Improvement of Pan Bread and Croissant Quality by Using Barley *Tarhana* Dough

Hemat, E. Elsheshetawy & Abdel-Razik, M.M.

Food Science. Dept., Fac. of Agric, Ain Shams Univ., Shoubra El- Kheima, Cairo, Egypt.

Received: 15 October 2010 ***Revised: 15 December 2010*** ***Accepted: 17 December 2010***

ABSTRACT

Tarhana is a traditional Turkish fermented food made from cereal, yoghurt, various vegetables and spices with using yoghurt bacteria and baker's yeast as starter culture. Wheat flour in *tarhana* dough was replaced by barley whole meal at a ratio of 1:1(w/w) and it was used in the preparation of pan bread and filling of croissant. Pan bread samples were prepared with replacement of wheat flour by barley *tarhana* dough at 0, 5, 10, 15 and 20%, whilst it was used in filling croissant at 5, 10, and 15 g /60g (croissant piece). Moisture content, softness index, loaf volume, weight and specific volume, crust and crumb colour and sensory characteristics were determined for pan bread. The moisture content was found to increase with elevating the replacement level of barley *tarhana* dough from 0 to 20 %. Also, addition of barley *tarhana* dough improved the freshness, specific volume and sensory acceptability of pan bread samples. The shelf life of *tarhana* pan bread was 5 days at room temperature (25±2ºC) as compared to 3 days for control sample. In croissant, the remained log numbers of lactic acid bacteria were 8.4, 9.5 and 10.9 at 5, 10, and 15 g filling barley *tarhana* dough, respectively. *Tarhana* croissant had significantly higher scores in most sensory characteristics than the control sample. The present research suggested that barley *tarhana* dough can be used as wheat flour replacer at 20% in pan bread making and in filling croissant as a source of probiotic lactic acid bacteria especially at 10g /60g (croissant piece).

Keywords: Tarhana, barley whole meal, pan bread, croissant, lactic acid bacteria, bread quality

INTRODUCTION

Tarhana is a traditional Turkish fermented cereal food, prepared by mixing wheat flour, yoghurt, some vegetables and spices. After fermentation, the mixture is sun dried and ground. Cereal flours, yoghurt and a variety of vegetables are the primary ingredients and therefore a good source of B vitamins (Ibanoglu, *et al.,* 1995), ascorbic acid, niacin, pantothenic and folic acid (Ekinci, 2005, Ekinci & Kadakal, 2005), minerals, organic acids and free amino acids which make it healthy for children, the elderly and medical patients (Daglioglu, *et al.,* 2002). *Tarhana* dough is a good source of lactic acid bacteria (LAB), log number reach to 12.78, especially which is made from wheat flour combined with barley whole meal at ratio 1:1 (Elsheshetawy & Yasin, 2008). They found that the addition of barley whole meal in the production of *tarhana* stimulates the growth of lactic acid bacteria (yoghurt probiotic source) at the same time barley whole meal was used as a source of β-glucan which is classified as a prebiotic.

Fermentation, an old and economical method of producing and preserving food, is carried out to enhance flavour, aroma, shelf-life, texture, nutritional value and other pleasant and appealing properties of foods (Nout, 1993, Vanberg & Lorri, 1997, Mensah, 1997, Nout & Motarjemi, 1997, Steinkraus, 2002). *Tarhana* has an acidic and sour taste with a strong yeasty flavour where, fermentation results in significant increases of organic acids as a result of the presence of ingredients such as yoghurt and vegetables. Erbas, et al., 2006 stated that the combined levels of organic acids in *tarhana* fermentation were found to be sufficiently high to ensure the microbiological safety of the product. Lactic acid, the main organic acid of many fermented foods like *tarhana* is formed by microbial degradation of available sugars (Fennema, 1985, Ekinci, 2005).

Bread and other bakery products like croissant have an important role in human nutrition. Generally, bread is considered to be a good source of energy and irreplaceable nutrients for the human body. It has been reported that bread made from white flour has low micronutrients content (Al-Kanhal *et al.,* 1999, Isserliyska *et al.,* 2001). Therefore, there have been many investigations to enhance the nutritive value of bread to fulfill the expand-

ing demands of modern dietary habits, considering proteins, minerals, vitamins and/or fiber contents. In recent years, improving the nutritional profile of white wheat bread has been of much interest. This is usually realized by supplementing wheat flour with different sources that contribute to enhance minerals, vitamins, proteins or dietary fibers composition and content in the end products.

The present work was conducted to study the effect of wheat flour replacement by fresh barley *tarhana* dough at different levels on quality of pan bread. Also, to follow the lactic acid bacteria count of filled croissant with the same dough as a probiotic food. Finally, study the effect of barely *tarhana* dough on the sensory acceptability of the aforementioned products.

MATERIALS AND METHODS

Materials

Wheat flour (72% extraction), sugar, salt, yoghurt, fresh and dried baker's yeast, tomato paste, green and red pepper as well as onion were purchased from the local markets in Cairo, Egypt. Barley (*Hordium vulgare L.)* whole meal used in this study was obtained from Barley Research Section, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt. DeMan Rogosa Sharpe (MRS), MacConkey agar, Bismuth sulphite agar and Baird-Parker media were purchased from Sigma (Germany).

