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# FEASIBILITY OF USING GREEN TEA POWDER AS A NATURAL ANTIOXIDANT AND STEVIA AS A SWEETENER IN NON-FERMENTED LAYER CAKE

**Leyla NNATEGHI[1*], Fatemeh ZAREI[2], Hosam E.A.F. BAYOUMI HAMUDA[3]**

*[1]Department of Food Sciences and Industries, Faculty of Agriculture, Varamin-Pishva Branch, Varamin, Iran, *Phone: +98-9125878775, Email: leylanateghi@iauvaramin.ac.ir, Email: leylanateghi@yahoo.com*
*[2]Food Sciences and Industries, Food and Drug Administration, Tehran, Iran*
*Phone: +98-9123480409, Email: Zarei.fatemeh@gmail.com*
*[3]Institute of Environmental Engineering and Natural Sciences, Óbuda University, Budapest, Hungary, Phone: +36303900813, E-mal: Bayoumi.hosam@uni-obuda.hu*

***Abstract:*** *Today there is an increasing demand for low-calorie and functional food products worldwide. Green tea powder has antioxidant property due to its phenolic structure which makes it a good natural replacement for synthetic antioxidants. Stevia is a calorie-free product which can be substituted for sucrose in foods. The aim of this study was to investigate the feasibility of using green tea powder and stevia instead of flour and sugar respectively in the formulation of non-fermented layer cake. To do so, different concentrations of green tea powder (10, 20, 30% w/w) and stevia (40, 60, 80% w/w) were incorporated into the formulation of cake. Ten treatments were designed and the rheological properties of dough including pharinograph and extensiograph characteristics were measured. Three dough samples with superior rheological properties along with control sample were baked. The physicochemical and sensory properties of the selected samples were compared with those of control sample. The layer cakes containing 10% green tea powder and 40, 60 and 80% stevia were selected as the superior treatments and their quality properties were compared with those of control sample. Increased concentration of stevia significantly reduced the specific volume and increased the firmness of the layer cake samples. Since there was no significant difference in total acceptance between the layer cakes containing green tea powder and stevia and control sample, the treatment containing 10% green tee powder and80% stevia was selected as the superior treatment regarding the nutritional and quality properties.*

***Keywords:*** *Non-fermented layer cake; Green tea powder; Stevia*

## INTRODUCTION

The cereal industry is among the largest sectors of the food industry worldwide and products such as biscuits, cookies and cakes are the most popular products due to their convenient consumption and long shelf life (usually about four weeks). Cakes as bakery products come in mary varieties and are popular among the people especially children and adolescents. Layer cake is among the most commontypes of cakes with a crispy crust and a soft crumb [1]. Different sweeteners are used in bakery products which affect their sweet taste, appearance, volume, color and texture [2, 3]. The main sweetener used in these products is sugar. It makes the product sweet and tender, develops a brown crust and keeps the product fresh longer [3, 4]. Schantz [5] reported that using high amounts of sugar in sweets reduced the plasticity of gluten thereby decreasing their volume. Also sugar causes tooth decay and obesity. On the other hand, due to the lack of metabolism of glucose resulted by sucrose
hydrolysis in the body in the absence of insulin and increased level of blood sugar in diabetics, there is

