Egypt. J. Food. Sci. **Vol. 47,** No. 2, pp. 187 - 199 (2019)

Egyptian Journal of Food Science

http://ejfs.journals.ekb.eg/

The Effect of Garden Cress Seeds Addition on Rheological Properties of Wheat Flour and Chocolate Flavored Cupcake

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TECHNOLOGICAL, medicinal and nutritional importance of garden cress seed powder was the most vital aspect ofthis study. This search was designed to study the effect of the addition of garden cress seeds powder (GCSP), with the replacement ratio of 5, 10 and 15% of wheat flour, on the rheological properties of wheat flour and specific volume, texture analysis, stalling and sensory properties of chocolate flavored cupcake processing. GCSP is a rich source of protein, carbohydrates, dietary fiber, fat, ash, potassium, phosphorus, magnesium, iron, polyphenols and flavonoids. GCSP had good functional properties. The water absorption (WA) percentages increased clearly with the addition of GCSP being 59, 62, 66 and 72% for control, 5, 10 and 15% treated flours, respectively. The control sample had the maximum mixing tolerance index (MTI). arrival time (AT), dough development time (DDT), departure time (DT) and stability of dough (SD) was increased with the increase of GCSP. The wheat flour containing 5% GCSP had the highest resistance to extension (R50), maximum resistance (MR) and ratio number (R50/E). The extensibility (E) and dough strength (DS) were decreased by increasing the level of GCSP addition. The replacement of wheat flour with 5, 10 and 15% increased significantly ($p \leq 0.05$) the weight, volume and specific volume of the resulted cupcakes with GCSP. Cupcake containing 15% of GCSP had the lowest hardness 1, hardness 2, springiness, gumminess and chewiness followed by that containing 10% of GCSP except for springiness. Cupcake containing 15 % of GCSP had the lowest decrease percent of alkaline water retention capacity (AWRC) during storage periods being 1.67, 1.90 and 2.79 at 2, 4 and 6 days of storage, respectively, followed by cupcake containing 10%, 5% GCSP and finally the control sample. Cupcakes containing GCSP were more acceptable and fresher than control samples. Thus, the addition of GCSP to wheat flour improved rheological properties and also improved cupcake quality.

Keywords: Garden cress, Rheological properties, cupcake

Introduction

Garden cress (*Lepidium sativum* L; locally known as ‘habarachad’), belongs to a *Brassicaceae* family is a fast growing annual herb that is native to Egypt and West Asia, although it is now cultivated in the all over the world (Gokavi et al., 2004; Doke and Guha, 2014). Garden cress (GC) seeds powder (GCSP) is rich in proteins, vitamins, minerals, especially calcium and iron. GC seeds contain 24 % fat in which 34.5 % of total fatty acids is α-linolenic acid (ALA, 18:3) (Bryan et al., 2009 and Patil et al., 2015). The seeds are rich phenolic compounds and have high antioxidant activity compared to other cress varieties. It contains many phytochemicals with potential nutraceutical activity like glucosinolates, flavonoids, coumarins, sulphur glycosides, triterpenes, sterols and various imidazole alkaloids (Maier et al., 1998).Toxicology studies of GC seeds revealed that GC seeds can be considered as non-toxic and safe (Patil et al., 2015).

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Received:13/10/2019; accepted:27/11/2019
DOI: 10.21608/EJFS.2019.18159.1025
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Garden cress seeds are known as antihypertensive and diuretic (Mohamed et al., 2003), diuretic (Umang et al., 2009),antidiarrhoeal (Manohar et al., 2009), antioxidant (Chand et al., 2010), galactogogue and antianaemic (Sarkar and Ghosh, 2011), Antihypercholesterolemic (Amawiand Aljamal, 2012), antidiabetic (Shukla et al., 2012), anti-inflammatory (Alqahtani et al., 2019) and antimicrobial effect (Adam et al., 2011). Moreover, Sarkar et al. (2014) reviewed that garden cress seeds haveemmenagogue, laxative, aphrodisiac, rubefacient and tonic activities, andit also used as poultices for sprains and hurts and as rapid bone fracture healing.Garden cress seeds volatile oil had a pronounced estrogenic activity (Chauhan et al., 2012). Traditional sweets for lactating mothers are prepared from the GC seeds (Patil et al., 2015).

Gaafar et al. (2013) reported that Lepidiumsativumseeds have high nutritional value and it considered a good functional food ingredient, besides, garden cress defatted meal and its protein isolate can be used as a rich source of minerals and protein with high essential amino acids content. However, several studies were conducted on incorporation of GC seed powder in biscuit (Patil et al., 2015), health drinks (Mohite et al., 2012), iron rich flour development (Gurjar, 2015), cookies (Nathiya and Nora, 2014; Deshmukh et al., 2017), dietary fiber formulation (Gokavi et al., 2004).Garden cress seed protein isolate was prepared and evaluated by Ali (2013). Protein isolate of garden cress seed contained 86.90% protein. The authors concluded that high water absorption capacity (2.29 ml H_2O/gm) of garden cress seed protein isolate makes it a potential ingredient in meat, bread, and cakes industries. Also, high oil absorption capacity (3.5 ml oil/gm) of garden cress seed protein isolate makes it a good ingredient for the cold meat industry, particularly for sausages, where the protein can bridge the fat and water in these products.

Cakes are vital bakery products and consumed worldwide. Yearly, the market for cakes grows about one and half percent. Challenges in the cake market include increasing of storability, quality control and cost reducing (Cauvain and Young, 2006). Wheat flours used in cake preparation have lower protein content (Gómez et al., 2010). In cake processing flours from other cereals (Turabi et al., 2008; Oliete et al., 2010), even from pulses, such as chickpea or lupine (Abdel Rahman et al., 2006; Paraskevopoulou et al., 2012), marjoram (Hafez, 2012), hard wheat flour (Al-Dmoor, 2013), jojoba meal (Sobhy et al., 2015), breadfruit (Abegunde et al., 2019),can be used.A good quality cake ought to have high volume with a fine uniform wet crumb. Starch gelatinization, super molecule denaturation beside carbon dioxide formation offers to cake its porous, soft structure. The degree of growth relies on the consistency of the batter. If the batter is thick, it might be tough for the air bubbles to flee, which might end in a high volume cake (Kim and Walker, 1992 and Al-Dmoor, 2013).

No researches conducted on the utilization of garden cress seeds in cupcake processing. Thus, the aim of the currentstudy was to determine the effect of garden cress seeds powder addition on rheological properties (farinograph and extensograph tests) of wheat flour and specific volume, texture analysis, stalling and sensory properties of chocolate flavored cupcake processing.

Materials and Methods

Materials

Garden cress seeds were purchased from local market, Zagazig city, Sharkia Governorate, Egypt. The seeds were cleaned andrendered free of dust, dirt, foreign materials and broken seeds. Garden cress seed powder (GCSP) was prepared by grinding the seeds (Moulinex A59, France). Sieving process was conducted using a 60 mesh sieve. Wheat flour (72%), eggs, cow milk (3.5 % fat), corn oil, sugar, powdered cacao, vanillin, salt and baking powder were purchased from a Supermarket, Zagazig city.All chemicals and reagents were of the analytical grade and purchased from Elgomhurya Company, Zagazig Branch, Egypt.

