J. Agric. Sci. Mansoura Univ., 34 (4): 2895 – 2909, 2009

INFLUENCE OF FATTY MATTERS STABILITY ON SHELF LIFE AND QUALITY OF CRUNCHY TOAST

Hassan, A. M.; M. M. Rabiex ; M. Abou - Raya ; A. Ezzat and O. Al Adl*

Dept. of Food Ind. Faculty of Agri., Mansoura Univ. Egypt 2009

*** Modern Bakeries Company (Rich Bake),6th October ,Egypt.**

ABSTRACT

Vegetable oils are found in three major classes in the market; soft (liquid) oils, hard oils (shortening) and margarine that differ in their blends, physical and chemical properties. Sunflower oil, palm oil shortening, partially hydrogenated soybean oil (HSBO) and soft margarine were used to represent these classes in this study. Crunchy toast recipes (high fat roasted pan bread) were prepared using different ratios of these fatty matters (5,10,15,20 and 25% flour basis) and applying different heat treatments in roasting process (110^{o} C/hr, 140^{o} C/25 min and 170^{o} C/15 min). The partially hydrogenated soy oil (HSBO) showed the best stability and longest product shelf life, where sunflower oil was the lowest stability and worst product shelf life, that is indicated by stability chemical indices (peroxide value, free fatty acid, acid value, iodine value and TBA value) and storage tolerance.

Not only the fat type influenced the shelf life but also the ratio of this fat. Moreover, the heat treatment clearly affect the stability and shelf life of the crunchy toast where the highest adding ratio and heat treatment the lowest stability and shelf life of products.

Adding 1.5% of crushed herbs seeds (cumin, fennel and blackseed) enhances obviously the stability of oil and shelf life of product

Keywords Fat oxidative stability, crunchy toast, bakery shortening

INTRODUCTION

Lipids oxidation is a degradation process and considered to be a major cause of deterioration in the quality of fat products. It imparts rancid and unpleasant flavors to the products and thus decreases their organoleptic quality. Hence, oxidative stability of shortenings and oils is one of concern to bakers and snack food fryers. The oil stability evaluation at 120^{o} C, 20 L/hr air flow rate using the rancimat method showed the industrial shortening as the most stable fat with induction period of 10-15.47 hrs. Margarine and butter samples showed fair oxidative stability (IP of 4.98 – 6.10 hrs). (Farooq *et al*., 2003)

Hydrogenation is the process that reduces the relative unsaturation of the oil and promotes geometric and positional isomerization. Formation of trans isomers affects the physical and chemical properties of the final products, as trans isomers have higher melting point and greater stability than cis ones. (Aziz *et al.*, 2002).

Niall and Paul (2008) reported that the definition of margarine is rigidly fixed with regards to fat content, a minimum of 80% by weight must be present and any edible oil or fat source may be used in its manufacture. Although the tendency of any given fat to oxidize is greatly dependent on its overall degree of unsaturation, the manner and geometry in which the double bonds occur in the hydrocarbon chains also play a decisive role. For example, a single methylene group between 2 double bonds constitutes a particularly reactive site for oxidation.

Reduction of levels of Poly Unsaturated Fatty (PUFA) Acids particularly linolenic acid and increase of oleic acid concentration improves oxidative stability of soybean oil during storage and processing. (Igor *et al*., 2006)

El-Shattory *et al*. (2008) stated that during heating the oil subjected to high temperature for long periods of time caused sever damage to the oil. The peroxide value of soybean oil increased to reach the maximum value, then decreased gradually after total time of heating 60 hours. While acid value increased to reach its maximum value (2.65) indicating the increase of free fatty acids. On the other hand, iodine value decreased gradually during heating process.

Kazutoshi and Takyuki (2004) concluded that during the treatment of oils under cooking conditions, the formed aldhydes were comparable to those formed under accelerated conditions. Peroxide value of heated oils on low temperature 60ºC for long time (7days) is higher than higher temperature for 3 days and the lowest value of peroxide value recorded for all oils on higher temperature 200ºC for one hour.