Methods

Preparation of barley *tarhana* dough

Tarhana samples were prepared according to the method of Erkan *et al.,* (2006) with omit of paprika from ingredients. Onions (180g), green and red peppers, (75g) from each were chopped in a Food Processor (Toshiba). Tomato paste (112g) and salt (60g) were added and the mixture was blended. Yoghurt (600g) and dried baker's yeast (15 g) were added to the mixture and blended until complete homogenization. Wheat flour and barley whole meal, (375g) from each were added to the previous homogenate mixture and kneaded in a steel saucepan with a spoon to prepare the barley *tarhana* dough. The dough was put into covered containers and fermented at 30°C for 7 days. After fermentation, the fresh barley *tarhana* dough was used to prepare pan bread and filling croissant.

Pan bread - making

Dough of pan bread was prepared according to the method described by AACC (1990). It was prepared using one hundred grams of wheat flour (72% extraction), mixed with 1g salt, 2g sucrose, and 100 ml freshly prepared yeast suspension (12g fresh yeast suspended in 100 ml water). Barley *tarhana* dough was added at replacement levels of 0, 5, 10, 15 and 20 % from wheat flour weight used in the preparation of pan bread samples.

Bread evaluation

The baked bread samples were cooled at room temperature and stored at 25±2ºC until spoilage. The bread samples were evaluated after 24 hr of baking. Moisture content of bread samples was determined according to AOAC methods (AOAC, 2007). Loaf weight, volume (rape seed displacement method) and specific volume were determined according to Randez-Gil *et al.* (1995). For softness index, penetrometer number reading (Koehler Instrument Company, INC.), was measured according to the method described by Maleki *et al.* (1980) with spherical probe, 25 mm diameter. Each sample was compressed in five spots by a weight of 203g for 10 sec. The compressed spots were marked by holes on the four corners and center of each sample. Average of five points from each bread sample was recorded to give the compressibility measured in penetrometer units (P.U).

Colour parameters of the pan bread samples were determined according to tristimulus colour system described by Françis, (1983) using a Spectrophotometer (MOM, 100 D, Hungary). L, a and b colour coordinates, chroma values were calculated from $(a2 + b2)^{1/2}$ and total colour intensity from $(a2 + b2 + c2)^{1/2}$.

Filling of croissant with *tarhana* dough

Dough of croissant was prepared according to the method described by Strenhagen & Hoseney 1994. Barley *tarhana* dough was added to baked croissant as a filling material at levels of 0, 5, 10, 15g/ 60g (croissant piece).

Microbial analysis of croissant

Counts of lactic acid bacteria of prepared croissant were determined at selected times (0, 2, 4 and 6 days from filling procedure) during storage of baked croissant samples at room temperature (25±2ºC). Ten grams of each prepared croissant samples were aseptically transferred to sterile plas-

tic bags and homogenized in a Stomacher machine (PBI, Milan, Italy) for 2 min with 90 ml of sterile 1% peptone water (Oxoid). Appropriate decimal dilutions of the samples were prepared using the same diluents and plated in duplicate on deMan Rogosa Sharpe (MRS, Oxoid) agar, incubated at 30°C for 48-72hr to count lactic acid bacteria. Croissant samples were examined for, coliforms count, *Staphylococcus* spp. and *Salmonella* spp., on VRB agar (sigma) at 30°C/ 24-48hr, Baird-Parker agar (sigma) at 37°C/ 48hr and Bismuth sulphite agar (sigma) at 37°C/ 24-48hr, respectively according to Oxoid Manual, (1991).

Sensory evaluation

Pan bread and croissant samples were subjectively evaluated by ten trained panel assessors. A panel group was randomly selected from the staff members of the Food Science Department, Faculty of Agriculture, Ain Shams University, Cairo, Egypt. For fresh pan bread, the panelists were asked to score the general attributes of each sample which classified to volume, (15 points), crust characteristic, (5 points), shape symmetry, (5 points), bake uniformity, (5 points), crumb texture,(15 points), crumb colour, (10 points), grain, (10 points), aroma, (15 points) and taste, (20 points) (Pyler, 1988). Quality attributes of fresh and stored croissant at (25±2ºC) were determined according to Bennion & Bamford, (1983), and scored as follows, taste/ odour, (25 points), texture, (15 points), crust appearance, (15 points) as well as volume and eating quality, (25 points).

Statistical analysis

All determinations were performed in triplicates. The statistical analyses were conducted using ANOVA procedures. Differences in samples due to the using of barley *tarhana* dough were tested for statistical significance at the $P < 0.05$ level. Duncan's multiple – range significant difference was used to differentiate between the mean values. Analyses were done with Statistical Analysis System (SAS, 1996) computer program.

RESULTS AND DISCUSSION

Pan bread evaluations

Moisture content

Moisture content of pan bread prepared with different replacement levels of barley *tarhana* dough during storage period of five days at 25±2ºC is shown in Table (1). Generally, addition of barley *tarhana* dough significantly increased the moisture content of prepared pan bread ($P < 0.05$). The moisture content of pan bread samples were 36.65, 37.15, 37.70, 38.55 and 39.10% as wheat flour was replaced by barley *tarhana* dough at levels of 0, 5, 10, 15 and 20%, respectively on the first day of storage period. A significant increase in moisture content was noticed with raising the replacement level of barley *tarhana* dough through all days of storage. This may be due to the ability of *tarhana* bread to hold the water, where that bread was enhanced by more fiber and β-glucan content in barely whole meal which added to *tarhana* dough. On the third day of storage, the moisture content was significantly ($P < 0.05$) the same as the first day in all replaced pan bread samples. On the contrary, significant decreases in moisture content were observed at the fifth day of storage being 34.25, 34.60, 35.55 and 37.05 in bread supplemented with 5, 10, 15, and