a growing demand for special foods for diabetics [5]. Today the consumers pay more attention to the quality and health of foods. So there is a great demand for healthy and low-calorie food products [6]. Bakery products such as non-fermented layer cakes and sweets are widely consumed however nutritionists recommend their low consumption because of their high sugar and fat content. Therefore healthier products can be marketed by improving the nutritional value of the above-mentioned products. Mariotti et al. [7] studied the effect of food industry on health and growth as well as the public interest in using the sucrose replacers and reported that the consumers were tended to consume low-calorie products [7]. Today attempts are being made to use sugar replacers such as invert syrup, glucose syrup, date syrup, molasses, stevia, etc. in such products [1, 3]. Stevia is the "steviol glycoside" which is the extract of Stevia rebaudiana bertoni. It is a natural calorie-free sweetener with its extract being 250-300 times sweeter than sucrose. The research has shown the beneficial effects of stevia on diabetes and hypertension. Stevia is known as the best sugar replacer for diabetics. Its positive effect on improving the flavor, taste, color and smell of foods has been demonstrated. Kroyer
[4] conducted extensive research on stevia and its beneficial effects on diabetes and hypertension and reported that it was one of the best sugar replacers for diabetics [4]. Green tea powder has phenolic compounds resulting in antioxidant activity which extends the shelf life and also makes a healthy product. Green tea powder exerts healthful effects on the consumer such as preventing cancer,diabetes, hypertension, etc. [8]. Lu et al. [9] added green tea powder to sponge cake and found that theamounts of protein, fiber, ash and different catechins of the cake samples increased while the cake volume decreased [9]. Najafzadeh et al. [6] investigated the addition of green tea to sponge cake, measured its chemical properties and stated that the protein content of cake increased due to the protective effects of green tea and the reduced denaturation of the flour proteins [6]. Savita et al. [10] studied the chemical and functional properties of stevia and reported that increased water retention by stevia leaf powder was due to its protein content (10 g/100 g dry matter) and that with increasing the stevia concentration the protein content of the cake samples increased. Also they stated that increased level of stevia could increase the ash content of the samples due to the minerals content of stevia [10]. Stevia is a natural and calorie-free product which can improve the aroma, flavor and color of foods and exert beneficial effects on the people suffering from diabetes and high blood pressure. Green tea powder also has antioxidant properties and healthful effects such as preventing cancer and diabetes, reducing the incidence of arthritis, etc. The objective of this study was to investigate the feasibility of using green tea powder as a natural antioxidant as well as stevia in non-fermented layer cakes.

## MATERIALS AND METHODS

### Materials

The materials used in this study included null wheat four (Setareh Co., Iran), green tea powder (Golestan Co., Iran), stevia powder (Takfa Co., Iran), salt (Hedieh Co., Iran), sugar (Golestan Co., Iran), baking powder (Hermin Co., Iran), liquid oil (Naz Co., Iran), egg (Telavang Co., Iran), vanilla (Golha Co., Iran) and skim milk powder (Caseinate Co., Iran). All chemicals were prepared from Merck company (Germany).

### Chemical tests of wheat flour

The moisture, ash and protein contents, flour Falling number (FN) and pH value were determined according to Iranian national standards No. 2705, 103, 2863, 4175 and 37, respectively [11, 12, 13, 14, 15].

### Rheological tests of dough

Rheological tests of dough included pharinographic (AACC method No. 21-54) and extensiographic tests (standard ICC method No. 114) which were performed by pharinograph and extensiograph (Brabander, Germany) [16, 17].

### Non-fermented layer cake preparation

The control layer cake dough was prepared according to the method of Gavlighi et al. [23]. The

ingredients required for preparing the layer cake were determined on the basis of 100 g of null flour. To do so, lukewarm water (114.3 g), egg (50 g), sugar (118 g), liquid oil (33.3 g), vanilla (2 g), skim milk powder (10 g) and salt (2 g) were mixed thoroughly using Moulinex mixer (Model depose 13025, France) at 380 rpm for 3 min .Then null wheat flour (100 g) and baking powder (2.8 g) were added and mixed for 3 min to make the desirable dough. The prepared doughs of equal weight were baked in oven (Model Saiva, Germany) at 220℃ for 12 min. To prepare the treatments of interest, green tea powder at 10, 20 and 30% (w/w) instead of flour and stevia at 40, 60 and 80% equivalent to sucrose sweetness were incorporated into the control formulation (Table 1). It should be noted that different ratios of green tea powder and stevia were determined based on the pretreatment to produce layercakes with desirable quality properties.

