	

**calculated by difference *Mean of three replicates ±SD

Table (3) shows that Lemongrass powder contains 95.75 (mg/100 g) aluminum, which is used medically to stop bleeding and treat stomach ulcers 18.76 (mg/100g) copper, 804.5 (mg/100 g) calcium, which is necessary for building bones and maintaining their strength. 71.54 (mg/100 g) irons which is included in the formation of hemoglobin protein, which is responsible for transporting oxygen to all cells of the body, and 89.61 (mg/100 g) silicon. Silicon is essential for normal growth. Silicon protects against atherosclerosis in human. The results reported about the nutritional content of lemongrass here agreed with the results published by Shruti and Thiagarajan (2015), but did not agree in regard to mineral content because they reported 39.5 mg/100 g for calcium, 0.024 mg/100 g for iron, 70 mg/100 g for magnesium, 0.952 mg/100 g for manganese and 121 mg/100 g for zinc but our results in

the Table (3) for mineral content show that calcium was 804.5 mg/100 g, iron was 71.54 mg/100 g, magnesium was 267.70 mg/100g, which helps maintain the proper functioning of muscles and nerves, maintain a stable heart rate, support the proper functioning of the immune system, as well as in building bones. Manganese was 4.5 mg/100 g and zinc was 11.78 mg/100 g.

Table 3. Some Mineral content in Lemongrass powder

Element	mg/100 g
Calcium	804.50
Magnesium	267.70
Iron	71.54
Copper	18.76
Manganese	4.50
Zinc	11.78
Aluminium	95.75
Silicon	89.61
Strontium	8.55

Sensory evaluation of cookies supplemented with different levels of lemongrass powder.

The sensory evaluation of cookies supplemented with lemongrass powder is presented in Table (4). The results of sensory evaluation revealed a improvement in the odor, taste, texture, and overall acceptability of cookies supplemented with 5%, 10% and 15% dried lemongrass powder relative to the control.

The control scored the highest for different tested properties. However, the supplemented cookies with 5% were the second one, the cookies with 10% supplement came the third and the last one was the 15% supplement. This result may be due to color property because increasing the concentration gave darker color cookies which affect the acceptability of cookies.

Table 4. Sensory evaluation of cookies supplement with different levels of lemongrass powder

Treatment	Color	Odor	Taste	Texture	Overall acceptability
Control	9.45±0.68	9.4±0.69	9.6±0.69	9.1±0.87	9.5±0.70
5% Powder	8.0±1.58	8.25±1.47	8.35±1.59	8.1±1.91	8.3±1.70
10% Powder	6.9±1.85	7.1±1.79	7.0±1.90	7.55±1.95	7.26±2.11
15% Powder	6.3±2.21	6.3±2.71	7.1±2.51	6.4±2.06	6.26±2.19

Results are expressed as mean values ±standard deviations.

CONCLUSION

Cymbopogon (lemongrass) cookies have great therapeutic activities and are a lot of bioactive, so their food application is important to boost the immune system of the human body. Cookies fortified with lemongrass are rich in antioxidants phenols who capture free radicals coming from chemical pollutants surrounding children. Lemongrass contains fibers who decrease constipation, LG has lots of minerals such as calcium who is necessary in building bones and maintaining their strength, Iron who is essential in forming hemoglobin protein responsible for transporting oxygen to all cells of the body, aluminum which is required medically to stop bleeding and treat stomach ulcers, silicon is essential for normal growth and protects against atherosclerosis in human, Strontium is similar to calcium, It plays a role in how body makes new bone while it slows the breakdown of old bone. That means it affect how strong bones are. Some women with osteoporosis may not absorb strontium as they should. Consequently, lemongrass is needed to increase the defense of human bodies & eliminate using synthetic chemical flavor who are extremely toxic.

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الملخص العربي

استخدام حشيشة الليمون في إنتاج غذاء وظيفي

شرين شوقي فياض ، محمد عماد نصر

والمغنسيوم بنسبة ٢٦٧,٧ ملجم / ١٠٠ جم و المنجنيز بنسبة ٤,٥ ملجم / ١٠٠ جم و السيليكون بنسبة ٨٩,٦١ ملجم / ١٠٠ جم و عنصر St (السترونشيوم) بنسبة ٨,٥٥ و الزنك بنسبة ١١,٧٨ ملجم / ١٠٠ جم. تم اجراء التقييم الحسي للكوكيز من قبل ١٠ محكمين . و قد قيم المنتج من حيث خواصه الحسية التي تشمل اللون، الطعم و القوام والرائحة وكذلك التقبل العام و أوضحت النتائج أن إضافه لمنتج من بودره حشيشه الليمون بنسبة ٥% و ١٠% و ١٥% و مقارنتها بالكنترول لتحسين النكهه، نتج عن ذلك الاستحسان العام للمحكمين للكنترول ثم تركيز ٥% ثم ١٠ % ثم ١٥ % علي التوالي.

الكلمات المفتاحية: حشيشه الليمون، التركيب الكيميائي، الفينول، كوكيز.

يعاني كثير من الأطفال من سوء التغذية و نقص المعادن مما يؤدي لكثير من الأمراض أهمها نقص النمو وقله التركيز كما انهم يفضلون الكوكيز لسهوله حملها كإفطار يومي في المدارس. لذلك حاولنا تدعيم الكوكيز بنبات حشيشه الليمون المعروف برائحته الذكيه مثل نكهه الليمون و كذلك له فوائد صحيه كثيرة كمضاد أكسده و يحتوي علي نسبة فينولات ١٦٠٧,٥٥ ملجم / ١٠٠ جم تستطيع محاربه الشقوق الحرة الناتجة عن التعرض لمختلف أنواع التلوث البيئي و نسبة الياف خام ٢٧,٣٨% تمكن الجسم من محاربه الامساك و نسبة بروتين ٧,٩٢% و نسبة كربوهيدرات ٥٣,٦٨%. يحتوي نبات حشيشه الليمون علي كثير من المعادن أهمها الالومنيوم بنسبة ٩٥,٧٥ ملجم / ١٠٠ جم و الكالسيوم بنسبة ٨٠٤,٥ ملجم / ١٠٠ جم و النحاس بنسبة ١٨,٧٦ ملجم / ١٠٠ جم و الحديد بنسبة ٧١,٥٤ ملجم / ١٠٠ جم