Table 1: Moisture content (%) of pan bread prepared with different replacement levels of barley *tarhana* dough during storage period at 25±2ºC

Bread samples	Moisture content (%)		
	Storage period (days)		
	1	3	5
Control	36.65^{Ad}	35.85^{Bd}	Spoiled
5% BTD	37.15^{Ac}	37.8^{Ac}	34.25^{Bc}
10% BTD	37.70^{Ac}	38.05^{Abc}	34.60^{Bc}
15% BTD	38.55^{Ab}	38.4^{Ab}	35.55^{Bb}
20% BTD	39.10^{Aa}	39.65^{Aa}	37.05^{Ba}

Values followed by the same capital letter (superscript) in the same row and small letter in the same column are not significantly different ($P<0.05$).

BTD= Barely *tarhana* dough

20% barley *tarhana* dough, respectively. These declines in moisture content could be attributed to its evaporation and thereby loss of freshness. *Tarhana* pan bread became more resistance to spoilage than the control pan bread which spoiled after three days of storage, this may be due to the effect of barley *tarhana* dough which enhances the microbiological safety of pan bread (Erbas, *et al.,* 2006).

Softness index

Table (2) shows the results of softness index of prepared pan bread with different levels of barley *tarhana* dough during storage period at 25±2ºC. Higher penetration units indicate higher freshness. It could be noticed that, there was a gradual decrease in freshness for all prepared pan bread samples during storage period. On the first day, pan bread prepared without barley *tarhana* dough (control) had a significantly lower softness index ($P < 0.05$) as compared to *tarhana* pan bread samples. As it is recorded, softness index of the control was 67.20 PU, whereas *tarhana* pan bread samples at 5, 10, 15 and 20% replacement had 69.50, 73.20, 67.87 and 82.42 PU, respectively. These results are in the same trend with moisture content values of pan bread samples (Table 1). This means that, addition of barley *tarhana* dough may affect positively on retention of moisture in bread which leads to more freshness.

In general, there is a significantly increase ($P<0.05$) in softness index values of pan bread samples with increasing the replacement levels of wheat flour by barley *tarhana* dough as seen from the results in Table (2). After three days of storage period, the control sample was spoiled. On the contrary, *tarhana* pan bread samples were stored till five days and recorded 40.00, 40.80, 44.40 and 54.00 PU at 5, 10, 15 and 20% replacement levels, respectively. Pan bread prepared with 20% barley *tarhana* dough had the highest softness values (less staling) after five days of storage.

These results are in a good agreement with the observations of Hallen *et al.* (2004), Ilyas *et al.* (2005) and Nermin (2009) as they reported that *tarhana* dough had high water retention capacity.

Loaf weight and volume

The results of weight, volume and specific volume of fresh pan bread samples are presented in Table (3). There is no significant differences ($P<0.05$) in the weight values of all pan bread samples. These values were 514.49, 514.1, 517.24, 516.10 and 515.73g for samples containing zero, 5, 10, 15 and 20% of barely *Tarhana* dough, respectively. The volume of prepared pan bread samples were not significantly increased ($P<0.05$) as a replacement levels increased till 10%. Whereas, the replacements with 15 and 20% barely *Tarhana* dough significantly ($P<0.05$) increased the pan bread volume. The specific volume of prepared pan bread samples exhibited the same observed trend as the volume of pan bread samples. So, barley *tarhana* dough can improve the volume of pan bread especially at high replacement levels (15 and 20%).

These measurements of pan bread were in the same direction with the previous results of moisture content and softness index. As it can be noticed that there are improvement in the volume and specific volume of pan bread samples with increasing of replacement levels. This could be attributed to the

Table 2: Softness index (PU) of pan bread prepared with different replacement levels of barley *tarhana* dough during storage period at 25±2ºC

Bread samples	Softness index (PU)		
	Storage period (days)		
	1	3	5
Control	67.20^{Ad}	49.10^{Bd}	Spoiled
5% BTD	69.5^{Acd}	54.80^{Bc}	40.00^{Cc}
10% BTD	73.20^{Ac}	56.20^{Bc}	40.80^{Cc}
15% BTD	76.87^{Ab}	59.43^{Bb}	44.40^{Cb}
20% BTD	82.42^{Aa}	66.10^{Ba}	54.00^{Ba}

Values followed by the same capital letter (superscript) in the same row and small letter in the same column (superscript) are not significantly different ($P<0.05$).

BTD = Barely *tarhana* dough PU: Penetrometer units

presence of barley whole meal, rich in β-glucan and fiber contents, which is classified as a water binding and affects the water retention and other functional properties of *tarhana* and bread dough. Subsequently, addition of barley *tarhana* dough influencing the crumb structure of pan bread samples. Besides, barley *tarhana* dough contains lactic acid bacteria which play a positive role with baker's yeast in improvement of fermentation process of pan bread. These results are in coincidence with that of Ilyas *et al.* (2005) and Nermin (2009), they concluded that tarhana dough had more desirable functional properties and could be used as an improver in bakery products.

