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The Effect of Adding Sweet Basil Seed Powder (Ocimum basilicum L.) on Rheological Properties and Staling of Baguette Bread

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ABSTRACT: In this research, the functionality of sweet Basil seed powder (Ocimum basilicum L.) on Buguette bread quality and its potential application in retarding the staling process has been studied. Three different concentrations of the powder (0.5%, 1% and 1.5%, w/w, flour basis) were applied. The effects of powder on the rheological properties of dough were also investigated instrumentally by using farinograph and extinsograph. Sweet basil seed powder effects on the physical properties of bread were established by measuring the texture, the loaf volume and the crust colour of baguette bread with a texture analyser and Hunter Lab instrument respectively. All of the instrumental evaluations and sensory tests were applied on the bread after the 1^{st}, 3^{rd} and the 5^{th} days of production. The results indicated that with the addition of 0.5% sweet basil seed powder to the formulation, the staling and sensory characteristics were improved.

Keywords: *Baguette Bread, Staling, Sweet Basil Seed.*

Introduction

The use of additives has become a common practice in the baking industry. The objects of their applications are to improve dough handling properties, increase the quality of fresh bread and extend the shelf life of stored bread (Rosell *et al*., 2001). Bread is a product with great nutritional value consumed worldwide. In order to extend its shelf life, either different recipe formulations or specific storage conditions might be applied. From caloric point of view bread is responsible for a great proportion of daily energy intake. Having a caloric content ranging from 239 kcal/100 grams (rye bread) to 282 kcal/100 grams (white wheat bread), bread could provide up to 50% of the daily recommended caloric intake. Some ingredients have been added to bread formula to improve the technological properties of dough and the final properties of produced bread (Gray & Bemiller, 2003).

This study is an attempt to explore the functional properties of powder which has been obtained from the seeds of *Ocimum basilicum* – and can be potentially used as a novel food ingredient. Basil (Ocimum Basilicum L.) is an herbaceous plant popularly grown in India, Iran (Fekri *et al*., 2008) and in some warm regions of Africa (Phippn, 2000). Aside from its culinary use, basil seeds have been traditionally used as a natural remedy for the treatment of indigestion, ulcer, diarrhoea, sore throats, and kidney disorders (Vieira & Simon, 2000). In some regions in Asia, the powder

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is incorporated into food products such as desserts and beverages as a source of dietary fibre (Mathew *et al*., 1993). The seeds of basil are mainly composed of two major fractions; (i) glucomannans (~43 %) and (ii) (1→4) linked xylan (~24.3%) (Anjaneyalu & Tharanathan, 1974).

The present study has been carried out to evaluate the effect of sweet basil seed powder on the quality of Baguette bread and its potential application in retarding the staling process.

Materials and Methods

Wheat flour (containing 0.67% ash in dry matter, 11.7% proteins and 27% wet gluten) and sweet basil seed obtained from the Agricultural Organization Karaj were used in this study. The dough was prepared according to the formulation with blend flour, salt (1%), dry yeast (1%), sweet basil seed powder (0.5, 1 or 1.5%) and water according to farinographic consistency 500 BU (Brabender Units).

Chemical and physical analyses of sweet basil seed consisting of moisture, ash, fiber, fat and protein were determined according to AACC standard methods 44-15 A, 08-01, 32-10, 30-10, 30-25 and 46-12 respectively.

The rheological characteristics of the dough were investigated using farinograph and extensigraph instruments based on the methods presented by AACC (1983) numbers 54-21 and 54-10.

The loaf volume was determined by using rape seed displacement method (AACC, 2000, Standard 10-05). This was carried out by loading sorghum grains into an empty box with calibrated mark until it reached the marked level and unloaded back. The bread sample was put into the box and the measured sorghum was loaded back again. The remaining sorghum grains left outside the box was measured using measuring cylinder and recorded as loaf volume in cm^3. The specific volume, volume to mass ratio, (cm^3/g) was thereafter calculated.

Hardness of the baked loaf samples were measured after 1, 3 and 5 days storage by using a manual penetrometer (10 KN M350-10 AT/CT, England). This analysis was accomplished at ambient temperature with a cylindrical probe (d= 6mm). The penetration rate was adjusted at 60 mm/min. The crust hardness is expressed as the force (N) needed to penetrate the sample (Ptaszek & Grzesik, 2007).