Hsu and Chu (1997) studied the effect of heat treatment on stability and deterioration of different oils. Corn, palm, soybean and sunflower oils were heated at 180º C and they found that the oil deteriorated in the following order: sunflower, soybean, corn and palm oil. The tocopherol contents of the four oils decreased with increasing heating time.

The effects of soybean oil frying time and number of frying treatments on the quality of yu-kwa (Korean traditional rice cookies) were examined by Lim *et al*. (1993). As the frying time increased, acid and peroxide values increased.

El- Wafa (2001) reported that heat treatment of soybean and sunflower oil at 160º C for 60 hours increased and then decreased peroxide value and caused an increase in acid value and saturated fatty acids content. Decrease in iodine value and unsaturated fatty acids content was recorded.

Phenols are naturally occurring antioxidant substances found in the skins, peels and seeds of many fruits, vegetables and herbs. (Robards *et al*. 1999)

Furthermore, Satio *et al*. (1976) found that most herbs gave a fairly strong antioxidantative effect with lard and some of them showed very strong antioxidative effect being almost equivalent to that of butylated hydroxy anisole (BHA) and tocopherol.

The methanol extract and essential oils of thirty five Turkish spices were examined in sunflower oil stored at 70ºC by measuring peroxide value after regular intervals and showed stability effect for oil with different degree. The results obtained depended on the chemical composition of both extract and essential oils, suggesting mainly their phonolic compounds. (Ozcan and Akgul, 1995).

Accordingly, this investigation was carried out to explore the effect of fat type and its adding ratio in roasted bakery product on the stability of the fat and the shelf life of finished product. In addition to study the effect of adding some herbs to bakery product contained high ratio of fat on fat stability after heat treatment and the product shelf life.

MATERIALS AND METHODS

1. Materials

1.1 Fatty Matters:

All fatty matter used in this study; Sunflower oil, palm oil shortening, hydrogenated soy bean oil (HSBO) and soft margarine were obtained from IFFCO Company, Suez, Egypt.

1.2 Herbs Seeds:

Cumin (*Cuminum cyminumn*) , Fennel (*Foeniculum vulgare*) and blackseed (*Nigella sativa*) are purchased from local market , Cairo , Egypt.

1.3 Bread recipe:

Flour, sugar, yeast, salt, soy flour, skimmed milk powder, and bread improvers were obtained from Modern Bakeries Co. – 6th October city- Egypt as its regular ingredients.

2. Methods

2.1 Preparation of Crunchy Toast:

The research followed straight dough method according to AACC (2002) and applied the same recipe and technique used by Modern Bakeries Company in Crunchy Toast product, that contains The following as gm/100 gm flour, sugar 5, yeast 1.4, salt 1.65, skimmed milk powder 2.5, soy flour 2.5 and bread improver 1.2 .While water varied depending on the fat ratio added where four different fatty matters used with five adding-ratios on flour basis (5, 10, 15, 20 and 25%). As the regular recipe of fresh normal toast contain 5% fat, the sample of 5% is considered as a control sample during baking trials and following investigation steps. The bread loaves were kept in the refrigerator at 5^{o}c over night after baking and cooling them, then sliced into 10 mm slices and subjected to the roasting process using different heat treatments (110^{o}c/60 min, 140 ^{o}c /25 min and 170 ^{o}c /15 min).

2.2 Melting Point

All melting point determinations for all solid fats were carried out according to the methods of AOAC (2005).

2.3 Chemical tests

Moisture of crunchy and fatty matters, peroxide value, free fatty acids, acid value and iodine value, fat extraction were determined according to the methods of AOAC (2005).

2.4 Thiobarbituric acid (TBA) determination:

TBA values were determined according to the modified procedure described by Dobbs (1975) at National Research center, Giza- Egypt using UV/VIS spectrometer, model: T80+ and absorbance was measured at 538nm. TBA value was expressed as mg. malonaldhyde/kg.

2.5 Fatty acid composition

Methylesters of fatty acids were obtained according to AOAC (2005) at IFFCO Company laboratory, Suez- Egypt. The fatty acid methyl esters were determined by Hewlett Packard (P) 6890 GC and detected with a flame ionization detector (FID) and AHP.S column (30 n) , 5% dimelhy, 95% diphenyl polysiloxane was used and detector temperature 250º C.