Table 1. Non-fermented layer cake treatments

| Treatments | Descriptions |
|---|---|
| 0 | Non-fermented layer cake without stevia and green tea powder (control) |
| 1 | Non-fermented layer cake containing 10% w/w green tea powder + 40% stevia |
| 2 | Non-fermented layer cake containing 10% w/w green tea powder + 60% stevia |
| 3 | Non-fermented layer cake containing 10% w/w green tea powder + 80% stevia |
| 4 | Non-fermented layer cake containing 20% w/w green tea powder + 40% stevia |
| 5 | Non-fermented layer cake containing 20% w/w green tea powder + 60% stevia |
| 6 | Non-fermented layer cake containing 20% w/w green tea powder + 80% stevia |
| 7 | Non-fermented layer cake containing 30% w/w green tea powder + 40% stevia |
| 8 | Non-fermented layer cake containing 30% w/w green tea powder + 60% stevia |
| 9 | Non-fermented layer cake containing 30% w/w green tea powder + 80% stevia |

**Post-bake tests:** Protein, ash and moisture were determined using AACC 150-1, AACC 08-08 and AACC 44-16, respectively [16]. Catechin (antioxidant) concentration was determined by HPLC using the method of Lu et al. [9]. The specific volume of the cake samples was measured by the method presented by Henry Simon company (UK) using a volume measuring device in $cm^3/g$ [18].

**Texture measurement:** The texture of the cake samples was measured by standard AACC 74-09 upon production, 12 and 48 hours after production using universal tesing machine (Instron, Model 1116, UK) [16]. To prepare the sample for texture measurement, the crust was removed and then the crumb was cut into 2.9 cm square cubes.

**Sensory evaluation:** The sensory properties were evaluated by 6 trained panelists by using 5-point hedonic scale. The cake samples were baked, cooled, cut and coded. Then they were evaluated by the panelists 24 hr after production.

## STATISTICAL ANALYSIS

Data were analyzed by ANOVA and Duncan test using Minitab software version 16 at 95% confidance interval.

## RESULTS AND DISCUSSION

### Results of chemical test of wheat flour

The results of chemical tests are shown in Table 2.

Table 2. Chemical properties of wheat flour

| Sample test | Moisture (%) | Ash (%) | Protein (%) | Falling number (S) | pH |
|---|---|---|---|---|---|
| Wheat flour | 12.50±0.19 | 0.4±0.01 | 8.5±0.35 | 659±34 | 5.85±0.05 |

**Rheological tests of layer cake dough**

**Results of pharinograph test:** The results of pharinograph test are presented in Table 3. As shown in the Table, the lowest and the highest rates of water absorption were observed for treatment 3 and treatments 4 and 7, respectively ($P \leq 0.05$). Lai et al. [19] added green tea powder to flat cake and reported that higher amount of green tea powder resulted in increased water absorption by fibers [19]. Yu et al. [20] investigated the effect of green tea powder on the rheology of dough and stated that the water absorption of dough increased at higher concentrations of green tea powder. The increased water absorption is attributed to the presence of fiber and cellulose compounds, gums, dextrin, pectin and starch in green tea leaves [20]. As indicated in Table 3, the longest and the shortest dough expansion times were found for treatments 7 followed by 4 and treatments 3 followed by 2 and 1 showing no significant ($P>0.05$) difference. Zhumaliyeva [21] showed that the addition of 5, 10 and 15% stevia to wheat flour significantly increased the dough expansion time however 20% stevia decreased the expansion time significantly [21]. Also the lowest consistency and stability were observed for treatments 7, 8 and 9 and the highest ones were found for treatments 1 followed by 2. Lin et al. [18] studied the effect of ultra-refined green tea powder on the rheological properties of wheat flour and stated that increased amount of green tea powder resulted in a significant increase in the dough stability. The polyphenolic compounds of green tea can form very strong bond with the proteins of wheat flour resulting in an increase in dough stability [3]. The highest degree of dough softening was found for treatment 9 after 12 min followed by treatments 8 and 7 showing a significant difference from control and other samples. Treatment 1 had the lowest degree of dough softening being significantly different from control and other treatments. Yu et al. [20] also examined the effect of green tea powder on dough rheology and reported similar results as high concentrations of green tea powder (GTP) increased the degree of dough softening [20]. The greatest and the smallest quality numbers were observed for treatments 3 and 2 and treatments 9, 8 and 7, respectively.

