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EFFECT OF ADDITION OF CITRUS FIBER-PECTIN AND XANTHAN GUM ON THE CHARACTERISTICS OF TOAST BREAD

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ABSTRACT : Dietary fiber is very important for the human and improve the main quality attribution in food products especially baked foods. Citrus fiber-pectin extracted from lime and orange peel fiber at the concentration of 0.5%, 1 % and 2%, and the xanthan gum 0.25% will be used to study the effect of these polysaccharides on the quality of toast bread. Xanthan gum was added at the concentration of 0.25% with both fiber pectin to improve the characterestics of the dough and the resultant toast bread.

Farinograph tests revealed that addition of 2% from lime and orange fiber-pectin increased water absorption. But in the baking results, the concentration of 2% lime and orange fiber decreased specific volume of toast bread. Baking results revealed that the concentration of 1% from lime or orange fiber-pectin, produced toast bread characterized with color of crust, crumb, and specific volume more than the control sample.

The addition of 0.25% xanthan gum with 1% lime or orange peel fiber lead to increase dough stability than that of the dough containing fiber alone and prolong the shelf life of toast bread during one to five days of storage period at room temperature.

Statistical analysis of organoleptical evaluation of toast bread revealed that there is a significant differences between treated samples than the control.

INTRODUCTION

Bakery foods are the major cereal products available to consumer. Among the bakery products, bread has been the principle food in over half of the countries from the world (Chung and Pomeranz, 1983).

Orange and lime peel are the major important citrus by - product from citrus processing are high source of pectic polysaccharides rich fiber concentrate, names dietary fiber. Superior water and fat bending is the major reason for using to improve the main properties of some bakery products such as bread products are suitable for this purpose (Pomeranz et al. 1977; Scola, 1974; Shorgen et al., 1981 and Toma et al., 1979).

Pomeranz et al. (1977) showed that replacing up to 5% of wheat flour with fiber materials, loaf volume reduced by expected theoretical amount. At levels above 7%, fiber materials decreased loaf volume much more than expected. The large decrease resulted from lowered gas retention rather than unstatisfactory gas production.

Park et al. (1997) mentioned that addition of 5% fiber ingredients to loaf formula increased water absorption, mixing time and imparted stickiness to the dough. The addition of fiber and antioxidant resulted in 10% reduction in loaf volume. The crumb remained much softer than the control. They also reported that during one to seven days of storage at room temperature, bread containing wheat fiber showed a more pale crust calor L* = 48.3 than the control L* = 41.9m but crumb color was little affected.(L* indicates lightness)

Christianson (1976) and Christianson et al. (1974) used xanthan gum in the preparation of gluten - Free starch breads. In this application, it is believed that xanthan gum and starch interact to form a mixture which allows the development during baking of a structure similar to that obtained in normal breads. Xanthan gum can also combined with gluten under controlled conditions to give a modified

gluten which has better rehydration characteristics and is more easily processed than normal gluten. (Singer and Murray, 1980).

Bread stailing is an extremely complex phenomenen refers to all changes that occur in bread during aging. These changes include the increase in crumb firmness, loss in flavor and decrease in hydration capacity, amount of soluble starch, swelling power and starch viscosity (Ponte, 1978).

Mettler and Seibel, (1993) suggested that hydrocolloids (Guar gum and carboxymethyl cellulose) can be combined in a baking improve contributing to optimum functional properties of whole wheat bread. They also reported that high-binding capacity of hydrocolloides was responsible for the increased water absorption for optimum 500 B.U consistency up to 2 - 3%

Sanderson (1982) showed that xanthan gum in baked goods is undoubtedly due not only its unique rehology in solution but also to its ability to interact with other ingredients present, notably starch and protein. Such interaction may well be responsible for the improvements in moisture retention, shelf life and excellent crumb structure that have been observed by several manufactures on inclusion of xanthan gum in baked products.

Mettler and Seible, (1995) stated that the specific volume of rye bread could be improved without altering the crumb elasticity by addition of 0.8 % monodiglyceride, 0.6% carboxymethyl cellulose and 0.3% guar gum.

Xanthan gum is widely used in the food industry because it is soluble in cold or hot water, had a high viscosity at low solids, high stability at high temperature and low pH. (Alexander, 1999).

Hefnawy (2000) reported that xanthan gum have an improving effect on the dough stability of wheat flour as it increased the dough stability

from 4.0 min. to 13.5 min, when 0.25 % xanthan gum was mixed with the flour.