Colour evaluation

The results of crust and crumb colour parameters of fresh pan bread containing different replacement levels of barley *tarhana* dough are illustrated in Table (4). Regarding the crust colour, lightness values (L) ranged from 48.60 to 60.11, there was a significant decrease (P<0.05) as the barley *tarhana* dough replacement levels increased up to 20%, whereas the opposite trend was observed with the results of redness (a). Considering the yellowness values (b) of pan bread samples, the sample with 5% replacement had the highest value. These results could be attributed to the high yoghurt protein and reducing sugars content in addition to tomato and pepper which exist in barley *tarhana* dough. These ingredients could play an important role in the browning reactions (Marshall & Pomeranz, 1982). Furthermore, both of chroma and colour intensity of the prepared pan bread samples significantly (P<0.05) increased as percentage of barley *tarhana* dough increased 0 up to 20% replacement.

The data in Table (4) presented the results of crumb colour parameters of pan bread samples. Generally, the lightness (L) which ranged from 73.08 to 80.89 showed significant decrease (P <0.05) as the barley *tarhana* dough content increased from 0 up to 20%, in similar, colour intensity values of pan bread crumb significantly (P<0.05) decreased as percentage of barley *tarhana* dough increased. On the contrary, redness (a), yellowness (b) and chro-

Table 3: Weight, volume and specific volume of pan bread prepared with different replacement levels of barley *tarhana* dough

Bread samples	Loaf measurements		
	Weight (g)	Volume (cm^3)	Spec. volume(cm^3/g)
Control	514.49[a]	2430[b]	4.72[b]
5% BTD	514.1[a]	2320[c]	4.54[c]
10% BTD	517.24[a]	2440[b]	4.72[b]
15% BTD	516.1[a]	2495[a]	4.83[a]
20% BTD	515.73[a]	2540[a]	4.94[a]

Values followed by the same letter (superscript) in the same column are not significantly different (P <0.05).

BTD = Barely *tarhana* dough

Table 4: Crust and crumb colour parameters of fresh pan bread prepared with different replacement levels of barley *tarhana* dough

Bread samples	Crust colour					Crumb colour				
	L	a	b	chroma	Colour intensity	L	a	b	chroma	Colour intensity
control	60.11[a]	11.97[d]	30.20[b]	32.48[e]	68.32[d]	80.89[a]	-0.59[d]	15.32[e]	15.33[e]	82.33[a]
5% BTD	55.92[b]	25.83[c]	30.68[a]	40.11[d]	68.82[d]	80.32[b]	1.74[c]	17.26[d]	17.35[d]	82.18[b]
10% BTD	54.09[c]	39.29[b]	21.63[e]	44.85[c]	70.27[c]	78.54[c]	3.66[b]	19.64[c]	19.97[c]	81.05[c]
15% BTD	53.74[d]	39.18[b]	25.86[d]	46.95[b]	71.36[b]	74.53[d]	3.89[ab]	20.98[b]	21.34[b]	77.53[d]
20% BTD	48.60[e]	57.89[a]	27.67[c]	64.17[a]	80.50[a]	73.08[e]	4.18[a]	21.66[a]	22.06[a]	76.33[e]

Values followed by the same letter (superscript) in the same column are not significantly different (P<0.05).

BTD= Barely *tarhana* dough. L= lightness, a= redness, b= yellowness

ma were found to significantly (P<0.05) increase as percentage of barley *tarhana* dough increased. The colour intensity of the control sample crumb is significantly (P<0.05) higher than those of the other samples, this may be due to the less effect of barley *tarhana* dough on lightness (L) of crumb colour. At the same time barley *tarhana* dough had strong influence on the redness colour of crust, so the sample contained 20% of barely *tarhana* dough had significantly higher total colour intensity.

Sensory evaluation

The mean scores of sensory characteristics of pan bread prepared with different replacement levels of barley *tarhana* dough are shown in Fig (1). Generally, all pan bread samples were found to be acceptable to the panelists. The volume of 20% *tarhana* pan bread was significantly (P<0.05) increased as compared to the other bread treatments. Crust characteristics values of pan bread samples significantly (P<0.05) increased for *tarhana* pan bread samples as compared to the control. There is no significant (P>0.05) difference among all treatments in shape symmetry and bake uniformity. At the same time, the control and 20% *tarhana* pan bread had the highest significant (P<0.05) values for texture, crumb colour and grain.

Considering aroma and taste, there were clear improvements when percentage of barley *tarhana* dough increased with high significant acceptability (P<0.05) of 20% *tarhana* pan bread samples (Fig 1). Improvement of sensory characteristics can be explained on the basis of the high functionality and quality characteristics of barely *tarhana* dough, which contains different ingredients and lactic acid bacteria, as reported by Ilyas *et al*., (2005) and Nermin (2009). The improvement of volume, texture and taste of prepared samples had been explained in terms of the amount of water available, extent of starch gelatinization and protein modification during baking as well as the water activity of the baked products (Primo-Martin *et al.,* 2006).