Methods

Cupcake preparation and baking

The formula used to prepare the chocolate flavored cupcake was as follows: 150 g wheat flour (72%), 2 eggs (weighting 48±0.5 for one egg), 100 ml caw milk (3.5 % fat), 50 ml corn oil,220 g sugar, 15 g powdered cacao,6 g vanillin, 0.5 g salt and 8 g baking powder. This formula served as a control. In the formulas of treated cupcake, the wheat flour was substituted by 5, 10or15% of garden cress seeds powder (GCSP). The ingredients were mixed using kitchen mixer (Mammonlex, China) for 5 min. After that, the liquid mixture was pouredin a cake cups by 35.00

g for each one and baked in electric oven at 180 °C for 20 min,then cooled at room temperature (26±2 °C) for 2 hr. The resulted cupcakes were packaged in polyethylene bagsand stored in the refrigerator at 4 ºC ± 2 until used.

Proximate chemical composition

Proximate chemical components (moisture, crude protein, crude fat, crude fibers and ash) of GCSP were measured in triplicate according to AOAC (2005). Carbohydrate content was calculated by differences as follows: carbohydrate content =100 - (% ash + protein + fat + moisture). These assays were conducted in Central Lab., Fac. of Agric., Zagazig University.

Determination of minerals contents

Minerals contents in GCSP(potassium, K, phosphorus, P, magnesium, Mg, sodium, Na, calcium, Ca, iron, Fe, zinc, Zn, manganese,Mn, copper, Cu) were determined according to the method of AOAC (2005) using spectrometer (iCE3000 Series, England) at the Central Lab., Fac. Agric., Zagazig Univ., Egypt.

Determination of total phenolic content

Total phenolic contentin GCSP was measured using UV spectrophotometer (Jenway-UV-VIS Spectrophotometer), based on a colorimetric oxidation/reduction reaction, as described by Skerget et al. (2005) using Folin- Ciocalteu reagent.

Determination of total flavonoid content

The content of total flavonoid in the examined GCSP was determined using spectrophotometric method (Quettier et al., 2000).

Determination of functional properties

Water holding capacity (WHC, ml/g), oil-holding capacity (OHC, ml/g), emulsifying activity and stability (%) of GCSP were determined according to Chau and Huang (2003), Garau et al. (2007) andNeto et al. (2001), respectively.

Determination of rheology properties

The rheological analyses (farinograph and extensograph) of wheat flour supplemented with different levels of GCSP and control flour (free from GCSP) were measured according to AACC (2000). Where, the AACC method 54-21 and AACC method 54-10 with Brabender equipment were used to determine the farinography (Farinograph/Resistograph FA/R-2, Germany) and extensography (Brabender Extensograph DM 90-40, Germany) properties of studied flours, respectively.

Determination of specific volume

Cake samples were weighted (g) after 2 hours of cooling at room temperature (22±1°C). The volume (cm^3) was measured by rapeseed replacement method. Specific volume was obtained by dividing the volume of sample by their weight according to ACC 10-05 method (AACC, 2000).

Texture profile analysis (TPA)

TPA was conducted for control and treated cupcake samples as described by Guadarrama-Lezama et al. (2016) and Soleimanifard et al. (2018). Texture Analyzer (Brookfield Texture Pro CT V1.6 Build, USA) was used for analyses the texture of control and treated cupcake samples. The apparatus equipped with a 10000 g load cell and cylindrical probe (36 mm diameter) at a test speed of 4.00 mm/s, this equipment was used for the double compression Texture Profile Analysis (TPA) tests. Cylindrical crumbs of cupcake with 50 mm diameter and 25 mm height were compressed to 50%. A number of textural parameters (hardness1, hardness2, Cohesivenes s,Springiness,Gumminess and Chewiness) were extracted from the resultant force-time curve. The experiment was performed in triplicate.

Determination of stalling rate

The staling rate of different prepared cupcake samples was determined after baking within one hour and after 2, 4 and 6 days of storage at room temperature (26±2 °C) by alkaline water retention capacity (AWRC, %) according to AACC 56–10 method(AACC, 2000).

Sensory Evaluation

Sensory properties of chocolate flavored cupcake treatments were determined 1, 7 and 14 day after processing and cold storage at 4±2°C in three sessions. Cupcakes were evaluated byten members from the staff of Food Sci.Dept., Fac. Agric., Zagazig Univ., Egypt using a hedonic rating test to assess the degree of acceptability of cakes. The taste panelists were asked to rate the cupcake samples for appearance, crust color, odor, taste, crumb texture, crumb grain and overall acceptability on a 1-9 point scale where 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 = 1ike very much and 9 = like extremely (Lawless and Hildegarde, 1999).

Statistical analyses

The obtained results of different parameters were analyzed using MSTAT-C programme (Anonymous, 1986).The means were compared using Fisher's protected least significant differences (L.S.D.) test at 0.05 (Steel et al., 1997). Standard division (SD) was recorded. Means having different letters are significantly different.

Results and Discussion

Proximate chemical composition,minerals, total phenols and total flavonoidscontents of GCSP

Proximate chemical composition of garden cress seeds (GCSP) is illustrated in Table 1. It contained 19.73 and 14.18 % crude protein and crude fat, respectively. Moreover, GCSP is considered a good source of carbohydrate, crude fiber and ash. These results were confirmed by the results obtained previously by Bryan et al. (2009), Zia-Ul-Haq et al. (2012) and Patil et al. (2015) Doke et al. (2017).

Table 2 shows the minerals, total phenols and total flavonoids contents of GCSP. GCSP have a considerable amount of certain elements that important for human nutrition. It was found that the most abundant element in GCSP was potassium (2955.50 mg100/g) followed by phosphorus (947.32 mg100/g) and magnesium (322.00 mg100/g). Noteworthy, it also contained high levels of sodium and calcium. Shail et al. (2016) and Doke et al. (2017) reported that GCSP are a good source of minerals such as K, P and Mg. Moreover,GCSP had 176.67 µg/gtotal phenols and 24.28 µg/g of total flavonoids. These results agreed with that recorded by Zia-Ul-Haq et al. (2012) and Ait-Yahia et al. (2018).

Functional properties of GCSP

Functional properties (water, oil holding capacity, emulsifying activity and stability) of GCSP were studied (data not tabulated). GCSP had 4.51±0.83 ml/g water holding capacity (WHC), 2.79±0.32 ml/g oil holding capacity (OHC), 44.54±1.35% emulsifying activity and 40.65±1.02% emulsifying stability, which makes it an important constitute in bread, meat, and cakes processing and can be used as a nutrient substitution or supplementation and also act as a functional agent in food systems.Ali (2013) recorded thatprotein isolate of garden cress seeds contains 86.90% protein and has WHC of 2.29 ml H_2O/g and OHC of 3.5 ml oil/g.

Rheological characteristics of wheat flour supplemented with GCSP

In this experiment, the rheological characteristics of wheat flour free from GCSP

TABLE 1. Proximate chemical composition of GCSP (on wet weight basis)

Component	Moisture	Crude protein	Crude fat	Carbohydrate	Crude fiber	Ash
%	7.05±0.45	19.73±1.03	14.18±0.94	35.45±1.65	18.79±0.79	4.8±0.88

* The results are means of triplicate determination ± standard deviation.