The colour of bread was measured by using Hunter Lab Colorimeter on the first day after the bread was made. Hunter lab colorimeter values, L * (0=black, 100=white), a * (+value = red, -value = green) and b * (+value = yellow, -value = blue) were recorded and YI (Yellowness index), WI (White index) and ΔE (total color difference) were calculated (Ghodke *et al*., 2007).

$$YI = \frac{142.86\, b}{L}$$

$$WI = 100 - \sqrt{(100 - L)^2 + a^2 + b^2}$$

$$\Delta E = [(L\ standard - L\ sample)^2 + (a\ standard - a\ sample)^2 + (b\ standard - b\ sample)^2]^{0.5}$$

The loaf quality and sensory attributes were evaluated 1, 3 and 5 days after baking at room temperature. Sensory evaluation was accomplished by the 5-point hedonic scale determination by 10 panelists. The assessors evaluated the shape of the product, crust colour and thickness/hardness, crust/crumb odour and taste, crumb elasticity, porosity and colour.

The results were compared in a random design (samples were selected randomly) with 3 replications in analytical methods and 10 replications in sensory evaluation. For the mean comparison of averages and introducing the best sample, Duncan's new multiple range tests were used. Statistical analysis of the data was carried out using SPSS software.

Results and Discussion

The results of chemical analysis of sweet basil seed are presented in Table 1.

Rheological characteristics reflect the dough properties during processing and the quality of the final product (Shahzadi *et al*., 2005). The effect of sweet basil powder addition on dough rheology is summarized in Table 2. As shown in Table 2, water absorption was increased in the treatment with 0.5 % basil sweet powder but in two other dosages this factor was decreased. Although, the differences between the treatments were not significant ($P<0.05$), but by increasing the sweet basil powder the rate of dough development time and dough stability were increased and the degree of softening was reduced. The results show the positive effect of sweet basil powder on dough rheological characteristics and the gluten network. Considering the FQN number, whenever the quantity of this factor is greater, the quality of flour and dough is improved. By adding sweet basil powder the FQN factor was increased and the highest increase was observed at the %1 treatment.

For the Extensograph test, each sample was stretched at 45, 90, and 135 minutes after the end of the mixing. This procedure was designed to simulate the fermentation period in the conventional bread baking. The following characteristics of the Extensograph are widely used for the determination of dough quality; Energy, the extensibility, expressed as the length of the curve until the point of rupture; the resistance at a fixed extension, maximum resistance and ratio number (Dempster *et al*., 1952). The results of Extensograph analysis are shown in Table 3. The viscoelastic behavior of the dough was affected by sweet basil powder addition. In all the treatments, the extensibility of dough was significantly decreased with an increase in the resting time from 45 to 135 minutes, probably owing to the water-biding ability of sweet basil powder. The results also showed that higher concentration of powder gave significantly longer extensibility. Table 3 shows the effect of sweet basil powder on dough resistance. With an increase in resting time from 45 to 135 minutes, this value for both control and powder-added samples was significantly increased except the control in 135 min after the end of the mixing. This value was also affected by sweet basil powder concentration. The higher the powder concentration, the higher the resistance to extension value. The application of different percentages of

Table 1. The results of the chemical characteristics of sweet basil seed

Sample	Protein (%)	Moisture (%)	Ash (%)	Fiber (%)	Fat (%)
Sweet basil seed powder	20.42	3.97	8.93	26.18	16.61

Table 2. The effect of sweet basil powder rate on farinograph characteristics

	Sweet Basil Seed Powder rate (%)			
Rheological Properties	**standard**	**0.5**	**1**	**1.5**
Water absorption (%)	60.1	61.2	59.6	59.5
Dough development time (min.)	1.8	1.8	2.0	5.8
Dough stability (min.)	7.4	12.1	12.3	11.7
Degree of softening (10 min after begin)	44	18	15	14
Degree of softening (12 min after Max)	58	31	28	46
Farinograph quality number (FQN)	75	138	147	130

sweet basil powder in dough formulation caused significant increases in this value of dough as compared to the control sample. Among the treatments 1.5% and 0.5% addition showed the highest and the lowest effects on dough resistance value at all resting times, respectively. This might be due to the interactions between sweet basil and flour proteins. As the resting time has increased from 45 to 135 minutes, the dough deformation energy also has increased except the control and 0.5% addition (Table 3). The addition of sweet basil seed powder to the dough formulation has caused an increase in the deformation energy as compared to the control and this effect was concentration dependent.