Croissant evaluations

Microbiological analysis

Lactic acid bacteria (LAB) count and detection of coliforms, *Staphylococcus* spp. and *Salmonella* spp., are presented in Table (5). The LAB count was significantly (P<0.05) high with the highest concentration of filling croissant with barley *tarhana* dough. In general, with the prolonged storage period there were significant (P<0.05) decrease in LAB counts in all prepared croissant. It is worthy to mention that the remained counts (log number)

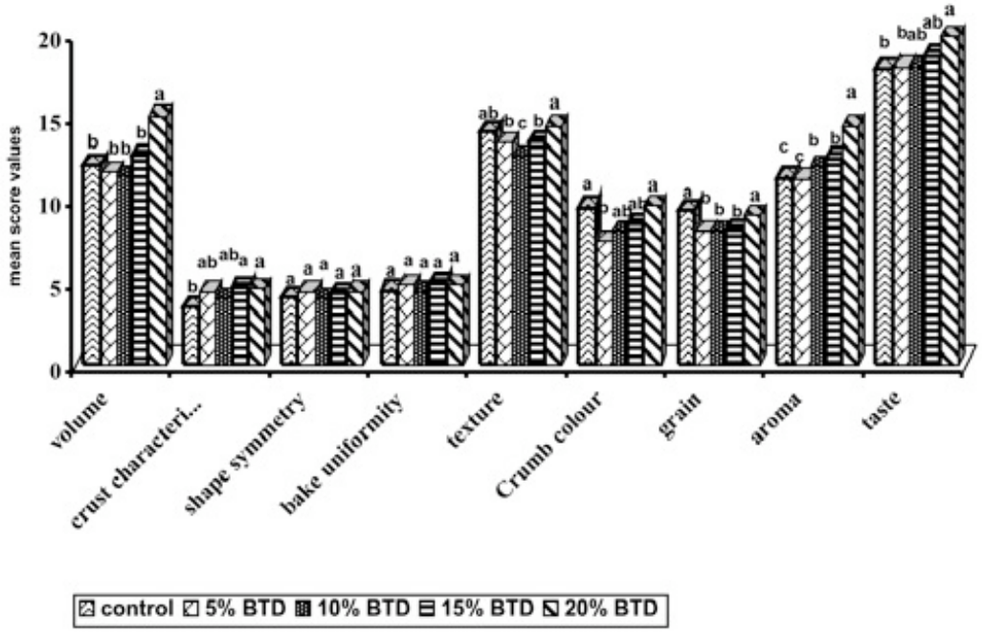

Fig. 1: Sensory evaluation of fresh pan bread prepared with different replacement levels of barley *tarhana* dough

Columns have the same letter in the same character are not significantly different (P<0.05).

BTD = Barely *tarhana* dough.

Table 5: lactic acid bacteria count (log CFU/g) and detection of some pathogenic bacteria in croissant filling with different levels of barley *tarhana* dough during storage period at 25±2ºC

storage period (days)	Log No. (cfu / gm)															
	control				5g BTD / 60g				10g BTD / 60g				15g BTD / 60g			
	LAB	Col.	St.	S.	LAB	Col.	St.	S.	LAB	Col.	St.	S.	LAB	Col.	St.	S.
0	0	NF	NF	NF	10.8^{Ca}	NF	NF	NF	11.0^{Ba}	NF	NF	NF	11.7^{Ab}	NF	NF	NF
2	0	NF	NF	NF	9.8^{Cb}	NF	NF	NF	11.1^{Ba}	NF	NF	NF	11.9^{Aa}	NF	NF	NF
4	0*	NF*	NF*	NF*	9.7^{Cb}	NF	NF	NF	10.8^{Ba}	NF	NF	NF	11.6^{Ab}	NF	NF	NF
6	-	-	-	-	8.4^{Cc}	NF	NF	NF	9.5^{Bb}	NF	NF	NF	10.9^{Ac}	NF	NF	NF

Values followed by the same capital letter (superscript) in the same row and small letter (superscript) in the same column are not significantly different ($P < 0.05$).

BTD = Barely *tarhana* dough. NF: not found. LAB= lactic acid bacteria. Col. = coliforms
St. = *Staphylococcus* spp. S.= *Salmonella* spp *: at these points samples were organoleptically rejected

of LAB were 8.4, 9.5 and 10.9 in croissant filling with 5, 10, and 15g barley *tarhana* dough, respectively. These were sufficient to reveal its beneficial effects in gastrointestinal tract as reported by Guerin-Danan *et al.*, (1998), Bouhnik *et al*. (1992), Klijn *et al*. (1995), Wang *et al.* (1999a) and Wang *et al.* (1999b). From the aforementioned results it could be recommended that, barley *tarhana* dough can be used as a filling material, rich in LAB, in preparing croissant depending on consumer acceptability. Coliforms, *Staphylococcus* spp. and *Salmonella* spp., were not found in all croissant samples at all the filling levels, that means safety of the product.

Sensory evaluation

Data in Fig (2) represent the sensory evaluation values of different croissant samples filled with different concentrations of barley *tarhana* dough (5, 10 and 15 /60 g, croissant piece) during storage at 25±2ºC. There were no significant differences ($P< 0.05$) in crust appearance character among different samples during storage period. It could be noticed that with increasing the amount of *tarhana* dough, which was used in filling the croissant, the eating quality of croissant became more putty subsequently affected the croissant texture. The croissant sample filled with 10g of *tarhana* dough had the highest scores in taste, odour, texture and volume and eating quality on the second day of storage. The volume and eating quality showed noticeable decline with the increasing the filling concentrations up to 15g/ piece as compared to the control sample. From Figure (2) it could be concluded that, as the level of filling with barley *tarhana* dough increased there was an enhancement in taste/odour in croissant samples during storage period up to 2 days of storage especially at level of 10g barley *tarhana* dough/piece. This was due to the effect of flavour and composition of the added *tarhana* dough (Erkan *et al.,* 2006).