TABLE 2. Mineral, total phenols and total flavonoids contents of GCSP

Element	Concentration
Potassium (K)	2955.50 (mg100/g)
Phosphorus (P)	947.32 (mg100/g)
Magnesium (Mg)	322.00 (mg100/g)
Sodium (Na)	229.35 (mg100/g)
Calcium (Ca)	203.23 (mg100/g)
Iron (Fe)	6.50 (mg100/g)
Zinc (Zn)	2.95 (mg100/g)
Manganese(Mn)	1.94 (mg100/g)
Copper (Cu)	0.77 (mg100/g)
Total phenols	176.67 µg/g
Total flavonoids	24.28 µg/g

(control) and those containing 5, 10 and 15% of GCSP were determined by farinograph and extensograph tests. The results of the effects of GCSP addition on farinograph properties of wheat flour and the resulted farinogramsare presented in Fig. 1 (a and b) and Fig. 2, respectively.

The water absorption (WA) percentages increased clearly with the addition of GCSP being 59, 62, 66 and 72% for control, 5, 10 and 15% treated flours, respectively (Fig. 1a).This is a logical result because garden cress seeds had high WHC (Ali, 2013). On the other hand, control sample had the maximum mixing tolerance index (MTI, 40 FU) and the 15% sample had the lowest (5 FU, Fig. 1a). Furthermore, the 5 and 10% flour samples had the maximum dough weakening (DW) being 110 FU followed by 15% flour (90 FU) and finally control sample (60 FU, Fig. 1a). The addition of GCSP to the wheat flour increased the arrival time (AT), dough development time (DDT), departure time (DT) and stability of dough (SD, Fig. 1b).In this respect, Sahraiyan et al. (2013) found that the addition of GCSP to rice-wheat flour increased the water absorption, dough development time, dough stability and viscosity.

The extensograph presents information about the viscoelastic behavior of dough (Walker and Hazelton, 1996). This equipment measures dough extensibility for its resistance to extension. A combination of the properties of good resistance and good extensibility indicate desirable dough. The results of the effects of GCSP addition on extensograph properties of wheat flour and the resulted extenograms are presented in Fig. 3 (a and b) and Fig. 4, respectively. The wheat flour containing 5% GCSP had the highest resistance to extension (R50), maximum resistance (MR) and ratio number (R50/E) comparing with other studied samples (Fig. 3 a and c).The extensibility (E) and dough strength (DS) were decreased by increasing the level of GCSP addition (Fig. 3b). Sahraiyan et al. (2013) mentioned that the rice-wheat flour samples with maximum level of garden cressseed gum (GCSG) had the highest resistance to extension (R50). Also, the results showed that GCDG had a more marked effect on R50 than guar gum.

Weight, volume and specific volume of cupcakes

Baked cakes specific volume articulates theamount of air that can keep in the final product. A highergas keeping and higher extension of cakes leads to ahigher specific volume (Gômez et al., 2008). The specific volume of chocolate flavored cupcakes enriched with different levels of GCSP and control sample (free from GCSP) are shown in Table 3 and the photos of resulted cupcakes are shown in Fig. 5. Significant (p≥0.05) differences in weight, volume and specific volume were

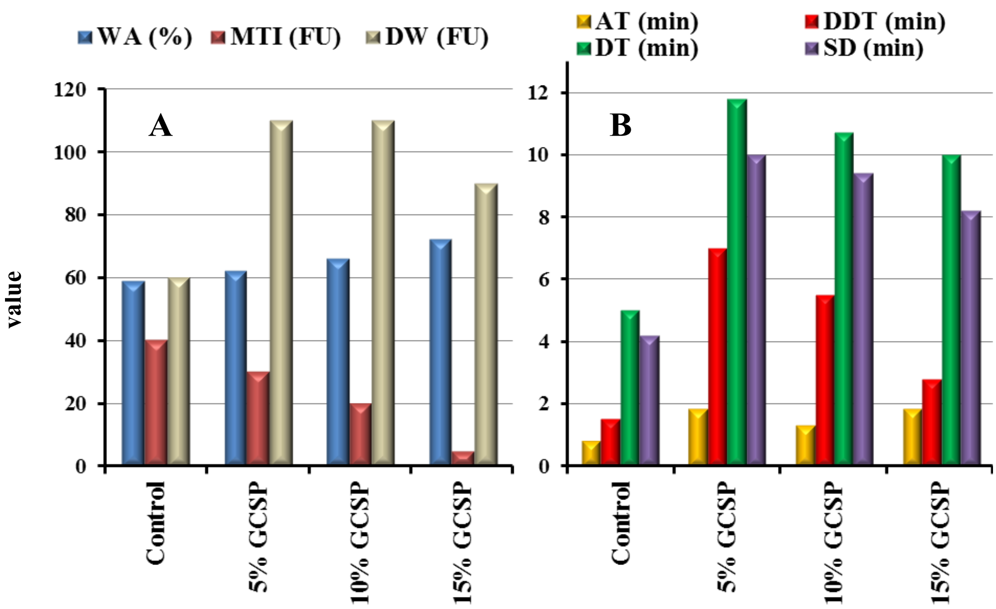

Fig. 1. Farinograph properties of wheat flour substituted with different levels of GCSP. Where, *Part A*)WA: water absorption (%, to the dry basis at 14% humidity), MTI: mixing tolerance index (FU, Farinograph unit), DW: degree of weakening (FU), *Part B)* AT: arrival time (min), DDT: dough development time (min), DT: departure time (min), SD: stability of dough (min).