Table 3. Results of pharinograph test

| Sample | Water absorption (%) | Dough expansion time (min) | Dough consistency and stability (min) | Degree of dough softening after 10 min (Brabender) | Degree of dough softening after 12 min (Brabender) | Pharinograph quality number |
|---|---|---|---|---|---|---|
| 0 | $52.60\pm0.15^{d}$ | $2.10\pm0.01^{ab}$ | $2.80\pm0.15^{bc}$ | $38.00\pm0.15^{b}$ | $88.00\pm0.50^{de}$ | $68.0\pm0.00^{g}$ |
| 1 | $52.30\pm0.10^{d}$ | $1.90\pm0.20^{a}$ | $5.00\pm0.10^{e}$ | $34.00\pm0.25^{ab}$ | $73.00\pm0.10^{a}$ | $73.0\pm0.10^{h}$ |
| 2 | $51.30\pm0.35^{c}$ | $1.85\pm0.12^{a}$ | $4.75\pm0.25^{e}$ | $36.00\pm0.15^{bc}$ | $75.00\pm0.00^{b}$ | $74.00\pm0.24^{ahi}$ |
| 3 | $44.50\pm0.22^{a}$ | $1.80\pm0.10^{a}$ | $3.55\pm0.15^{d}$ | $30.00\pm0.10^{a}$ | $76.00\pm0.20^{b}$ | $76.00\pm0.00^{i}$ |
| 4 | $66.00\pm0.30^{e}$ | $3.05\pm0.10^{cd}$ | $2.10\pm0.15^{ab}$ | $38.00\pm0.40^{bc}$ | $87.00\pm0.50^{d}$ | $60.0\pm0.50^{f}$ |
| 5 | $51.00\pm0.35^{c}$ | $2.09\pm0.10^{c}$ | $3.30\pm4.25^{cd}$ | $41.00\pm0.00^{bc}$ | $89.00\pm0.20^{ef}$ | $58.0\pm1.00^{e}$ |
| 6 | $49.40\pm0.32^{b}$ | $2.00\pm0.20^{a}$ | $2.73\pm0.55^{bc}$ | $43.10\pm0.10^{bc}$ | $80.00\pm1.00^{c}$ | $53.0\pm1.00^{d}$ |
| 7 | $72.20\pm0.36^{ab}$ | $3.50\pm0.10^{d}$ | $1.98\pm0.50^{a}$ | $40.00\pm0.00^{bc}$ | $90.0\pm0.15^{f}$ | $48.0\pm0.50^{c}$ |
| 8 | $52.80\pm0.35^{d}$ | $2.40\pm0.10^{c}$ | $1.90\pm0.20^{a}$ | $48.00\pm0.10^{bc}$ | $98.00\pm0.00^{g}$ | $45.0\pm1.00^{b}$ |
| 9 | $52.30\pm0.12^{d}$ | $2.00\pm0.10^{a}$ | $1.50\pm0.10^{a}$ | $50.00\pm0.00^{c}$ | $105.0\pm0.20^{h}$ | $43.0\pm1.00^{a}$ |

Values are expressed as mean±SD.

Dissimilar letters in each column represent significant difference at 5% significance level.

Ingredients: (O) wheat flour, (1) 40% stevia + 10% GTP, (2) 60% stevia + 10% GTP, (3) 80% stevia + 10% GTP, (4) 40% stevia + 20% GTP, (5) 60% stevia + 20% GTP, (6) 80% stevia + 20% GTP, (7) 40% stevia + 30% GTP, (8) 60% stevia + 30% GTP, (9) 80% stevia + 30% GTP.