2.6 Oxidative stability of raw fatty matters

The oxidative stability of different fatty matters was estimated by Rancimat method according to AOAC (2005) at IFFCO Company laboratory, Suez- Egypt, using Metrohm 679 apparatus. The induction period refers to the time (h) at the break point of extrapolated of the curve obtained by the Rancimat apparatus.

3. Statistical Analysis

The statistical analysis was done using (ANOVA) for the chemical analysis according to SAS (2006).

RESULTS AND DISCUSSION

Analysis of crude fatty matters:-

From data shown in Table (1), the margarine was clearly different from the other fat types especially in moisture content (17.2%). The rest of parameters were also higher than sunflower oil and different types of shortening except the iodine value that varies from one type of lipid to another to express the degree of unsaturation in agreement with (Haryati 1998), where the highest value recorded with sunflower oil (127) and the lowest value was for palm oil shortening (47).

Table (1): Chemical properties of different crude fatty matters

Analysis	Sunflower	Palm Oil Shortening	Soy Shortening	Soft margarine
Moisture %	0.06	0.04	0.05	17.2
F.F.A %	0.05	0.05	0.05	0.12
Acid Value	0.10	0.10	0.10	0.24
P.V.	0.6	0.5	1.0	1.0
Iodine Value	127	47	70	64
Melting point ºc	N/A	38	40	37
TBA	1.85	1.60	0.35	1.53

The primary oxidation products normally determined using peroxide value while secondary oxidation products which emerged during degradation of hydroperoxides into carbonyl compounds are determined using Thiobarbituric acid value (El Gammal 2006).

Data presented in Table (2) shows the fatty acids composition for all fatty matters used during study. The highest unsaturated fatty acid ratio was detected in sunflower oil (90.32%) and the linoleic was the predominant fatty acid (55%), whereas the lowest unsaturated fatty acid percent was found in soft margarine (36.73%) and the predominant fatty acid was stearic (38.2%) that was very close to its value in palm oil shortening. The illustrated data in table (2) are in coincidence with those of HO and CHOW (2000)

Rancimat index is a fast oxidation measurement for fats and oils to determine the resistance degree to oxidation. It indicates the potential shelf life of oil and expiry of the inherent antioxidative protection of the oil (Dachtler *et al*., 2003).

Table (2): Fatty acid composition of different crude fatty matters

Saturated Fatty Acid	Sunflower oil	Palm Oil Shortening	Soy Shortening	Soft margarine
C 12:0	0.05	0.23	0.12	--
C 14:0	0.12	0.6	0.05	0.38
C 16:0	5.44	43.5	12.5	38.2
C 18:0	3.95	4.3	18	20.8
C 20:0	0.12	0.3	0.23	--
Total	9.68	48.93	30.9	59.38
Unsaturated Fatty Acid				
C 16:1	--	--	--	0.15
C 18:1	35.2	37.5	65.1	30.1
C 18:2	55	10	3.7	6.0
C 18:3	0.12	0.3	0.3	0.48
Total	90.32	47.8	69.1	36.73

The obtained results presented in Table (3) show an obvious difference between the fatty matters concerning of the resistance to oxidation measured by rancimat that expressed as induction period (IP). These data indicate also that the highest induction period was 44.96 hours for hard soy shortening. Sunflower oil recorded the lowest value of induction period that reflects its low stability against oxidation compared with those of other fatty matters used that agreed with the results obtained by Farooq *et al*. (2003)

Table (3): Stability of different crude fatty matters measured by rancimat

Fatty Matter type	Sunflower oil	Palm Oil Shortening	Soy Shortening	Soft margarine
Induction Period (hr)	3.05	17.90	44.96	12.37

The effect of heat treatment and fatty matters concentrations on the fatty matters stability:-

The edible oils undergo a complex series of thermolytic and oxidative reactions during heating or frying processes (Choe and Min 2005 and El-Shattory *et al*., 2008).