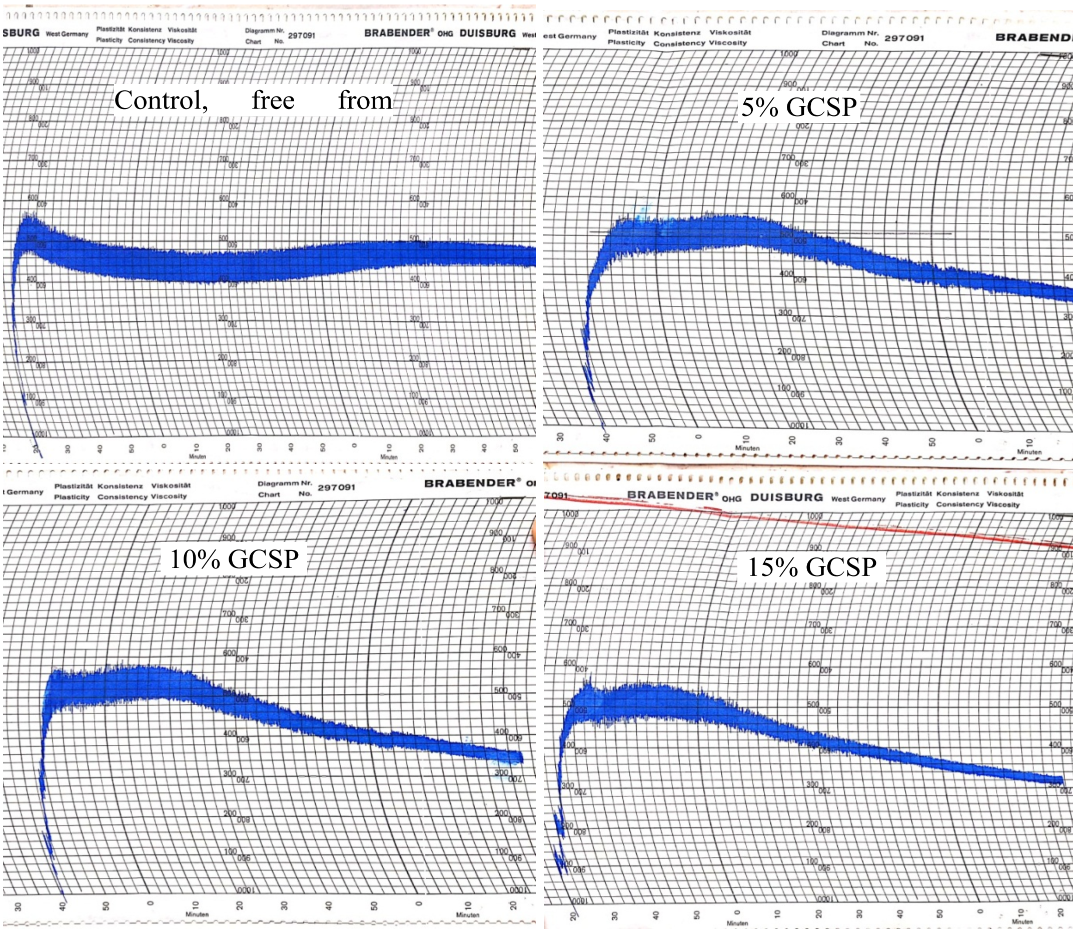

Fig. 2. Farinograph curves obtained from the experimental farinograph Brabender for wheat flour substituted with different levels of garden cress seeds powder (GCSP).

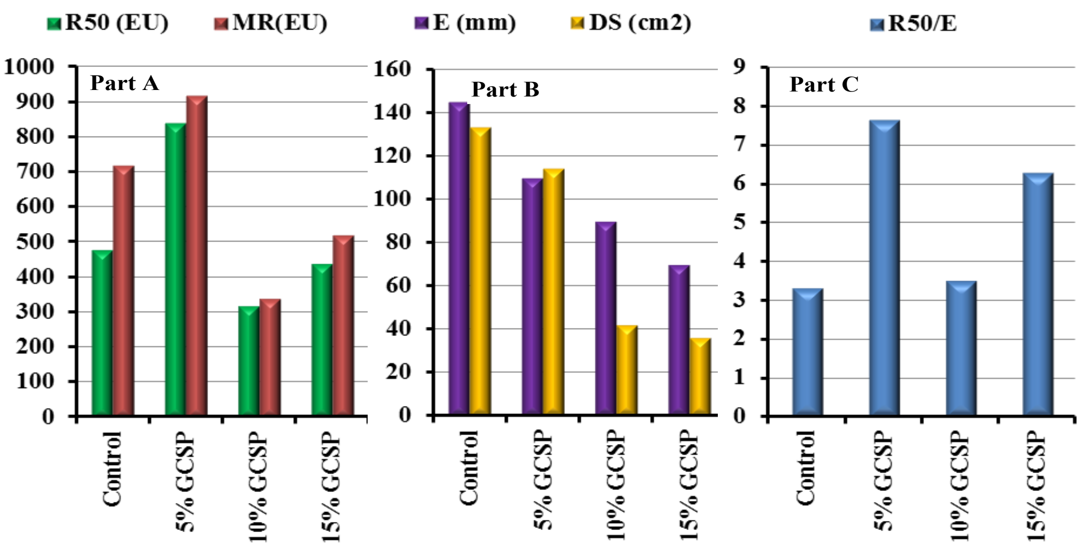

Fig. 3. Extensograph properties of wheat flour substituted with different levels of GCSP. Where, Part A)R50: resistance to extension at 50 mm (EU, Extensograph unit), MR: maximum resistance (EU), Part B) E: Extensibility (mm), DS: dough strength (cm2), Part C) R50/E: ratio number.

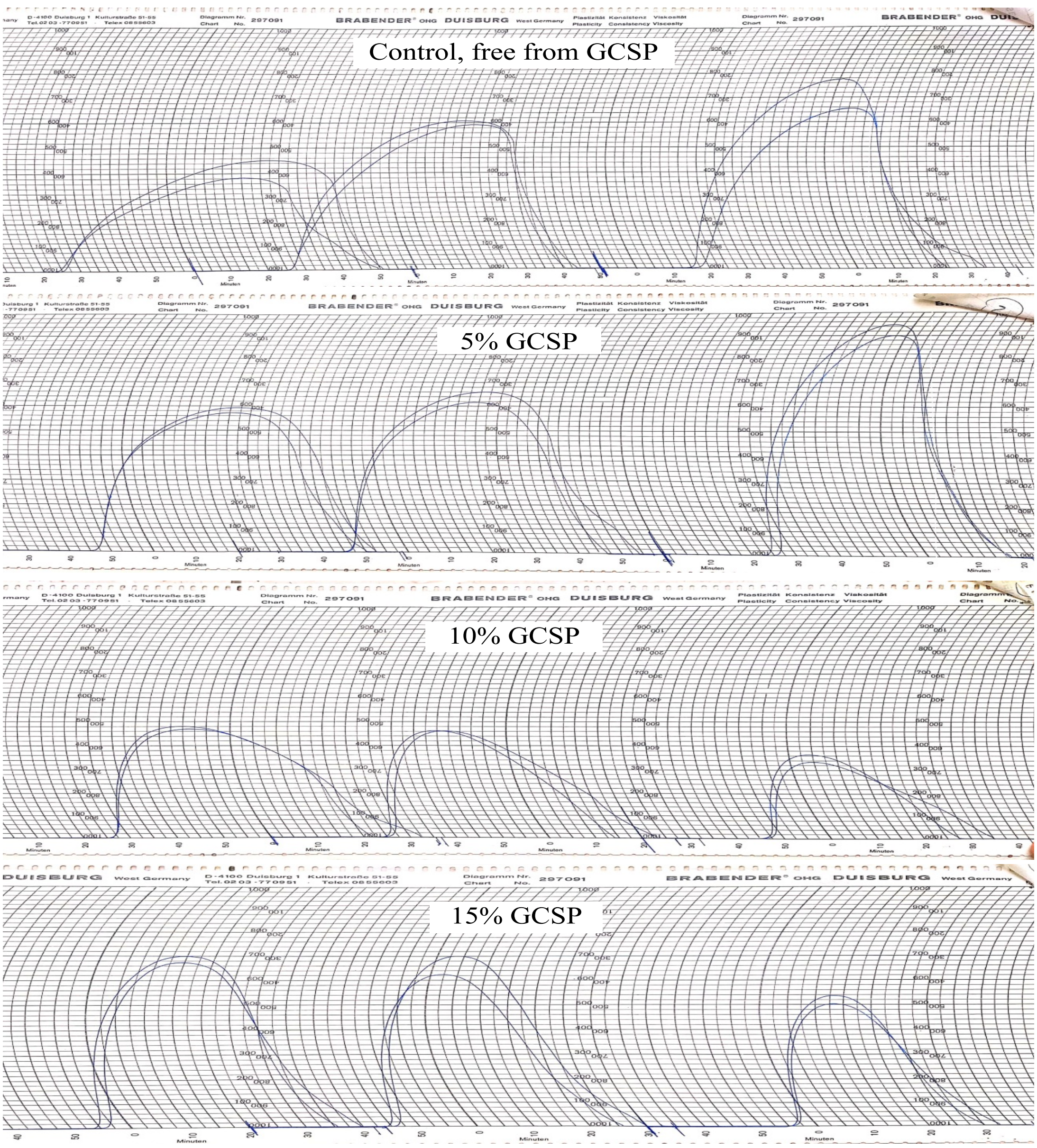

Fig. 4. Extensograph curves obtained from the experimental extensograph Brabender for wheat flour substituted with different levels of garden cress seeds powder (GCSP).