**Results of extensiograph test:** The results of extensiograph test are shown in Table 4. The highest tensile strength and maximum tensile strength were observed for treatments 9 followed by 6 and the lowest ones were found for control sample. The highest tensile strength within 90 min was found for treatments 9 and 6. Also tensile strength of control sample was significantly lower than that of other treatments ($P \leq 0.05$). Within 135 min, the highest tensile strength was found for treatment 9 which was

significantly (P≤0.05) lower than control and other treatments and the lowest tensile strength was observed for control. Yu et al. [20] studied the addition of green the powder to wheat flour dough and reported that tensile strength of dough increased as the amount of green tea increased [20]. Within 45, 90 and 135 min, the highest and the lowest tensile strengths were observed for control and treatment 9, respectively. Within 45 and 90 min, the smallest and the greatest numbers were found for control and treatments 8 and 9 showing no significant (P≤0.05) difference. Within 135 min, the smallest and the greatest numbers were found for control + treatment 3 and treatment 9, respectively being significantly (P≤0.05) different from other treatments. Within 45 min, the highest and the lowest amounts of energy were observed for treatments 9 and 5, respectively. Within 90 and 135 min, the highest and the lowest amounts of energy were observed for treatment 9 and control. Yu et al. [20] added green tea to wheat flour and reported that within 45 and 90 min, the area under the dough curve increased significantly as the concentration of green tea increased and decreased within 135 min [20].

Table 4. Results of extensiogreph test (A: used energy or area under curve, R 50: Resistance to stability (50 mm), E: Elasticity)

| Treatment | A ($cm^2$) | A ($cm^2$) | A ($cm^2$) | R50 (B.U) | R50 (B.U) | R50 (B.U) | E (mm) | E (mm) | E (mm) | R50/E (Bμ/mm) | R50/E (Bμ/mm) | R50/E (Bμ/mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45′ | 90′ | 135′ | 45′ | 90′ | 135′ | 45′ | 90′ | 135′ | 45′ | 90′ | 135′ |
| 0 | $123^{e}$ | $111^{a}$ | $131.85^{a}$ | $527.1^{a}$ | $580.1^{a}$ | $690.10^{a}$ | $151.8^{e}$ | $125.7^{d}$ | $131.8^{h}$ | $3.47^{a}$ | $2.52^{a}$ | $5.05^{a}$ |
| 1 | $115^{Cd}$ | $122.3^{b}$ | $136.3^{b}$ | $680.85^{b}$ | $782.9^{b}$ | $790.9^{d}$ | $111^{d}$ | $130.5^{e}$ | $121^{e}$ | $6.13^{b}$ | $2.67^{a}$ | $6.53^{bc}$ |
| 2 | $119^{d}$ | $124.3^{b}$ | $140.3^{c}$ | $700.9^{c}$ | $760.9^{bc}$ | $810.9^{f}$ | $108.75^{d}$ | $120^{b}$ | $110^{c}$ | $6.44^{b}$ | $3.3^{b}$ | $7.36^{cd}$ |
| 3 | $120.5^{d}$ | $127^{c}$ | $135^{b}$ | $800.5^{d}$ | $710.9^{d}$ | $699.9^{b}$ | $76.85^{b}$ | $122.5^{c}$ | $129^{g}$ | $10.41^{a}$ | $2.85^{ab}$ | $5.41^{a}$ |
| 4 | $116^{c}$ | $135^{d}$ | $149^{d}$ | $780.05^{e}$ | $790.1^{c}$ | $800^{e}$ | $89^{c}$ | $130^{e}$ | $118^{d}$ | $8.79^{c}$ | $2.42^{a}$ | $6.77^{c}$ |
| 5 | $103^{a}$ | $150^{e}$ | $157^{e}$ | $785.3^{f}$ | $810.15^{d}$ | $899.1^{h}$ | $86^{c}$ | $118.5^{ba}$ | $104.5^{b}$ | $9.13^{cd}$ | $3.37^{b}$ | $8.64^{e}$ |
| 6 | $130^{f}$ | $157^{f}$ | $171^{f}$ | $790.25^{i}$ | $799^{c}$ | $812.4^{j}$ | $80^{b}$ | $129^{e}$ | $100.5^{a}$ | $9.87^{de}$ | $2.53^{a}$ | $8.12^{de}$ |
| 7 | $120^{d}$ | $160.^{g}$ | $170^{f}$ | $783.8^{j}$ | $870.1^{f}$ | $700.9^{c}$ | $89^{c}$ | $125^{d}$ | $1236.5^{f}$ | $8.80^{c}$ | $2.46^{a}$ | $5.54^{ab}$ |
| 8 | $107^{b}$ | $167^{h}$ | $175^{g}$ | 845.4 | $835.35^{e}$ | $890.1^{i}$ | $73.9^{ab}$ | $120^{b}$ | $105.5^{b}$ | $11.43^{f}$ | $2.94^{ab}$ | $8.43^{de}$ |
| 9 | $137^{g}$ | $171^{i}$ | $179^{h}$ | $862^{l}$ | $890.9^{g}$ | $900.9^{j}$ | $70.5^{a}$ | $118^{e}$ | $100^{a}$ | $12.22^{f}$ | $3.3^{b}$ | $8.19^{de}$ |