As the staling of bread occurs, its texture becomes stiffer and more extending force is required for cutting (Gujral & Pathak, 2002). Regarding the increased hardness during storage, the treatment with 0.5 % sweet basil powder gave the lowest value, reflecting a better effect as antistaling agent (Table 4).

Loaf volume is regarded as the most important characteristic for bread since it provides a quantitative measurement of baking performance (Tronsmo *et al.*, 2003). The influence of applied sweet basil powder on volume of the final product is presented in the Table 5. It was observed that by increasing the sweet basil powder, bread volume has decreased as compared to the control. This difference is not considerable in the treatment with 0.5 % addition of sweet basil powder.

Table 3. The effect of sweet basil powder rate on extensigram characteristics

	Rheological Properties					
Extraction rate	**Time (min.)**	**Energy (cm2)**	**Resistance to extension (BU)**	**Extensibility (mm)**	**Maximum resistance (BU)**	**Ratio Number**
	45	81	348	138	411	2.5
Standard	90	91	371	142	466	2.6
	135	74	328	133	405	2.5
	45	82	343	145	387	2.4
0.5 %	90	80	403	124	459	3.3
	135	78	349	137	400	2.5
	45	92	372	149	425	2.5
1 %	90	96	397	144	478	2.8
	135	97	423	147	466	2.9
	45	88	389	144	408	2.7
1.5 %	90	95	449	136	489	3.3
	135	98	501	131	538	3.8

Table 4. The effect of sweet basil powder rate on Hardness Index during storage

	Hardness Index (N)		
Treatments	**1st day**	**3st day**	**5st day**
Control	4.44^{b}	3.99^{ab}	3.54^{a}
0.5% sweet basil powder	3.39^{a}	3.40^{a}	3.42^{a}
1% sweet basil powder	4.47^{b}	4.20^{b}	4.13^{a}
1.5% sweet basil powder	6.75^{c}	7.10^{c}	7.65^{b}

Values are the mean of three replications. Different letters in each column indicate significant differences (P< 0.05).

The addition of sweet basil powder resulted the loss of bread brightness (L*) and a decrease in bread yellowness-blue (b*), probably due to the sweet basil seed colour (Table 6). The redness of the bread increased with the addition of sweet basil powder (a*), however there is not a significant difference between 0.5 and 1% treatments as compared to the control. As presented in Table 6, YI increased and WI decreased with the addition of sweet basil seed powder respectively. Therefore bread with 1 and 1.5% is darker than the control.

The effect of the addition of various percentage of sweet basil powder on sensory properties of Baguette bread is shown in Table 7. Each attribute was scored from 1 (lowest) to 5 (highest). As shown in Table 7, on the first day after baking, the control and 0.5 % addition did not have significant difference but on the third and the fifth days after baking the panelists preferred breads with 0.5% sweet basil powder. Also three and five days after bread making, the treatments containing 1% and 1.5 % sweet basil powder did not have significant differences. The results indicated that breads with 0.5% sweet basil powder were preferred by the panelists.

Table 5. The effect of sweet basil powder rate on loaf volume of baguette bread

	Loaf Volume		
Treatments	**1st day**	**3st day**	**5st day**
Control	5.083^c	5.042^c	4.046^b
0.5% sweet basil powder	5.081^c	5.047^c	4.044^b
1% sweet basil powder	4.704^b	4.284^b	3.204^a
1.5% sweet basil powder	4.205^a	4.053^a	3.196^a

$^{a-c}$ Means in the same column followed by different letters were significantly different ($p<0.05$).

Table 6. The effects of sweet basil powder on bread brightness (L^*), yellowness-blue (b^*), redness (a^*), YI and WI

Treatments	L*	a*	b*	YI	WI	ΔE
Control	60.95^a	7.08^a	33.56^a	78.69^a	48.12^a	0(0)^a
0.5% sweet basil powder	60.72^a	6.95^a	32.84^a	77.30^a	48.30^a	0.14(±4.12)^a
1% sweet basil powder	56.53^{ab}	8.76^{ab}	33.84^a	85.72^b	44.16^{ab}	2.45(±6.32)^b
1.5% sweet basil powder	51.42^b	10.56^b	33.18^a	92.32^c	40.22^b	6.43(±3.24)^c

$^{a-c}$ Means in the same column followed by different letters were significantly different ($p<0.05$).