The objective of this work was to evaluate the effect of addition of lime and orange fiber-pectin at different levels with or without addition of xanthan gum on the dough properties, studying the effect of these additives on the main characterestics and shelf life of resultant toast bread.

MATERIALS AND METHODS

Wheat flour :

Wheat flour 72% extraction was obtained from North Cairo Flour Mills Company.

Citrus fiber :

Lime and orange fiber-pectin prepared from lime and orange peels according to the methods of Siliha et al. (2000).

Xanthan gum :

Xanthan gum was obtained from Sigma Chemical Company, U.S.A.

Farinograph test :

Water absorption (%), development time (min), stability (min) and dough weakening units (BU) were determined by Brabender Farinograph apparatus Nr. 941020, type 810105001 made in Germany available at The Center Laboratory in the Faculty of Agriculture, Zagazig University, according to the methods described by the AACC (1983).

Toast bread making :

The toast bread was prepared in The Egyptian Baking Technology Center, Giza, Egypt. The straight dough process was carried out according to the method applied in The Egyptian Baking Technology Center, on an experimental scale. The formula used to prepare the toast bread was as follow : 100 gm 72% flour or blend of the flour with pulverized fiber, 0.5 gm. dry yeast, 10gm salt, 20 gm sucrose, 20 gm shortening and water % (obtained by Farinograph based on the flour weight)

Pulverized fiber : wheat flour 72% extraction with lime or orange fiber - pectin at the ratio of 0.5, 1.0 and 2.0% with 0.25% xanthan gum.

These ingredients with or without additives were placed in a mixing bowel at 28°C and mixed with the suitable quantity of water.

The dough was divided and rested 10 min, and then rounded mechanically and placed in baking pan. The fermentation period was 90 and 120 min at 30°C and 85% relative humidity. After proofing, pans were baked in an electrical oven at 210°C for 20 min. and cooled at room temperature for 2 hours before measuring the specific volume and sensory evaluation. The toast bread was stored for seven days at room temperature and then analyzed.

Specific volume of bread :

Bread loaves were weighted (g) after 2 hours of cooling at room temperature. The volume (Cm^3) was measured by rapessed replacement method. Specific volume was obtained by dividing the volume of loaf by it's weight according to the method described by the AACC (1983).

Bread freshness :

Alkaline water retention capacity was used to evaluate the bread freshness according to the method described by Yamazaki (1953) and modified by Kitterman and Rubentholar (1971). The bread was dried in an air oven at 40 °C, milled in a Buhler mill and passed through wire sieves with 30 mesh. Five grams of bread flour were placed into a 50 ml dry plastic centrifuge tube and then 25 ml of 0.48% $NaHCo_3$ solution were added. The tube was stopped and shaked until all bread flour was wet. The mixture was then left for 20 minutes with shaking every 5 min. The contents were centrifuged at 2500 rpm. for 15 min. The supernatant was discounted and the precipitate was left for 10 minutes at 45 angle (to get ride of free water). The experiment was duplicated and average grain of the 2 runs was multiplied by 20 to give alkaline water retention capacity.

Table (1) : Chemical composition of wheat flour 72% extraction

Constitution	%
Moisture	13.67
Protein	12.56
Fat	0.6
Ash	0.54
Carbohydrates	72.03

Analytical methods :

Moisture, ash, carbohydrates, protein and fat were determined according to the methods of A.O.A.C. (1990).

Organoleptic evaluation :

Toast bread were evaluated organoleptically by 10 experienced panelists from the staff of The Egyptian Baking Technology Center after baking and during storage period at room temperature. The numerical scale used was 1-5 point for symmetry of form and break and shred. 1 - 10 point for volume, color of crust, color of crumb, texture, aroma and mouth feel, and 1 - 15 point for grain and taste, according to the methods of Matz (1960).

Statistical analysis :

The organoleptic data were statistically analyzed using ANOVA procedure of the SPSS statistical analysis (1987).

RESULTS AND DISCUSSIONS:

Rhyological properties of the dough was measured using a Farinograph testing. Table (2) and Fig (1) revealed that the addition of lime and orange peel fiber increased water absorption (%) when 0.5, 1 and 2% of fiber were used than the control sample. The great water absorption was 65.20 and 64.60 when the concentration of 2% from lime and orange peel fiber was added. Followed by the concentration of 1% from lime and orange fiber. This increase

Table (2) : Farinograph properties of dough made from different amounts of lime and orange fiber-pectin on wheat flour 72% extraction.