1- Values are expressed as mean±SD.
2- Dissimilar letters in each column represent significant difference at 5% significance level.
Ingredients: (O) wheat flour, (1) 40% stevia + 10% GTP, (2) 60% stevia + 10% GTP, (3) 80% stevia + 10% GTP, (4) 40% stevia + 20% GTP, (5) 60% stevia + 20% GTP, (6) 80% stevia + 20% GTP, (7) 40% stevia + 30% GTP, (8) 60% stevia + 30% GTP, (9) 80% stevia + 30% GTP.

**Determination of specific volume of selected treatments**

As shown in Table 5, treatment 1 had the largest dough volume showing a significant (P≤0.05) difference from control and other treatments and the lowest specific volume was observed for treatment 3. Lu et al. [9] investigated the quality and antioxidant properties of green tea and stated thatas the amount of green tea increased the volume of cake decreased significantly. Increased level of flour replacement with cellulose led to further weakening of the gluten network and since the gluten network is responsible for gas retention in bakery products, the volume of cakes decreased [9]. Walter [22] added stevia to bakery products and stated that the cake sample containing 100% stevia was denser and less voluminous than other treatments containing stevia and sugar 25 and 50% stevia resulted in increased specific volume while the addition of 75 and 100% stevia decreased the specific volume of the samples [22].

Table 5. Results of specific volume test

| Treatment | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Specific volume ($cm^3/g$) | $1748.55±7.15^{a}$ | $2103.48±5.20^{b}$ | $1616.08±2.12^{a}$ | $1580.55±1.12^{a}$ |

- Values are expressed as mean ± Sd.
- Dissimilar letters in each column represent significant difference (P≤0.05).

Ingredients: (0) wheat flour, (1) 40% stevia + 10% green tea powder, (2) 60% stevia + 10% green tea powder, (3) 80% stevia + 10% green tea powder

**Results of texture test of selected treatments**

As shown in Table 6, the results of compression test by Instron machine demonstrated that with increasing time and stevia concentration in the formulation of cake, its firmness increased significantly ($P<0.045$). The highest and the lowest levels of firmness were observed for treatment 3 (80% stevia + 10% green tea powder) and treatment 1 (40% stevia + 10% green tea powder). Also Lu et al. [9] studied the quality and antioxidant properties of green tea cake and stated that with increasing greentea powder concentration the firmness of cake increased significantly [9].