As the storage period was elongated, there were significant ($P<0.05$) deteriorations in all sensory parameters, the highest deteriorations appeared in the control samples (without barley *tarhana* dough) which became mouldy and organoleptically rejected after 4 days of storage whereas, the other treatments still accepted till the sixth day of storage. This may be due to the preservation effects of *tarhana* as mentioned by Klaenhanmer, (1988), Daeschel, (1989) and Bozkurt & Gürbüz, (2007).

Based on the previously mentioned results, improvement fermentation properties and high safety of barley *tarhana* dough could be utilized in enhancement of bakery product characteristics. So, barley *tarhana* dough can be utilized in production of pan bread with significantly ($P < 0.05$) increase in its moisture content, improvement the freshness, extended shelf-life of the prepared pan bread and significantly increase the loaf volume. At the same time, barley *tarhana* dough had strong influence on the redness colour of crust and improvement the sensory characteristics. Also, it could be utilized as a source of lactic acid bacteria (probiotic food) when it was used in filling of croissant without negative effects on the sensory acceptability of the products.

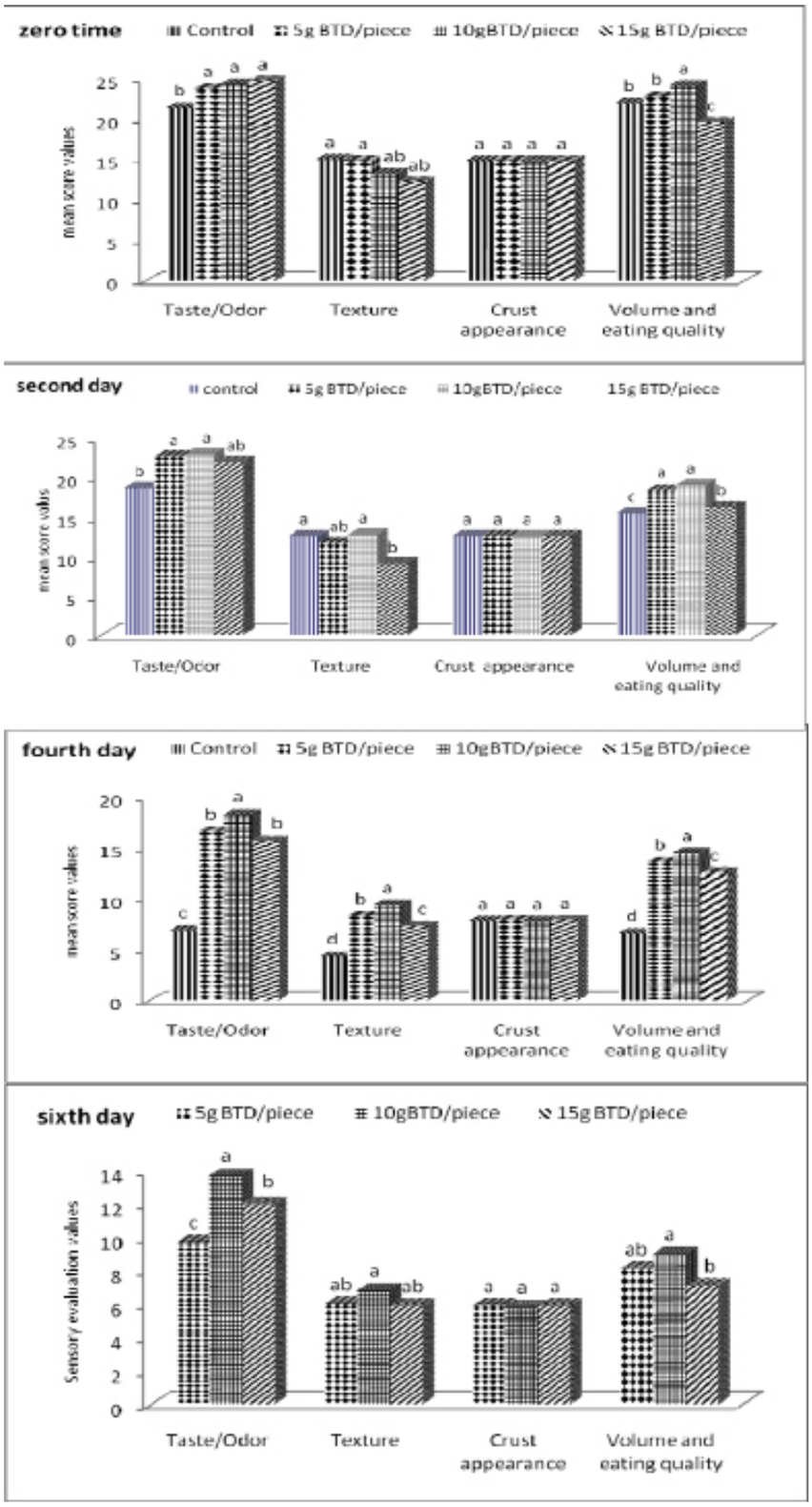

Fig. 2: Sensory evaluation of croissant filling with different levels of barley *tarhana* dough during storage period at 25±2°C.

Columns have the same letter in the same character are not significantly different (P<0.05).
BTD = *Tarhana* dough.

REFERENCES

AACC, **1990**. Approved Methods of the American Association of Cereal Chemists (8th ed.). St. Paul: AACC.