Rhyological properties / Additives	Water absorption (%)	Arrival time (min.)	Dough dev. time (min.)	dough Stability (min.)	Weaking after 10 min. (B. U.)
Control sample wheat flour 72%	58.0	1.30	1.9	6.30	90
Lime fiber-pectin 0.5 (%)	59.7	1.30	2.1	6.30	92
Lime fiber-pectin 1 (%)	61.40	1.30	2.3	6.40	94
Lime fiber-pectin 2 (%)	65.20	1.30	2.0	6.50	94
Orange fiber-pectin 0.5 (%)	58.90	1.50	2.3	6.80	98
Orange fiber-pectin 1 (%)	61.50	1.40	2.6	6.60	98
Orange fiber-pectin 2 (%)	64.60	1.30	2.1	6.50	110

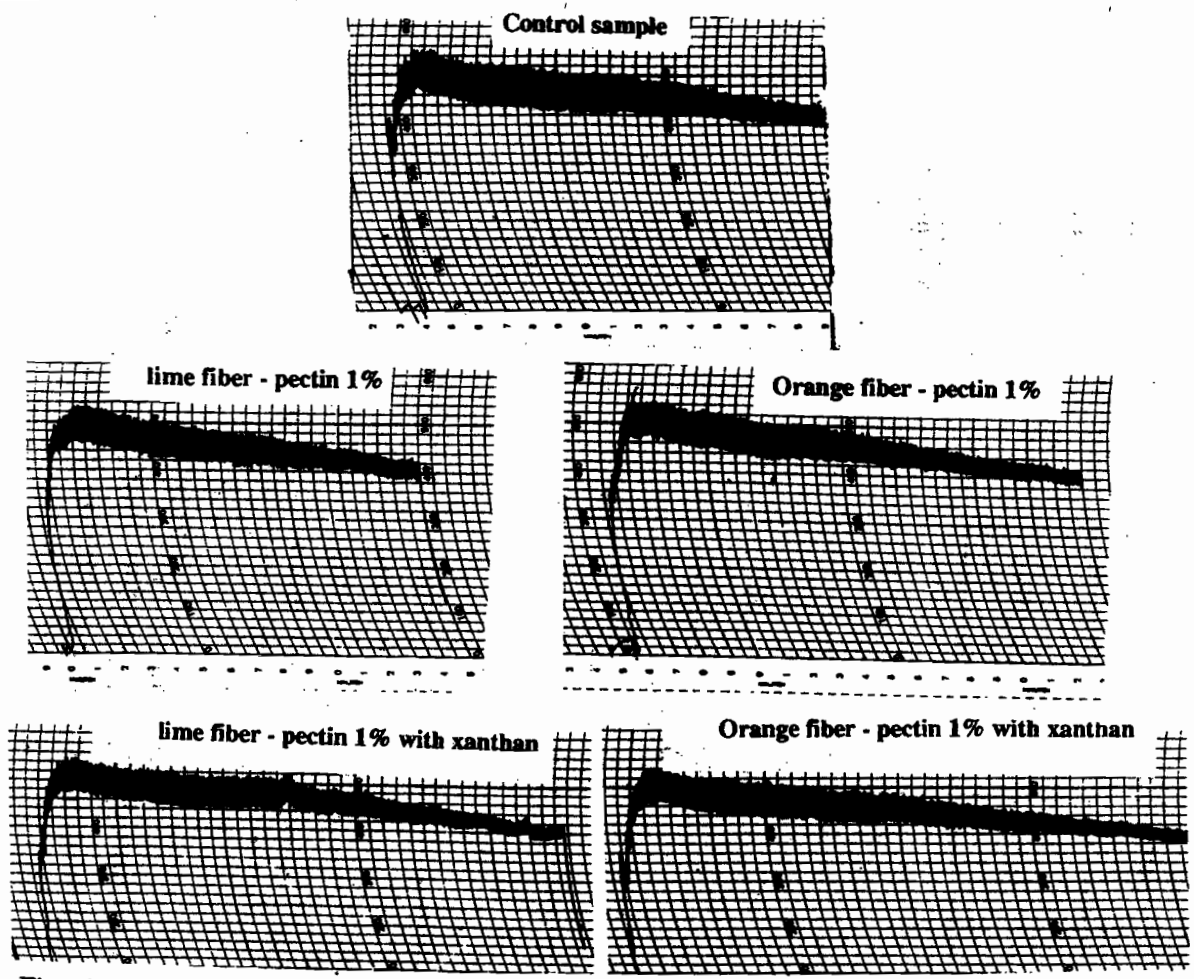

Fig. (1) : Farinograph for dough control sample, addition of 1% of lime and orange fiber pectin with and without xanthan gum.

appeared clearly when using xanthan gum (Table 3).