Table 6. Results of texture measurement by Instron machine (N)

| Treatment | Baking data | 24 hr | 48 hr |
|---|---|---|---|
| 0 | $0.0\pm91.15^{c}$ | $0.0\pm97.11^{c}$ | $0.0\pm99.06^{c}$ |
| 1 | $1.0\pm04.11^{c}$ | $1.0\pm08.09^{c}$ | $1.0\pm11.13^{c}$ |
| 2 | $1.0\pm32.13^{b}$ | $1.0\pm37.10^{b}$ | $1.0\pm41.12^{b}$ |
| 3 | $1.0\pm61.18^{a}$ | $1.0\pm65.13^{a}$ | $1.0\pm69.15^{a}$ |

Values are expressed as mean ± Sd.
Dissimilar letters in each column represent significant difference ($P\leq0.05$).
Ingredients: (0) wheat flour, (1) 40% stevia + 10% green tea powder, (2) 60% stevia + 10% green tea powder, (3) 80% stevia + 10% green tea powder

**Results of chemical test of selected treatments**

The results of chemical test are shown in Table 7. The highest and the lowest moisture contents were found for control and treatment 3, respectively however there was no significant ($P<0.05$) difference in moisture content between the treatments.
Lu et al. [9] also reported that with increasing green tea powder concentration the moisture content of the sponge cake samples remained constant [9].
The highest and the lowest ash contents were found for treatment 3 and control showing no significant ($P>0.05$) difference.
Najafzadeh et al. [6] added green to sponge cake and reported higher ash content for the cake samples containing higher green tea concentration [6].
The highest and the lowest protein contents were observed for treatments 3+2 and control, respectively. Najafzadeh [6] investigated the chemical properties of sponge cake containing green tea and stated that increased amount of green tea resulted in higher protein content which was attributed tothe protective effect of green tea and reduced denaturation of the flour proteins [6].
Since epigallocatechin gallate is the most abundant catechin in green tea, its content was measured in the present study which was found to be significantly higher in all treatments as compared to control sample.
Lu et al. [9] added green tea powder to flour and showed that protein, fiber, ash and different catechins contents of the cake samples increased while their volume decreased [9].

Table 7. Chemical properties of cakes containing green tea and stevia

| Sample test | Moisture (%) | Ash (%) | Protein (%) | Catechin (EGCG) (mg/100g) |
|---|---|---|---|---|
| 0 | $29.30\pm0.35^{a}$ | $0.83\pm0.20^{a}$ | $7.30\pm0.80^{a}$ | $0.000\pm0.00^{a}$ |
| 1 | $29.26\pm0.60^{a}$ | $0.97\pm0.15^{a}$ | $8.30\pm0.20^{ab}$ | $161.02\pm2.00^{b}$ |
| 2 | $29.00\pm0.42^{a}$ | $1.02\pm0.35^{a}$ | $8.91\pm0.32^{b}$ | $160.29\pm0.50^{b}$ |
| 3 | $28.60\pm0.5^{a}$ | $1.17\pm0.450^{a}$ | $9.01\pm0.10^{b}$ | $159.10\pm1.20^{b}$ |

Values are expressed as mean ± Sd.

Dissimilar letters in each column represent significant difference (P≤0.05).
Ingredients: (0) wheat flour, (1) 40% stevia + 10% green tea powder, (2) 60% stevia + 10% green tea powder, (3) 80% stevia + 10% green tea powder

**Results of total acceptance of selected treatments**

As shown in Table 8, there is no significant (P>0.05) different in total acceptance between the selected treatments and control sample.

Table 8. Results of total acceptance of cake samples

| Treatment | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Total acceptance | 5.00±0.00[a] | 5.00±0.00[a] | 5.00±0.00[a] | 5.00±0.00[a] |

Values are expressed as mean ± Sd.
Dissimilar letters in each column represent significant difference (P≤0.05).
Ingredients: (0) wheat flour, (1) 40% stevia + 10% green tea powder, (2) 60% stevia + 10% green tea powder, (3) 80% stevia + 10% green tea powder

## CONCLUSION

The results demonstrated that the addition of different levels of green tea and stevia had significant effect on rheological parameters and texture of the produced non-fermented layer cakes. Also therewas no positive relationship between the addition of green tea powder and pharinograph and extensiograph characteristics. The added green tea powder increased water absorption and dough expansion time and decreased quality number, consistency and stability of dough as the samples containing 10% green and 80% stevia had the highest quality number, consistency and stability as compared to control and other treatments. Since there was no significant difference in total acceptance between the selected samples containing green tea powder + stevia and control, treatment 3 (80% stevia + 10% green tea powder) was selected as the superior treatment due to its lower calorie and improved nutritional properties.