observed between control sample and cupcake supplemented with 5, 10 and 15% of GCSP. Generally, partial replacement of wheat flour with 5, 10 and 15% of lead to a significant (p≤0.05) increase in weight, volume and specific volume of resulted cupcakes. The difference between these values of the cupcake weight, volume and specific volume of the tested cupcake samples were due to differences in the properties of the gluten and GCSP protein, which was particular lyevident in the previously mentioned tests such as rheological tests obtained by farinograph and extensograph. A significant increase in cake volume was noted with an increase in the marjoram powder level (Hafez, 2012). On the other hand, No significant (p≥0.05) differences in specific volume were observed between control sample and cakes supplemented with 5, 10 and 15% of protein isolate as well as 5% of jojoba meal (Sobhy et al., 2015). In this study, the addition of GCSP to wheat flour maybe increased the OHC (as mentioned above) of resulted flour mix and this lead to consist a stable emulsion with more sufficient viscosity which prevents the air bubbles to escape from the dough. Some investigations (Paton et al., 1981, Ngo and Taranto, 1986 and Hafez, 2012) found a good cake batter must retain sufficient viscosity to prevent the incorporated air bubbles from rising to the surface and being lost during initial heating. Additionally, Sahraiyan et al. (2013) found the addition of GCSP to rice-wheat flour increased the specific volume and porosity.

Texture profile analyses (TPA) of cupcakes

Texture profile analyses of chocolate flavored cupcake enriched with different levels of GCSP and control sample (free from GCSP) are presented in Table 4. The height of the force peak on the first compression cycle was defined as hardness 1 and on the second was hardness 2. The ratio of the positive force areas under the first and second compression was defined as cohesiveness (the extent to which a sample can be deformed before it ruptures). Springiness was considered as the rate at which the sample returns to its original shape after compression and resilience as the degree to which the sample returns to the original shape. Two other parameters were derived by calculation from the measured parameters: Gumminess was defined as the multiple of hardness and cohesiveness; chewiness was defined as multiple of gumminess and springiness (which is hardness× cohesiveness× springiness) (Soleimanifard et al., 2018). Hardness 1, hardness 2, cohesiveness, gumminess and chewiness of control cupcake and those containing 5, 10, and 15% GCSP were significantly different ($p \leq 0.05$). In addition to that, cupcake containing 15% of GCSP had the lowest hardness 1, hardness 2, springiness, gumminess and chewiness followed by that containing 10% of GCSP except for springiness.It is known that the lower the hardness of the cupcake the more evidence of acceptability and freshness, and this shows that the addition of GCSP to the cupcake increased the degree of its freshness (Al-Dmoor, 2013; Khalifa et al., 2017).

Stalling rate of cupcakes

The staling rate of different studied chocolate flavored cupcake samples was measured after baking within two hours and after 2, 4 and 6 days of storage at room temperature (22±2 °C) by alkaline water retention capacity (AWRC %) and the obtained results are tabulated in Table 5. The lower reduction in staling values equals a high freshness. Generally,the staling values of different studied cupcake decreased during storageperiods. In addition to that, the stalling rate of all studied

TABLE 3. Weight, volume and specific volume of chocolate flavored cupcake containing different levels of GCSP and control sample (free from GCSP).

Treatment		Weight (g)	Volume (cm^3)	Specific volume (cm^3/g)
Control		29.17±0.29c	88.00±1.00d	3.02±0.015c
Cupcake containing GCSP with the ratio (%) of	5	30.67±0.58b	100.33±0.58c	3.27±0.056b
	10	31.17±0.76 ab	106.00±2.00b	3.40±0.07a
	15	32.00±0.50a	111.33±1.53a	3.48±0.01a
L.S.D at 0.05		1.05	2.61	0.08

GCSP = garden cress seeds powder
L.S.D. = Least Significant Difference.
Values with different litters are significantly different.

Control, free from GCSP **5% GCSP** **10% GCSP** **15% GCSP**

Fig. 5. Photos of chocolate flavored cupcake containing different levels of GCSP.

cupcake samples was significantly ($p \leq 0.05$) different at all storage periods. The cupcake sample obtained from wheat flour containing 15% GCSP had the highest values of alkaline water retention capacity which were decreased during 0, 2, 4 and 6 days of storage to 432.35, 425.06, 424.14 and 420.30%, respectively. That cupcake also had the lowest decrease percent during storage periods being 1.67, 1.90 and 2.79 at 2, 4 and 6 days of storage, respectively, followed by that cupcake containing 10, 5% GCSP and finally control sample. As mentioned previously, the addition of GCSP to wheat flour increased the water absorption (Fig.1) and accordingly this may increase the amount of water retained in the cupcakes after baking which cause more freshness for treated cupcakes during storage periods. Additionally, such effect might be related to the difference in quantitative distribution of protein fractions and physicochemical properties of starch of wheat flour containing GCSP. Same trends were obtained by Hussein et al. (2012) who studied production and evaluation of cakes from germinated rice flour and Khalifa et al. (2017) who studied theinfluencing of guava processing residues incorporation on cupcake characterization.

Sensory properties of cupcakes

The panelists evaluated the treated chocolate

TABLE 4. Texture profile analyses of chocolate flavored cupcake enriched with different levels of GCSP and control sample (free from GCSP).

Treatment		Hardness 1, N	Hardness 2, N	Cohesiveness, mm³/mm³	Springiness, mm/mm	Gumminess, N	Chewiness, mJ
Control (free from GCSP)		6.96±0.68a	6.63±0.62a	0.82±0.01a	8.89±0.28a	5.69±0.66a	50.7±7.44a
Cupcake containing GCSP with the ratio (%) of	5	6.46±1.04a	6.22±0.97a	0.82±0.01a	8.55±0.32a	5.27±0.90a	44.93±6.64a
	10	5.61±0.82ab	5.28±0.79ab	0.79±0.01b	9.04±0.21a	4.44±0.60ab	40.20±4.84ab
	15	4.26±0.81b	4.07±0.78b	0.78±0.02b	8.32±0.71a	3.34±0.69b	28.10±7.85b
L.S.D at 0.05		1.60	1.51	0.03	0.81	1.36	12.79

GCSP = garden cress seeds powder
L.S.D. = Least Significant Difference.
Values with different litters are significantly different.

TABLE 5. Stalling rate of chocolate flavored cupcake enriched with different levels of GCSP and control sample (free from GCSP).