Concerning dough development, it was increased with addition of lime and orange peel fiber than the control sample. The highest development was in the concentration of 1% from lime and orange peel fiber. They were 2.3 and 2.6 min respecively.

Results summarized in Table (3) and Fig. (1) indicate that xanthan gum have more effect on the stability of the dough when the concentration of 1% from lime peel fiber was added. It reached to 9 min. Such results are inagreement with those found by Ward and Andon (1993) and Alexander (1999).

Figure (2) shows the comparison of crust, crumb and specific volume between the concentration of 1% from lime and orange peel fiber with xanthan for 90 min. and 120 min. fermentation period than the control sample. The results show that 1% from fiber and 0.25% from xanthan gum improved the main quality attribute in toast bread especially when 120 min. fermentation period was used. This improvement may be due to the efficency of fiber and xanthan in the bread, which interact with the other ingredients such starch gluten. This interaction may be responsible for the improvement in moisture retention, shelf life and excellent crust, and crumb structure such results were inagreement with data obtained by Christianson et al. (1974).

The effect of addition of 1% lime and orange fiber, with xanthan for 120 min. fermentation period increased yield and specific volume of toast bread than the control, they were 87.00, 87.52 for yield and 5.08 and 4.57 for specific volume respectively. But the concentration of 2% from lime and orange peel fiber decreased specific volume of bread (Table 4). Such results were inagreement with data obtained by Pomeranz et al. (1977). They reported that at 5% fiber, the loaf volume decreased to an extent expected from the

Table (3) : Farinograph properties of 0.25% xanthan gum with lime and orange fiber-pectin on wheat flour 72% extraction.

Rhyological properties / Additives	Water absorption (%)	Arrival time (min.)	Dough dev. time (min.)	Stability (min.)	Weaking after 10 min. (B. U.)
Control sample wheat flour 72%	58.00	1.30	1.90	6.30	90
Lime fiber-pectin 0.5 (%) + 0.25% xanthan	60.40	1.50	2.50	8.50	90
Lime fiber-pectin 1 (%) + 0.25% xanthan	62.20	1.50	2.25	9.00	100
Lime fiber-pectin 2 (%) + 0.25% xanthan	66.40	1.70	2.50	7.50	90
Orange fiber-pectin 0.5 (%) + 0.25% xanthan	59.80	1.70	2.50	8.70	90
Orange fiber-pectin 1 (%) + 0.25% xanthan	61.80	1.60	2.25	6.80	90
Orange fiber-pectin 2 (%) + 0.25% xanthan	65.60	1.50	2.50	6.50	100