## REFERENCES


[1] Payan, R. (2010): Cereal products technology Ayeezh publications, Tehran, 149-161.
[2] Butt,s. I., pasha (2002): Use of low Absorptive sweeteners in cakes, Department of food Technology, University of Agriculture, Faisalabad, 102-115
[3] Lee, C. S., Lin. (2008): Quality and antioxidant property of green tea sponge cake, foodchemistry, 119(3):1090–1095
[4] Kroyer, G. (1999): The Low Calorie Sweetener Stevioside: Stability and Interaction with Food Ingredients, lwt-food science and Technology, 32)8(,509-512
[5] Schantz, R. (1994)? Bread machine baking at high altitude, university of Wyoming, agricultural experiment station, department of home economics college of agriculture,3,989
[6] Najafzadeh, A.; Elhamirad, H. (2011), Addition of green tea to sponge cake and investigation of its chemical properties, 20th National Congress on Food Science and Industries, 3, 29-38.
[7] Mariotti, M. C., Alamprese (2012): About the use of different sweeteners in baked goods. Influence on the mechanical and rheological properties of the doughs, lwt- Food Science and Technology, 48(3): 9-12
[8] Mousavi, F. (2010): Secret to health with green tea, Nassouh publications.
[9] Lu, T. L., Ching (2009): Quality and antioxidant property of green tea sponge cake. Food Chemistry, 119(6):1090-1095
[10] Savita, s. k., sheela (2004): Stevia rebaudiana-A Functional component for food industry hum. Ecology society of America, 15(4): 261-26
[11] Institute of Standards & Industrial Research of Iran (1992): Properties and tests of wheat flour, 103.
[12] Institute of Standards & Industrial Research of Iran (1995) Measurement of crude protein of

cereals and their products, No. 2863.
[13] Institute of Standards & Industrial Research of Iran (1987): Measurement of moisture content of cereals and their products, No. 2705.
[14] Institute of Standards & Industrial Research of Iran (2012): Cereals and their products, wheat: properties and tests, No. 4175.
[15] Institute of Standards & Industrial Research of Iran (1999): Properties and tests of biscuits, No. 37.
[16] AACC. (2003): Approved methods of analysis of the American association of Cereal Chemists (AACC), St. Paul, Minnesota.
[17] ICC (1992): International Cereal Chemistry-Standard,1972, No.. 15 and No. 114/1 Revised 1992.
[18] Lin, S. D., Hwang, C. F., Yeh, C. H. (2003): Physical and sensory characteristics of chiffon cake prepared with erythritol as replacement for sucrose. Journal of Food Science, 68(2): 2107– 2110.
[19] Lai, J.m., Nelson (2009): The Effect of Adding Green Tea Powder to Pancake, Food chemistry,104(5), 453-476
[20] Yu, K. N., Chng (2002): Effects of Green Tea Powder on Dough Rheology and Gelatinization Characteristics, Journal of the Korean Society of Food Science and Nutrition, 3(5): 749-753
[21] Zhumaliyeva, G. U., Chomanov (2015): Effect of Complex Supplements on the Rheological Properties of Dough, International Journal of Chemical, Environmental and Biological Sciences, 3(1): 2320.
[22] Walter, J. M., Soliah, Waco, l. (2010): Objective Measures of Baked Products Made with Stevia Family and Consumer Sciences, Baylor University, 2, 110, 9
[23] Gavlighi Ahmadi, Azizi H., M.; Jahanian, L; Amirkavei, sh. (2011): Effect of replacing date liquid sugar with invert sugar in layer cake, Quarterly of food Sciences and Industries, 8 (1).