The crunchy toast samples manufactured using palm oil shortening, soft margarine, partially hydrogenated soy bean oil, with adding ratios of 5,10,15,20 and 25% in and sunflower oil with only 25% adding ratio were subjected to extract the oil and study the chemical properties to determine the changes brought about the heat treatment and the effect of the concentration on these changes. On the other hand, samples produced from all types and concentrations were stored at ambient temperature (25^{o} c and 55% relative humidity) to determine the shelf life of each.

The results of chemical properties of palm oil shortening, soft margarine and partially hydrogenated soy oil were demonstrated in tables (5), (6) and (7) respectively that indicate a clear deterioration in all measurements carried out for all of three compared with the control (crude fatty matter before baking and roasting) whereas sunflower oil is analyzed only with 25% adding ratio with the different heat treatment as the sever damage and deterioration rapidly and greatly occurred Table (4) so, it was incomparable with others and could not be statistically analyzed.

Table (4): Effect of baking and roasting on chemical properties of sunflower oil

Chemical Parameters	25% Sunflower oil			
	Control	170ºC/15 min	140ºC/25 min	110ºC/60
FFA	0.05	0.793	0.753	0.878
AV	0.10	1.578	1.498	1.747
PV	0.6	305.7	299.8	335.92
IV	127	89.6	87.51	96.181
TBA	1.85	516.4	944.4	954.2

Table (5): Effect of baking and roasting on chemical constants of Palm Oil .

Ratio & Treatment	FFA	Acid V.	PV	IV	TBA
Control	0.05	0.10	0.5	48.0	1.60
5% 110º C	0.293	0.583	4.349	35.006	28.2
5% 140º C	0.291	0.579	2.737	35.02	28.4
5% 170º C	0.292	0.581	3.6	35.148	21.5
10% 110º C	0.317	0.738	4.52	32.148	28.9
10% 140º C	0.304	0.604	3.15	34.5	14.6
10% 170º C	0.316	0.628	3.6	36.61	23.9
15% 110º C	0.352	0.7	4.689	37.391	32.3
15% 140º C	0.322	0.64	3.17	32.3	19.7
15% 170º C	0.329	0.6547	5.379	33.78	16.0
20% 110º C	0.359	0.714	4.96	36.147	23.4
20% 140º C	0.325	0.6467	3.23	35.25	19.7
20% 170º C	0.388	0.485	5.92	34.63	17.12
25% 110º C	0.388	0.7722	4.96	44.081	14.3
25% 140º C	0.388	0.4656	4.015	38.91	17.9
25% 170º C	0.4	0.796	6.182	41.24	21.3

FFA : Free Fatty Acids (% as oleic) **AV : Acid Value**
PV : Peroxide value (ml. equivalent/kg) **IV : Iodine Value** **TBA : Thiobarbituric Acid**

Table (6): Effect of baking and roasting on chemical constants of Soft Margarine.

Ratio & Treatment	FFA	AV	PV	IV	TBA
Control	0.12	0.24	1.0	64.0	1.53
5% 110o C	0.387	0.77	8.111	77.04	33.7
5% 140o C	0.348	0.692	7.14	67.98	28.2
5% 170o C	0.371	0.738	8.087	70.25	38.2
10% 110º C	0.405	0.805	8.685	67.03	24.6
10% 140º C	0.396	0.788	7.667	65.46	20.7
10% 170º C	0.425	0.845	9.647	67.11	36.4
15% 110º C	0.443	0.881	8.92	67.03	30.4
15% 140º C	0.441	0.877	8.07	65.82	36.7
15% 170º C	0.442	0.879	10.119	66.41	24.3
20% 110º C	0.449	0.893	9.427	65.453	19.1
20% 140º C	0.445	0.885	9.062	65.988	21.7
20% 170º C	0.453	0.901	10.35	65.88	23.5
25% 110º C	0.473	0.941	10.56	69.59	37.7
25% 140º C	0.454	0.903	9.291	63.19	15.7
25% 170º C	0.46	0.915	9.877	60.73	19.4

FFA : Free Fatty Acids (% as oleic) **AV : Acid Value**
PV : Peroxide value (ml. equivalent/kg) **IV : Iodine Value** **TBA : Thiobarbituric Acid**