Treatment		AWRC (%) during storage time (day)				The decrease(%) of AWRC during storage time (day)*		
		0	2	4	6	2	4	6
Control		394.67±2.52d	379.00±3.00d	365.00±1.00d	349.33±4.04d	3.97	7.52	11.49
Cupcake containing GCSP with the ratio (%) of	5	404.174.53±c	396.85±3.60c	379.81±1.72c	373.36±3.51c	1.81	6.03	7.62
	10	412.38±2.59b	410.11±1.65b	398.62±2.51b	392.34±6.11b	0.55	3.37	4.86
	15	432.35±4.92a	425.06±1.78a	424.14±5.52a	420.30±4.51a	1.67	1.90	2.79
L.S.D at 0.05		7.15	4.97	6.02	8.74	-	-	-

GCSP = garden cress seeds powder
L.S.D. = Least Significant Difference.
Values with different litters are significantly different.
*calculated and not subjected to statistical analysis.

flavored cupcakes containing 5, 10 and 15% GCSP on the day of baking and after 7, 14 and 21 days of cold storage (Fig. 6). In general, it was found that all cupcake samples were highly accepted for all studied sensory properties at the beginning of storage period. Moreover, it was also noticed that the crumb texture and crumb grain of all studied samples scored >8 and did not affectedduring storage period. Additionally, the appearance, crust colour, odour, taste, overall acceptability of control sample were clearly decreased during storage period than those of treated samples. Finally, it could be summarized that at the end of storage period the cupcakes containing GCSP were more acceptable and fresher than control samples. Patil et al. (2015) studied the development and quality evaluation of biscuits containing GCSP and summarized that on the basis of sensorial properties the GCSP can be substituted up to ten percent in wheat flour for preparing garden cress biscuit without adversely affecting quality characteristics. Mohite et al. (2012) reported that the most suitable health drink among studied drinks was that containing three percent of GCSP, with an overall consumer acceptability of 8.75. Deshmukh et al. (2017) illustrated that sensory analysis of cookies containing 10% garden cress brain revealed highest overall acceptability and also significant increased dietary fiber and minerals content. Sahraiyan et al. (2013) revealed that the sensory evaluation by a consumer panel gave the higher score for overall acceptability to rice-wheat bread containing garden cress seeds.

Conclusion

GCSP is a good source of nutrients with high functionality. The addition of GCSP to the wheat flour increased the arrival time, dough development time, departure time and stability of dough. The incorporation of wheat flour with GCSP produced a successful and innovative chocolate flavored cupcake formula with excellent specific volume, stalling properties, texture profile and overall acceptability.

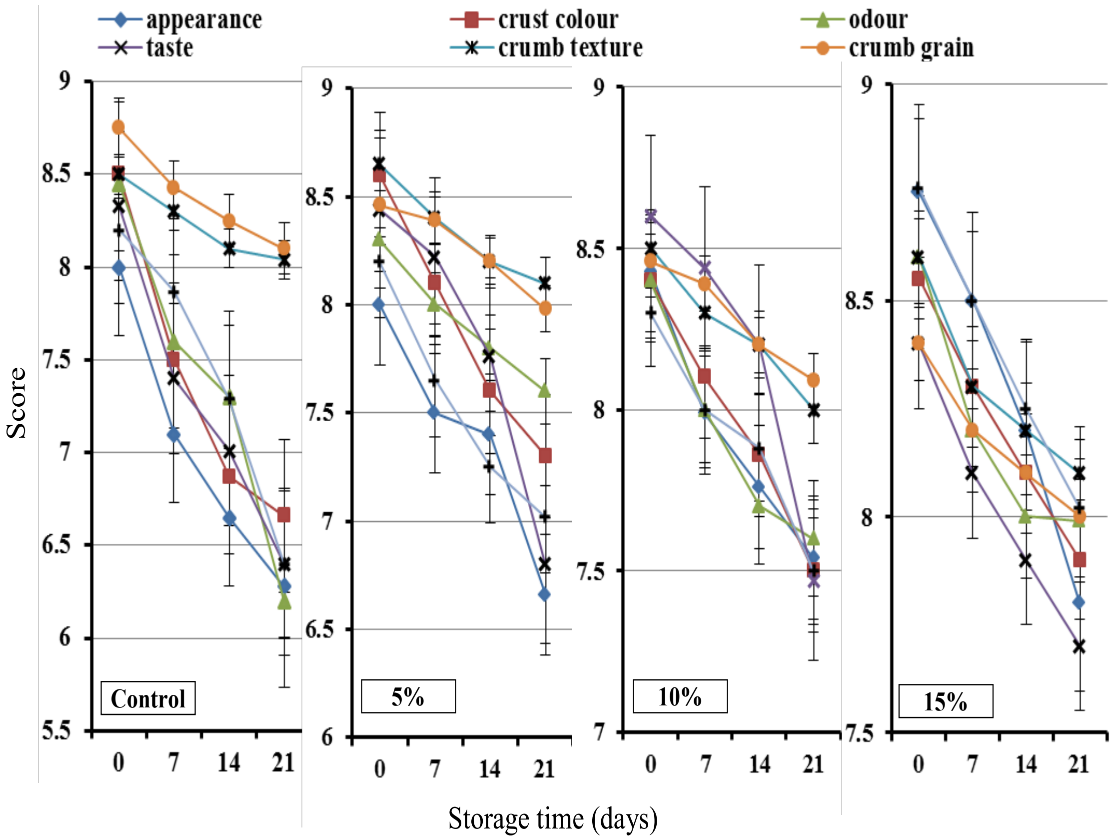

Fig. 6: Sensory properties of chocolate flavored cupcake enriched with different levels of garden cress seeds powder (GCSP) and control sample (free from GCSP).

References

AACC(2000) A*pproved Methods of the American Association of Cereal Chemists,* tenth ed. St. Paul, MN.

Abdel Rahman, A.A., Abdel Aleem, I.M. El-Deeb, A.E. and Hussein, A.E. (2006) Elimination of toxic compounds and nutritional evaluation of jojoba meal proteins., *Egypt. J. Biochem. Mol. Biol.*, **24,** 683-702.

Abegunde, T.A, Bolaji, O.T., Adeyeye, S.A. and Peluola-Adeyemi, O.A. (2019) Quality evaluation of baked cake from wheat breadfruit composite flour, *Amer. J. Food Sci. Technol.,***7,** 1, 31-39.

Adam, Shama I.Y., Shayma A. M. Salih and Abdelgadir, Warda S. (2011) *In vitro* antimicrobial assessment of *Lepidium sativum* L. seeds extracts, *Asian J. Med. Sci.,* **3,** 6, 261-266.

Ait-Yahia, O., F. Perreau, S. Bouzroura, Y. Benmalek, T. Dob and Belkebir T. (2018) Chemical composition and biological activities of nbutanol extract of *Lepidiumsativum* L. (Brassi caceae) seed, *Tropical J. Pharm. Res.*, **17**, 5, 891-896.

Al-Dmoor, H. (2013) Correlation study between volume and overall acceptability of cake with properties of hard wheat flour, *Amer. J. Agric. Biol. Sci.*, **8,** 2, 149-155.

Ali, Rehab .F.M. (2013) Preparation and characterization of protein isolate and biodiesel from garden cress seed, *Europ. J. Chem.*, **4**, 2, 85-91.

Alqahtani, F. Y., Aleanizy F. S., Mahmoud, A. Z., Farshori, N. N., Alfaraj, R., Al-sheddi, E. S., Alsarra, I. A. (2019) Chemical composition and antimicrobial, antioxidant, and anti-inflammatory activities of *Lepidium sativum* seed oil. *Saudi Journal of Biological Sciences,* **26,** 5, 1089-1092.