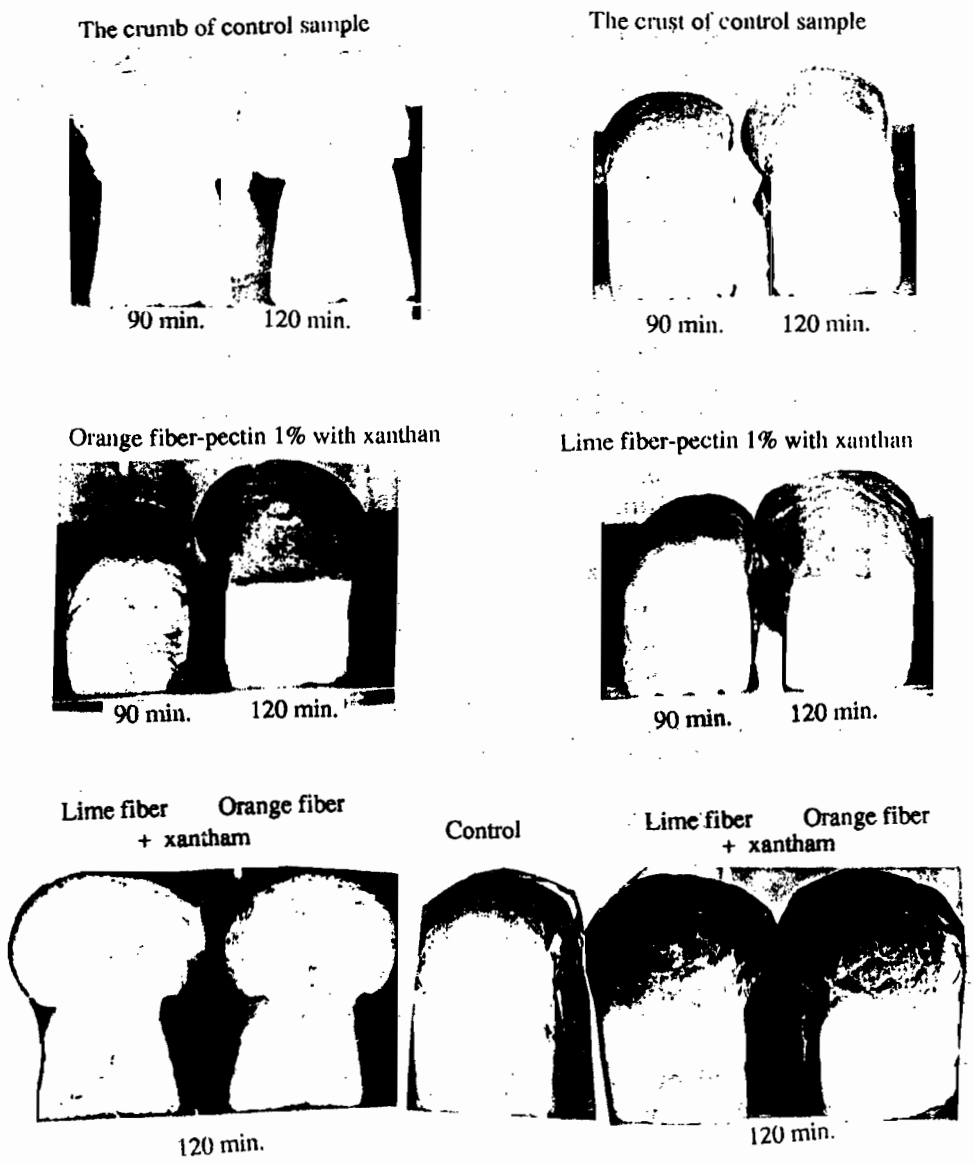

Fig. (2) : Effect of addition of 1% lime and orange fiber-pectin with xanthan on the crust, crumb and specific volume of toast bread.

Table (4) : Effect of addition of xanthan gum with different concentrations of lime and orange fiber-pectin at different fermintations period on the yield and specific volume of toast bread.

Properties / Various additives at different fermentation times	Yeild %	Specific volume
Control sample		
90 min.	88.50	3.86
120 min.	86.50	4.00
Lime fiber-pectin 0.5 (%) + 0.25% xanthan		
90 min.	89.80	3.62
120 min.	86.60	4.79
Lime fiber-pectin 1 (%) + 0.25% xanthan		
90 min.	89.50	3.82
120 min.	87.00	5.08
Lime fiber-pectin 2 (%) + 0.25% xanthan		
90 min.	89.30	3.55
120 min.	87.00	4.60
Orange fiber-pectin 0.5 (%) + 0.25% xanthan		
90 min.	89.70	3.34
120 min.	87.75	4.51
Orange fiber-pectin 1 (%) + 0.25% xanthan		
90 min.	89.39	3.51
120 min.	87.52	4.57
Orange fiber-pectin 2 (%) + 0.25% xanthan		
90 min.	90.26	2.96
120 min.	88.27	3.91

dilution of the functional gluten proteins.

However, addition of 1% lime or orange fiber with xanthan gum, gives parameter value at least as good as the control sample in terms of specific volume, color of crumb, crumb structure and color of crust.

Data listed in Table (5) shows that the stailing phenomena (determined as bread freshness) was affected by the addition of 1% lime or orange peel fiber with the addition of xanthan gum during storage for four days at room temperature. These results are inagreement with the results obtained by Anderson and Andon (1988) who reported that xanthan gum should increase the antistailing properties of finished baked goods.