Table (7): Effect of baking and roasting on chemical constants of HSBO

Ratio & Treatment	FFA	AV	PV	IV	TBA
Control	0.05	0.10	1.0	70.0	0.35
5% 110º C	0.328	0.653	2.04	50.346	13.9
5% 140º C	0.268	0.533	2.06	47.031	27.2
5% 170º C	0.375	0.746	2.19	46.666	19.9
10% 110º C	0.361	0.718	2.09	48.77	10.2
10% 140º C	0.275	0.547	2.09	43.8	11.5
10% 170º C	0.283	0.762	2.131	50.22	13.8
15% 110º C	0.377	0.75	3.06	48.68	19.1
15% 140º C	0.285	0.567	2.1	49.56	33.2
15% 170º C	0.351	0.698	3.103	55.47	15.5
20% 110º C	0.373	0.742	3.19	62.181	18.4
20% 140º C	0.27	0.537	2.17	53.72	11.8
20% 170º C	0.381	0.758	3.15	63.55	17.1
25% 110º C	0.496	0.988	3.505	64.113	16.1
25% 140º C	0.275	0.547	3.34	60.403	23.6
25% 170º C	0.435	0.865	3.244	64.558	19.9

FFA : Free Fatty Acids (% as oleic) **AV : Acid Value**
PV : Peroxide value (ml. equivalent/kg) **IV : Iodine Value** **TBA : Thiobarbituric Acid**

Generally, the chemical constants of fats determined after roasting which are; free fatty acids (FFA), peroxide value (PV), acid value (AV) and Thiobarbituric acid (TBA), were clearly increased in all fatty matters and its concentrations compared with the control, while iodine value (IV) was decreased that explain the deterioration of fat as a result of heat treatment. El-Shattory *et al*. (2008) and El- Wafa (2001) stated the same findings during the heat treatment of soy oil and sunflower oil.

The data listed in table (8) shows the effect of fat type on the stability after baking and roasting. It is obvious that soft margarine statistically recorded the highest values of all parameters (FFA, AV., PV, TBA and IV) with significant differences compared with palm oil and HSBO whereas HSBO was the best between the three types as it shows the lowest values for all evaluated parameters. Sunflower oil was incomparable with others due to its huge deterioration in all indices.

Table (8): Statistical Analysis of the Effect of Fatty Matters type on stability after baking & roasting

	Palm Oil Shortening	Soft Margarine	Soya Shortening	LSD
FFA	0.34 ± 0.039 b	0.43 ± 0.036 a	0.34 ± 0.0678 b	0.024
AV	0.64 ± 0.095 b	0.85 ± 0.072 a	0.69 ± 0.132 b	0.058
PV	4.30 ± 1.057 b	9.00 ± 1.028 a	2.63 ± 0.587 c	0.363
IV	36.14 ± 3.208 c	66.997 ± 3.602 a	53.94 ± 7.194 b	3.305
TBA	21.82 ± 5.607 b	27.35 ± 7.650 a	18.08 ± 6.223 b	4.608

These results are greatly correlated to the stability test (rancimat) which indicates that the soy shortening revealed the highest stability, that may return to its fatty acid profile and good level of its initial peroxide, iodine and TBA values, as a result of the partially hydrogenation process that lowers the unsaturated fatty acids and increases the saturated ones as agreed by Warner *et al*.(2000) and Aziz *et al*.(2002)

The statistical analysis shown in Table (9) explains that the chemical indices (FFA, Acid V, Peroxide value and iodine value) were affected clearly with by increasing the fat level, whereas TBA value did not show this correlation.