Al-Kanhal, M. A., Al-Mohizea I. S., Al-Othaimeen A. I. & Akmai Khan, M. **1999**. Nutritive value of various breads in Saudi Arabia. International Journal of Food Science and Nutrition, **50**: 345–349.

AOAC, **2007**. Association of Official Analytical Chemists. Official Method of Analysis. (18th ed.), chapter 33, pp. 10, 70-72, chapter 45, pp. 101, Benjamin Franklin Station Washington, D.C., USA.

Bennion, E.B. & Bamford, G.S.T. **1983**. Cake making process. In: The Technology of Cake Making. (5th ed.), pp. 225-230. Leonard Hill Book.

Bouhnik, Y., Pochart, P., Marteau, P., Alert, G., Goderel, I. & Rambaud J. I. **1992**. Fecal recovery in humans of viable *Bifidobacterium* spp. Ingested in fermented milk. Gastroenterology., **102**: 875-878.

Bozkurt, O. & Gürbüz, O. **2007**. Comparison of lactic acid contents between dried and frozen *Tarhana*. Food Chemistry **108**: 198-204

Daeschel, M. A., **1989**. Antimicrobial substances from lactic acid bacteria for use as food preservatives. Food Technology, **43**: 164-167.

Daglıoglu, O., Arıcı, M., Konyal, M. & Gumus, T. **2002**. Effects of *Tarhana* fermentation and drying methods on the fate of *Escherichia coli* O157:H7 and *Staphylococcus aureus*. European Food Research and Technology, **215**: 515–519.

Ekinci, R. & Kadakal, C. **2005**. Determination of seven water-soluble vitamins in *tarhana*, a traditional Turkish cereal food, by high-performance liquid chromatography. Acta Chromatographica, **15**: 289–297.

Ekinci, R. **2005**. The effect of fermentation and drying on the water-soluble vitamin content of *tarhana*, a traditional Turkish cereal food. Food Chemistry, **90**:127–132.

Elsheshetawy E. H. & Yasin M. N., Nessrien, **2008**. Utilization of *tarhana* as a pro- and prebiotic food in Egypt. Annals of Agriculture Science, Moshtohor, **46**: 11-19.

Erbas, M., Uslu, M.K., Erbas, M.O. & Certel, M. **2006**. Effects of fermentation and storage on the organic and fatty acid contents of *tarhana*, a Turkish fermented cereal food. Journal of Food Composition and Analysis, **19**: 294–301.

Erkan, H., Selik, S., Bilgi, B. & Köksel, H. **2006**. A new approach for the utilization of barley in food products: Barley *Tarhana*. Food Chemistry, **97**: 12-18.

Fennema, O.W. **1985**. Food Chemistry, second ed. Marcel Dekker Inc., New York, USA, pp 991.

Françis, F.J. **1983**. Colorimetry of foods. In : Physical Properties of Foods. Peleg, M & Bagly, E. B. (Eds) pp 105 – 123. The AVI publishing company Inc. Westport, Connecticut, USA.

Guerin-Danan, C., Chabanet, C., Pedone, C., Popote, F., Vaissade, P., Bouley, C., Szylit, O. & Andrieux, C. **1998**. Milk fermented with yoghurt cultures and *Lactobacillus casei* compared with yoghurt and gilled milk, influenced in intestinal micro flora in healthy infants. American Journal of Clinical Nutrition, **67**: 111-117.

Hallen, E., Ibanoglum S. & Ainsworth P. **2004**. Effect of fermented/ germinated cowpea flour addition on the rheological and baking properties of wheat flour. Journal of Food Engineering, **63**: 177-184.

Ibanoglu, S., Ainsworth, P., Wilson, G. & Hayes G. **1995**. Effect of formulation on protein breakdown, *in vitro* digestibility, rheological properties and acceptability of *tarhana*. International Journal of Food Science and Technology, **30**: 579–585.

Ilyas, C., Fatma, I., Omer, S. & Oguz, G. **2005**. The effects of the addition of baker's yeast on the functional properties and quality of *Tarhana*, a traditional fermented food. Czech Journal of Food Science, **23**:190-195.

Isserliyska, D., Karadjov, G. & Angelov, A. **2001**. Mineral composition of Bulgarian wheat bread. European Food Research and Technology, **213**:244–245.

Klaenhammer, T.R. **1988**. Bacteriocins of lactic acid bacteria. Biochimic, **70**: 337-341.

Klijn, N., Weerkamp, A. H. & Vos, W. M. **1995**. Genetic marking of *Lactococcus lactis* shows its survival in the human gastrointestinal tract. Applied and Environmental Microbiology, **61**:2771-2774.

Maleki, M., Hoseny, R. C. & Mattern, P.J. **1980**. Effects of loaf volume, moisture content and protein quality on the softness and stalling rate of bread. Cereal Chemistry, **57**: 138-140.

Marshall, H.G. & Pomeranz, Y. **1982**. Buckwheat: description, breeding, production, and utilization. Advances. Cereal Science Technology, **5**:157-210.

Mensah, P. **1997**. Fermentation—the key to food safety assurance in Africa? Food Control, **8**: 271–278.

Nermin B. **2009**. Effect of buckwheat flour on chemical and functional properties of tarhana. LWT - Food Science and Technology, **42**: 514–518

Nout, M. J. R. & Motarjemi, Y. **1997**. Assessment of fermentation as a household technology for improving food safety: a joint FAO/ WHO workshop. Food Control, **8**: 221–226.