Amawi, K and Aljamal, A. (2012) Effects of *Lepidium sativum* on lipid profiles and blood glucose in rats, *J. Phys. Pharm. Adv.,* **2,** 8, 277-281.

Anonymous, (1986) MSTATC. Microcomputer Statistical Programme.Michigan State University, Michigan, Lansing, USA.

AOAC, (2005) *Official Methods of Analysis of the Association of Official Analytical Chemists,* 18th ed. Gaithersburg, Maryland, USA, AOAC Int.

Bryan, R.M., Shailesh, N. S., Jill K., Winkler, M., Steven F. V. and Roque L. Evangelista (2009) Composition and physical properties of cress (*Lepidium sativum*L.) and field pennycress (*Thlaspi arvense* L.) oils, *Indust. Crops Prod.,* **30,** 199-205.

Cauvain, S.P., and Young, L. (2006) *Baked Products in Science, Technology And Practice,* Oxford, UK, Blackwell Publishing.

Chand, Y. Y., Srivastav, D.N., Seth. A.K. (2010) In vivo antioxidant potential of *Lepidium sativum* L. seeds in albino rats using cisplatin induced nephrotoxicity. *Inter. J.Phytomed.*, **2,** 292-298.

Chau, C.F. and Y.L. Huang (2003) Comparison of the chemical composition and physicochemical properties of different fibers prepared from the peel of *Citrus sinensis* L. cv. Liucheng. *J. Agric. Food Chem.,* **51,** 2615–2618.

Chauhan, K., Nishteswar, K., Chauhan, M. G. (2012) Pharmacognosticalevaluation of seeds of *Lepidiumsativum* Linn, *Int. J. Pharmaceutical Biol. Archives,* **3,** 3, 627-631.

Deshmukh, Y.R., S.S. Thorat and S.R. Mhalaskar (2017) Influence of garden cress seed (*Lepidium sativum* L.) bran on quality characteristics of cookies. *Int. J. Curr. Microbiol. App., Sci.* **6,** 9, 586-593.

Doke, S. and M. Guha (2014) Garden cress (*Lepidiumsativum* L.) seed - an important medicinal source: a review. *J. Nat. Prod. Plant Resource,* **4,** 1, 69-80.

Doke, S. C.,Chetana, R. and R. Guha (2017) Quality assessment of sweet snack from garden cress (*Lepidium sativum* L.) seeds-An unexplored health grain. *J. Food Proc.,* **42**, 1-6.

Gaafar, A. M., Morsi,Azza A. and Elghamry,Heba E. (2013) Chemical, nutritional and biochemical studies of garden cress protein isolate. *Nat. Sci.,* **11,** 2, 8-13.

Garau, M.C., S. Simal, C. Rossello and A. Femenia (2007) Effect of airdrying temperature on physicochemical properties of dietary fiber and antioxidant capacity of orange (*Citrus aurantium* v. *Canoneta*) by products. *Food Chem.,* **104,** 1014–1024.

Gokavi, S.S., Malleshi, N.G., and Guo, M. (2004) Chemical composition of garden cress (*Lepidium sativum*) seeds and its fractions and use of bran as a functional ingredient. *Plant Foods Hum. Nutr.* **59**, 105-111.

Gômez, M., Oliete, B. Rosell, C. M. Pando, V. and Fernandez, E. (2008) Studies on cake quality made of wheat-chickpea flour blends. *LWT - Food*

Sci. and Technol., 41, 1701-1709.

Gómez, M., Ruiz-París, E. Oliete, B. (2010) Influence of flour mill streams on cake quality. *Inter. J. Food Sci. Technol.* **45,** 1794-1800.

Guadarrama-Lezama, A. Y., Carrillo-Navas, H., Pérez-Alonso, C., Vernon-Carter, E. J. and Alvarez-Ramirez, J. (2016) Thermal and rheological properties of sponge cake batters and texture and microstructural characteristics of sponge cake made with native corn starch in partial or total replacement of wheat flour, *LWT-Food Sci. Technol.* **70,** 46-54.

Gurjar k. (2015).Development of iron rich flour using garden cress seeds and its quality evaluation.Master of home science (foods and nutrition), Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan.

Hafez, Alshimaa A. (2012) Physico-chemical and sensory properties of cakes supplemented with different concentration of marjoram. *Australian J. Basic Appl. Sci.,* **6,** 13, 463-470.

Hussein, A. M.S., HegazyNefisa A. and Ibrahim, T. A.A. (2012) Production and evaluation of gluten-free cakes. *Australian J. Basic Appl. Sci.*, **6,** 12, 482-491.

Khalifa, I., Barakat, H., El-Mansy H.A. and Soliman, S.A. (2017) Influencing of guava processing residues incorporation on cupcake characterization. *J.Nutr. Food Sci.***, 6,** 4, 1-8.

Kim, C.S. and Walker, C.E. (1992) Interactions between starches, sugars and emulsifiers in high ratio cake model systems. *Cereal Chem.*, **69,** 206-212.

Lawless, H.T. and Hildegarde, H. (1999) Sensory evaluation of food: principles and practices. 1st ed., Springer, New York, ISBN-10: 083421752X, pp: 848.

Maier, U.H., Heidrun, G. and Zenk, M.H. (1998) Seven imidazole alkaloids from *Lepidium sativum*. *Phytochem***.49**, 6, 1791-1795.

Manohar, D., Shylaja, H., Viswanatha, G.L., *et al*. (2009) Antidiarrhoeal activity of methanolic extracts of *Lepidium sativum* in rodent. *J. Nati. Natnir. Remedies,* **9,** 2, 197-201.

Mohamed, M., Naoufel, A., Jean, B. M., *et al*. (2003) Antihypertensive effects of *Lepidium sativum* L. In spontaneously hypertensive rats. *J. Ethanopharmacol.,* **100,** 193-197.

Mohite, S. Y., Gharal, D. B., Ranvbeer,R. C., Sahoo, A. K. and Ghosh, J. S. (2012) Development of health drink enriched with processed garden cress (*Lepidium sativum* L.) seeds. *Amer. J. Food Technol.,* **7,** 9, 571-576.

Nathiya, M. and Nora, V. (2014) Formulation of cereal based nutria cookies prepared incorporating garden cress seeds – A protein and iron rich snake. *Inter. J. Scientific Res.,* **3**, 225-226.

Neto, V.T., Narain, N., Silvce, J.B. and Bora, P.S. (2001) Functional properties of heat processed cashew nut (*Anarcarduim occidental* L.) kernel protein isolate. *Die Nahrung*, **45**, 258-262.

Ngo, W.I.I. and Taranto,M.V. (1986) Effect of sucrose level of the rheological properties of cake batters. *Cereal Foods World,* **31**, 317-322.

Oliete, B., Pérez, G.T., Gómez, M.,Ribotta, P. D.,Moiraghi, M. and León, A. E. (2010) Use of wheat, triticale and rye flours in layer cake production. *Inter. J. Food Sci. Technol.,* **45**, 697-706.

Paraskevopoulou, A., Chrysanthou, A. and Koutidou, M. (2012) Characterization of volatile compounds of lupine protein isolate-enriched wheat flour bread. *Food Res. Inter.,* **48,** 568-577.