The external toast bread quality parameters are loaf volume, crust color, break and shred (crust quality) and symmetery of the shape, Whereas the internal quality parameters included crumb color, texture, grain, aroma, taste and mouth feel. The data in Table (6) showed that the toast bread prepared by addition of lime or orange peel fiber - pectin and xanthan had a higher total scores in the external and internal parameters studied than the control during one to five days of storage period at room temperature. The total score of external and internal parameters of the bread made with lime fiber - pectin were higher than that of the bread made with orange fiber - pectin and the control bread. Therefore, the toast bread made with 1% lime fiber - pectin and 0.25% xanthan gum had significantly high parameters at the different times of storage than that of the control bread. The scores of texture and specific volume for all samples were inagreement with the values of water retention capacity as the indicator of stailing of toast bread. This means that the expert panelists did not only accept the bread made with flour blended with 1% lime and orange fiber - pectin with 0.25

Table (5) : Effect of various addition of lime and orange fiber-pectin with xanthan gum at 120 min. fermintation period on the stailing phenomena of toast bread during storage at room temperature.

Storage period hrs. / Various additives at 120 min. ferm. time	Zero Time	24	48	72	96
Control sample 120 min.	197.07	189.80	179.50	167.03	150.05
Lime fiber-pectin 0.5 (%) + 0.25% xanthan	200.50	194.05	189.35	193.52	159.50
Lime fiber-pectin 1 (%) + 0.25% xanthan	200.05	195.00	188.90	187.05	163.02
Lime fiber-pectin 2 (%) + 0.25% xanthan	194.99	191.02	188.20	186.64	156.80
Orange fiber-pectin 0.5 (%) + 0.25% xanthan	204.20	190.25	180.65	174.64	158.80
Orange fiber-pectin 1 (%) + 0.25% xanthan	201.49	190.40	185.50	176.50	156.00
Orange fiber-pectin 2 (%) + 0.25% xanthan	203.50	189.75	177.80	172.13	149.50

Table (6) : Sensory evaluation of toast bread prepared by addition of 1.0% lime and orange fiber-pectin with 0.25 % xanthan gum

Sensory attributes / Storage hours	Time	volume (10) Mean ± S.D.	Colour of crust (10) Mean ± S.D.	Symmet of crust (5) Mean ± S.D.	Break and shred (5) Mean ± S.D.	Colour of crumb (10) Mean ± S.D.	texture (10) Mean ± S.D.	Grain (15) Mean ± S.D.	Taste (15) Mean ± S.D.	Aroma (10) Mean ± S.D.	Mouth Feel (10) Mean ± S.D.
Control	0.00	7.00±0.36	9.00±8.36	4.30±7.9	4.00±7.07	8.60±7.07	8.40±8.36	14.00±7.07	12.90±1.0	8.50±7.07	8.00±0.41
	24.00	7.00±0.28	9.00±0.14	4.30±6.1	4.00±7.07	8.60±7.9	8.30±0.97	13.00±0.15	12.85±44.7	8.50±7.07	8.00±0.54
	72.00	7.00±2.9	9.00±7.07	4.17±7.5	3.95±3.53	8.00±0.15	7.75±0.11	11.43±4.1	12.24±5.0	7.25±5.0	7.00±0.49
	120.00	6.50±0.32	8.00±7.07	4.00±7.7	3.90±5.0	7.66±2.55	6.33±4.12	9.50±7.07	10.52±7.07	6.50±7.07	6.50±0.17
	168.00	6.30±0.40	7.50±0.38	3.83±2.7	3.80±9.24	7.52±5.72	6.00±1.0	8.10±7.07	10.10±0.20	6.00±1.04	6.00±0.35
Lime fiber - pectin 1% + 0.25 xanthan	0.00	8.50±0.30	9.00±4.47	4.67±3.9	4.80±7.07	8.95±3.53	8.90±1.0	14.50±7.07	14.00±7.07	8.90±7.07	9.00±0.14
	24.00	8.50±1.0	9.00±7.07	4.58±1.87	4.80±7.07	8.70±7.9	8.90±7.9	14.00±7.07	13.80±1.0	8.83±7.07	9.00±0.18
	72.00	8.30±0.12	9.00±7.07	4.37±1.8	4.70±3.53	8.35±0.11	8.50±7.9	13.30±7.9	13.70±0.21	8.90±7.07	9.00±0.14
	120.00	8.00±0.13	8.50±0.41	4.33±1.2	4.50±5.0	8.00±7.9	8.33±1.8	13.00±7.07	13.00±7.07	8.00±0.38	8.50±0.35
	168.00	7.50±1.0	8.00±1.0	4.08±1.58	4.05±5.0	7.90±7.07	8.20±0.15	12.50±7.07	12.00±7.07	6.50±7.07	7.00±0.35
Orange fiber - pectin 1% + 0.25 xanthan	0.00	8.00±1.0	9.00±4/47	4.42±1.58	4.60±7.07	8.90±3.53	8.50±7.9	14.00±7.07	13.80±7.07	8.70±7.07	9.00±0.18
	24.00	8.00±5.7	9.00±7.07	4.42±8.36	4.60±5.0	8.80±0.11	8.42±8.6	13.60±7.07	13.60±7.9	8.66±3.53	9.00±0.35
	72.00	7.60±0.13	8.70±7.07	4.25±3.53	4.40±3.53	8.00±7.07	7.88±5.1	12.43±1.48	12.87±7.07	7.88±7.07	8.50±0.94
	120.00	7.40±3.5	8.00±0.41	4.10±3.53	4.25±3.53	8.00±1.0	7.00±7.07	11.00±0.15	12.00±7.07	6.50±7.07	8.00±0.21
	168.00	7.00±0.21	8.00±1.0	3.91±1.0	4.10±3.53	7.70±0.27	7.00±7.07	10.00±1.0	11.00±7.07	6.00±7.07	7.00±0.51