Nout, M. J. R. **1993**. Processed weaning foods for tropical climates. International Journal of Food Science and Nutrition, **43**: 213–221.

Oxoide Manual, **1991**. The Oxoid Manual of Culture. Media and Other Laboratory Services. Fourth Edition.

Primo-Martin, C., Van de Pijpekamp, A., Vanvliet, T., Jongh, H., Plijer J., & Hamer, R. **2006**. The role of the gluten network in the crispness of bread crust. Journal of Cereal Science, **43**: 342-352.

Pyler, E. J. **1988**. Baking, Science and Technology, Sosland Merriam, Kansas, pp 132-183.

Randez-Gil, F., Prieto, J. A., Murcia, A., & Sanz, P. **1995**. Costruction of baker´s yeast strains that secrete *Aspergillus oryzae* alpha-amylase and their use in bread making. Journal of Cereal Science, **21**: 185 – 193.

SAS program **1996**. SAS / STAT user's guide release 6.12 ed. Cary, NC, USA: SAS Inst. Inc.

Steinkraus, K. H. **2002**. Fermentations in world food processing. Comprehensive Reviews in Food Science and Food Safety, **1**: 23–30.

Strenhagen, L. Q., & Hoseney R. C. **1994**. Firming effect in Danish pastry. Cereal Chemistry, **71**: 560- 563.

Vanberg, U. & Lorri, W. **1997**. Fermentation and nutrient availability. Food Control, **8**:319–327.

Wang, X., Brown, I. L., Evans, A. J. & Conway, P. L. **1999a**. The protective effects of high-amylose maize (amylomaize) starch granules on the survival of *Bifidobacterium spp*. in the mouse intestinal tract. Journal of Applied Microbiology, **87**: 631-639.

Wang, X., Conway, P. L., Brown I. L. & Evans, A. J. **1999b**. *In vitro* utilization of amylopectin and high-amylose maize (amylomaize) starch granules by human clonic bacteria. Applied Environmental Microbiology, **65**: 4848-4854.

تحسين جودة الخبز الإفرنجي والكرواسون باستخدام عجينة التارهانا المدعمة بالشعير

همت الششتاوي الششتاوي، محمد مصطفى عبد الرازق

قسم علوم الأغذية، كلية الزراعة، جامعة عين شمس، شبرا الخيمة، القاهرة، مصر

التارهانا هي غذاء تركي متخمر يتم تصنيعه من الحبوب ومنتجات الألبان وبعض الخضروات والتوابل مع استخدام بكتريا الزبادي وخميرة الخباز كمزرعة بادئ. وقد استخدمت عجينة التارهانا المدعمة بالشعير في إنتاج الخبز الإفرنجي وحشو الكرواسون. حيث تم تصنيع الخبز بنسب استبدال من الدقيق هي صفر، ٥، ١٠، ١٥، ٢٠٪، بينما تم حشو الكرواسون بنسب هي ٥، ١٠، ١٥ جرام/ ٦٠ جرام (قطعة) كرواسون. وقد تم تقييم خصائص الجودة للخبز المصنع والتي اشتملت على تقدير المحتوى الرطوبي ومعامل الطراوة وبعض قياسات الخبز (الحجم والوزن والحجم النوعي) وكذلك الخصائص الحسية. وجد أن المحتوى الرطوبي لعينات الخبز ازداد بزيادة معدل استبدال الدقيق بعجينة التارهانا وذلك من صفر إلى ٢٠٪. وقد أدى إضافة عجينة التارهانا إلى تحسين خصائص الطزاجة والحجم النوعي وكذلك القبول الحسي لعينات الخبز المصنعة. وفي نفس الوقت فقد زادت مدة حفظ عينات الخبز بإضافة عجينة التارهانا حيث فسدت عينة الكنترول بعد ثلاثة أيام على درجة الغرفة (٢٥±٢م°) بينما زادت صلاحية الخبز المستخدم فيه العجينة حتى خمسة أيام على نفس درجة الحرارة. ومن الجدير بالذكر أن الكرواسون المنتج يحتوي على أعداد من بكتريا حمض اللاكتيك كافية لإحداث تأثيراتها المفيدة في القناة الهضمية وذلك تحت كل مستويات الحشو المستخدمة من عجينة التارهانا فكان لوغاريتم العدد لبكتريا حمض اللاكتيك ٨,٤، ٩,٥، ١٠,٩ عند مستويات إضافة ٥، ١٠، ١٥ عجينة تارهانا/ ٦٠ جرام (قطعة كرواسون)، على الترتيب. ولقد حظيت عينات الكرواسون المحشوة بالتارهانا بأعلى القيم لخصائصها الحسية مقارنة بالعينة بدون إضافة عجينة التارهانا (الكونترول).

ومن هذا الدراسة يقترح إمكانية استبدال دقيق القمح المستخدم في إنتاج الخبز الإفرنجي بنسبة تصل إلى ٢٠٪ من عجينة التارهانا لتحسين جودة الخبز الناتج ونكهته وأيضاً استخدام هذه العجينة لحشو الكرواسون كمصدر جيد لبكتريا حمض اللاكتيك (البروبيوتك) حيث كانت أفضل النتائج مع العينة المحشوة بـ ١٠ جرام تارهانا/ ٦٠ جرام (قطعة كرواسون).