Patil, D. D., Lal,Er. A., Nandkule, V. D. (2015) Development and quality evaluation of garden cress seed biscuits. *Inter. J. Sci., Eng. Technol.*, **2,** 3, 770-774.

Paton, D., Larocque, G.M. and Holme,J. (1981) Development of cake structure influence ingredients on themeasurement of cohesive force during baking. *Cereal Chem.,* **58,** 527-534.

Quettier, D.C., B. Gressier, J. Vasseur, T. Dine, C. Brunet, C. Luyckx, J.C. Cayin, F. Bailleul and F. Trotin (2000) Phenolic compounds and antioxidant activities of buckwheat (*Fagopyrum esculentum* Moench.) hulls and flour. *J. Ethnopharmacol.*, **72,** 35-42.

Sahraiyan, B., Naghipour, F., Karimi, M., Davoodi, M. G. (2013) Evaluation of *Lepidium sativum* seed and guar gum to improve dough rheology and quality parameters in composite rice-wheat bread. *Food Hydrocolloids,* **30,** 698-703.

Sarkar, S. and Ghosh, I. (2011)Galactogogue effect of garden Cress seeds on lactating rats. *Asian J. Exp. Sci.,* **25,** 2, 87-92.

Sarkar, S., Datta (De), S. and Ghosh, I. (2014)

Experimental studies on nutritional and medicinal role of garden cress seed on animal and human being- a review, *I.J.M.C. A.,* **4,** 1, 41-45.

Shail, D., Manjari, K.N. and Gupta, L.N. (2016) Nutritional importance of *Lepidium sativum* L. (Garden cress/ Chandrashoor): A Rev. *J. Pharm. Anal. Res.*, **5**, 1, 152-160.

Shukla, A., Bigoniya, P. and Srivastava, B. (2012) Hypoglycemic activity of *Lepidium sativum* Linn seed total alkaloid on alloxaninduced diabetic rats. *Res. J. Med. Plant,* **6**, 2012, 587-596.

Skerget, M., P. Kotnik, M. Hadolin, A. Rižner-Hraš, M. Simonič and Z. Knez (2005) Phenols, proanthocyanidins, flavones and flavonols in some plant materials and their antioxidant activities. *Food Chem.,* **89,** 191–198.

Sobhy, H. M., Gaafar, A. M. and El-Anany,A. M. (2015) Nutritional and sensory evaluation of sponge cake incorporated with various levels of jojoba meal and protein isolate. *Adv. Food Sci.,* **37,** 1, 23-30.

Soleimanifard, S., Shahedi,M., Emam-Djomeh,Z., and Askari, G. R. (2018) Investigating textural and physical properties of microwave-baked cupcake *J. Agric. Sci. Tech.,* **20,** 265-276.

Steel, R.G.D., Torrie, J.H. and Dicky, D.A. (1997) Principles and procedures of statistics, a biological approach. 3rd ed. MacGraw Hill Book Co., New York, USA.

Turabi, E., Sumnu, G. and Sahin, S. (2008) Rheological properties and quality of rice cakes formulated with different gums and an emulsifier blend. *Food Hydrocolloids,* **22,** 305-312.

Umang, P., Undale, K. M., Ashok, B. (2009) Evaluation of diuretic activity of aqueous and methanolic extracts of *Lepidium sativum* garden cress (cruci ferae) in rats. *Trop. J, Pharma.* Res., **8,** 3, 215-219.

Walker, C. E., and Hazelton, J. L. (1996) *Cereal Foods World* (41th ed.). USA.

Zia-Ul-Haq, M., Ahmad,S., Calani,L., Mazzeo,T., Del Rio,D., Pellegrini, N.and De Feo, D. (2012) Compositional study and antioxidant potential of *Ipomoea hederacea* Jacq. and *Lepidium sativum* L. seeds. *Molec.,* **17,** 10306-10321.

تأثير إضافة بذور حب الرشاد على الخواص الريولوجية لدقيق القمح وكيك القوالب المنكه بالشيكولاتة
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يرجع الدافع الأساسى لهذه الدراسة الى الأهمية التكنولوجية والطبية والتغذوية لبذور حب الرشاد. حيث صُمِمت لمعرفة تأثير إضافة مسحوق بذور حب الرشاد (PSCG) (وذلك بنسبة إستبدال ٥ و١٠ و١٥٪ من دقيق القمح) على الخواص الريولوجية لدقيق القمح وكذلك الوزن النوعى والقوام وظاهرة البيات والخواص الحسية لكيك القوالب المنكه بالشيكولاتة. وقد أظهرت الدراسة أن مسحوق بذور حب الرشاد تُعد مصدراً غنياً للبروتين والكربوهيدرات والألياف الغذائية والدهن والأملاح المعدنية (مثل البوتاسيوم والفوسفور والماغنسيوم والحديد) والفينولات العديدة والفلافونويدات. وكذلك تمتلك بذور حب الرشاد خواص وظيفية جيدة. حيث زادت القدرة على إمتصاص الماء وذلك بإضافة مسحوق حب الرشاد مسجلةً ٥٩ و٦٢و٦٦و٧٢ لكل من عينة الكنترول والعينات ٥و١٠و١٥٪ من الدقيق المعامل على التوالى. وسجلت عينة الكنترول أعلى معدل خلط(ITM). وقد زاد وقت العجن(TA) ومدة تكوين العجين(TDD) ووقت الرحيل(TD) وثبات العجين(DS) بزيادة PSCG. وسجل دقيق القمح المحتوى على ٥٪ من بذور حب الرشاد أعلى مرونة(R50) وأعلى مرونة قصوى(RM) وأعلى رقم نسبى(R50/E). وقلّت مطاطية العجين(E) وقوة العجين(DS) بزيادة معدل إضافة مسحوق بذور حب الرشاد.ووجِد أيضاً أن إستبدال دقيق القمح بـ ٥و١٠و١٥٪ من مسحوق بذور حب الرشاد قد زوّد بدرجة ملحوظة ($P \geq 0.05$) وزن وحجم والحجم النوعى لكيك القوالب الناتج. وأن كيك القوالب المحتوى على ١٥٪ من مسحوق بذور حب الرشاد سجّل أقل قيمة للصلابة(١) والصلابة(٢) و springiness و gumminess وchewiness متبوعة بالعينة المحتوية على ١٠٪ من مسحوق بذور حب الرشاد فيما عدا. كما سجّلت عينة الكيك المحتوية على ١٥٪ من مسحوق بذور حب الرشاد أقل معدل نقص فى القدرة على ربط الماء القلوى(AWRC) وذلك خلال فترات التخزين مسجلةً١٠,٦٧ و ١,٩ و ٢,٧٩ و ٢,٤ بعد ستة أيام من التخزين على التوالى متبوعة بالكيك المحتوى على ١٠ثم ٥٪ من مسحوق بذور حب الرشاد وأخيراً عينة الكنترول. ووُجِد أيضاًأن الكيك المحتوى على مسحوق بذور حب الرشاد كان أكثر قابلية وطزاجة من كيك الكنترول. وبذلك، فإن إضافة مسحوق بذور حب الرشاد لدقيق القمح قد حسّن من الخواص الريولوجية للدقيق وأيضاً من جودة كيك القوالب.