Table 7. The effect of different concentrations of sweet basil powder on the bread sensory evaluation

	points assigned to treatments		
Treatments	**1st day**	**3st day**	**5st day**
Control	4.35^b	3.10^a	1.90^b
0.5% sweet basil powder	4.27^b	3.62^b	2.10^b
1% sweet basil powder	4.12^b	3.05^a	1.67^a
1.5% sweet basil powder	3.72^a	2.90^a	1.67^a

$^{a-c}$ Means in the same column followed by different letters were significantly different ($p<0.05$).

Conclusion

The characteristics of wheat flour and dough were modified to some extent by the addition of sweet basil powder. Dough with different percentage of sweet basil powder had pronounced effects on dough properties yielding a higher dough development time, dough stability, extensibility and lower degree of softening as compared to the control flour. On the other hand the results indicated the positive effect of sweet basil powder on dough rheological characteristics and the gluten network. Sweet basil powder addition at levels of 0.5%, 1% and 1.5% also affected the texture of bread and the treatment with 0.5 % reflected a better effect as antistaling agent. According to the sensory evaluation, the addition of 0.5% sweet basil powder might provide acceptable bread. Furthermore, these breads have improved nutritional values and longer shelf life along with acceptable softness and taste.

References

Anjaneyalu, Y. V. & Tharanathan, R. N. (1974). Polysaccharides from the seed mucilage of Ocimum basilicum Lin. Indian Journal of Chemistry, 12 (11) 1164-1165.

Fekri, N., Khayami, M., Heidari, R. & Jamee R. (2008). Chemical analysis of flax seed, sweet basil, dragon head and quince seed mucilages. Res J Biol Sci., 3 (2) 166-170.

Dempster, C. J., Hlynka, L. & Winkler, C. A. (1952). Quantitative Extensograph Studies of Relaxation of Internal Stresses in Nonfermenting Bromated and Unbromated Doughs. Cereal Chem., 29, 39-53.

Ghodke, A., Shalini, K. & Laxmi, A. (2007). Influence of additives on rheological characteristics of whole-wheat dough and quality of Chapatti (Indian unleavened Flat bread) Part I—hydrocolloids. Food Hydrocolloids, 21(1) 110-117.

Gray, J. A. & Bemiller, J. N. (2003). Bread staling: molecular basis and control. Comprehensive Reviews in Food Science and Food Safety, 2, 1-21.

Gujral, H. S. & Pathak, A. (2002). Effect of Composite Flours and Additives on the Texture of Chapatti. J. Food Eng., 55, 173- 179.

Mathew, S., Singhal, R. S. & Kulkarni, P. R. (1993). Some physico-chemical characteristics of Lepidium Sativum seeds. Die Nahrung, 1, 69-71.

Ptaszek, P. & Grzesik, M. (2007). Viscoelastic properties of maize starch and guar gum gels. Journal of Food Engineering, 82, 227-237.

Phippen, S. (2000). An assessment of land uses and other factors that affect sediment yields in the Rio Puerco basin, Sandoval County, New Mexico. Unpublished Master's thesis, Colorado State University, Fort Collins.

Rosell, C., Rojas, J. & Benedito, M. (2001). Influence of hydrocolloids on dough rheology and bread quality. Food hydrocolloids, 15, 75-81.

Shahzadi, N., Butt, M., Rehman , S. & Sharif , K. (2005). Rheological and Baking Performance of Composite Flours. International Journal of agriculture & biology. 1560–8530.

Tronsmo, K. M., Faegestad, E. M., Schofield, J. D. & Magnus, E. M. (2003). Wheat protein quality in relation to baking performance evaluated by the Chorleywood bread process and a hearth bread baking test. Journal of Cereal Science, 38, 205–215.

Vieira, R. F. & Simon, J. E. (2000). Chemical characterization of basil (Ocimum spp.) found in the markets and used in traditional medicine in Brazil. Economic botany, 54, 207-216.