S.D Standard Division
The main difference is significant at the 0.05 level.

xanthan, but also preferred any of them compared by the control toast bread.

These results were inagreement with those obtained by Mettler and Seibel (1995) and Davidou et al. (1996), they reported that the values and the rate of firmness during storage were reduced when hydrocolloids (locust bean gum 0.6% and 0.3% alginate or xanthan) were added to white bread.

The addition of 1% lime or orange peel fiber with 0.25% xanthan gum lead to improve the main quality and prolonged the shelf life of the toast bread during one to five days of storage at room temperature.

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تأثير إضافة الألياف المستخرجة من قشور الموالح وصمغ الزانثان على خواص خبز القالب

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نظراً لأهمية الألياف الغذائية بالنسبة للإنسان وتحسينها للصفات الأساسية فى بعض المنتجات الغذائية وبخاصة منتجات المخابز . لذا كانت الدراسة الحالية ، حيث تم استخدام الألياف المستخرجة من قشور الليمون البلدي والبرتقال البلدى الغنية بالبكتين وصمغ الزانثان ، وذلك كإضافات لدقيق القمح ٧٢٪ استخلاص ، وذلك بتركيزات منخفضة ٠,٥ ٪ ، ١٪ ، ٢٪ لكل من ألياف الليمون والبرتقـــال . كما تم إضافة صمغ الزانتـــان بنسبة ٠,٢٥ ٪ وذلك لمعرفة تأثير هذه السكريات العديدة على جودة خبز القالب

وقد أوضحت الدراسة باستخدام جهاز الفارينوجراف أن إضافة الألياف أدى إلى زيادة امتصاص الدقيق للماء ، واتضح أن التركيز الأمثل من الألياف هو ٢٪ ، ولكن أظهرت نتائج الخبيز أن تركيز ٢٪ أدى إلى انخفاض الحجم النوعى بالنسبة للخبز الناتج . وقد وجد أيضاً أن تركيز ١٪ من ألياف قشور الليمون أو البرتقال أدى إلى زيادة الحجم النوعى للخبز الناتج ، وتحسين لون القشرة ولون اللبابة للخبز الناتج . وقد اتضح أيضاً أن إضافة صمغ الزانثان بتركيز ٠,٢٥ ٪ فى الدقيق المضاف إليه ١٪ من ألياف قشور الليمون أو البرتقال أدى إلى تحسين خواص الخبز الناتج أثناء التخزين ، حيث تم الحفاظ على خواص الخبز الناتج أثناء التخزين خلال الفترة من ١ - ٥ أيام على درجة حرارة الغرفة، وذلك مقارنة بالعينات المضاف إليها الألياف فقط .

وقد أظهرت نتائج التحليل الإحصائى للاختبارات الحسية أن هناك فروقا معنوية بين العينات التى أضيف إليها الألياف وصمغ الزانثان والعينات المقارنة .