Table (9): Statistical Analysis of the Effect of Fatty Matters' concentrations on its stability after baking & roasting

	5 %	**10 %**	**15 %**	**20 %**	**25 %**	**LSD**
FFA	0.328 ± 0.044 d	0.342 ± 0.056 cd	0.37133 ± 0.059 cb	0.38256 ± 0.061 b	0.41878 ± 0.066 a	0.0312
AV	0.653 ± 0.087 c	0.715 ± 0.101 bc	0.73852 ± 0.117 ba	0.72908 ± 0.152 ba	0.79920 ± 0.180 a	0.075
PV	4.479 ± 2.602 c	4.842 ± 3.018 c	5.4011 ± 2.935 b	5.7177 ± 3.138 ba	6.1082 ± 3.010 a	0.4691
IV	51.610 ± 16.321 b	49.516 ± 14.133 b	50.716 ± 14.019 b	53.644 ± 14.224 ba	56.313 ± 11.556 a	4.2669
TBA	26.578 ± 7.296 a	20.511 ± 8.793 bc	25.244 ± 8.068 a	19.091 ± 3.652 c	20.656 ± 7.027 bac	5.9486

This finding can be explained as the extra amount of fat or oil added to the dough makes a considerable ratio of this fat in free state and not binding or involved inside the bread structure that makes it more contacted with oxygen (air), that agreed by Kambiz *et al*. (2003) and Barabanti *et al*. (1994)

On the other hand, the roasting at 110º/1 hr and 170º C/15 min were not significantly different in their effect on FFA, Acid v., Peroxide value and recorded the highest values, where 140º C/25 min. was the lowest. IV and TBA did not show any significant difference with different heat treatments (Table 10).

Table (10): Statistical Analysis of the Effect of Roasting temperatures on stability after baking & roasting

	110º C/ 60 min	140º C/25 min	170º C/15 min	LSD
FFA	0.38673 ± 0.058 a	0.33913 ± 0.068 b	0.38007 ± 0.057a	0.0241
AV	0.77655 ± 0.109 a	0.65409 ± 0.143 b	0.75011 ± 0.124 a	0.0581
PV	5.5377 2.829 a	4.6195 ± 2.753 b	5.7719 ± 3.086 a	0.3633
IV	53.667 ± 14.669 a	50.595 ± 13.429 a	52.817 ± 13.714 a	3.3052
TBA	23.353 ± 8.264 a	22.040 ± 7.504 a	21.855 ± 7.022 a	4.6078

The influence of herbs and spices and their methanol extracts on oils stability has been studied for long time by many authors and found that it has an appreciable antioxidative impact can be compared with that of the artificial antioxidants (Akgul and Ayar ,(1993) and Ozcan and Akgul, (1995). Moreover, adding herbs and spices to some bakery products became common and favorable for a wide sector of market and consumers.

From the previous results, roasting with adding ratio of 25% fat at 110º C/hr showed the highest effect on chemical indices determined. Kazutoshi and Takyuki (2004) reported that the long time at low temperature increases the peroxide value more than high temperature for short time. So, crunchy toast samples with different fatty matters were reproduced using this ratio(25%), that heat treatment(110/60min.) and 1.50% of the common used herbs in such products namely; blackseed, cumin and fennel.

Table (11) shows the effect of adding different herbs on the stability of fatty matters. All evaluated parameters are enhanced obviously by adding herbs for all types (Sunflower oil, palm oil, HSBO and soft margarine). There was a considerable improvement in all parameters values compared with those of control while the variation between different herbs was relatively small.

The stability improvement effect of the herbs may be due to their content from phenols that are naturally occurring antioxidants as mentioned by Robards *et al.* (1999). Moreover, many kinds of herbs and spices including fennel can preserve the naturally occurring tocopherols and increase their life time that approved by Jagait (1996). In addition, the spices and herbs including cumin, fennel and blackseed contain an antioxidative effect compounds in the range of 2-32 mg/100gm and their effect being almost equivalent to the effect of butylated hydroxyl anisole (BHA) and tocopherol (Satio and Asri 1976 and Satio *et al.,*1976).

Storage and shelf life of crunchy toast:

The shelf life of fat products is determined mainly by assessment of lipids oxidation that considered to be a major cause of deterioration of fat products quality. (Farooq *et al.*, 2003)

The produced samples with all fatty matters, different levels and roasting heat treatments were stored under ambient temperature in the ordinary packs (sealed polypropylene inside carton box) and checked twice per week to sensory detect any off or rancid odour. The sample used to check the rancidity was removed away either it is valid or deteriorated to make next check by new sample. The moisture determination for crunchy were carried out before storage (Zero time).

The results of storage/shelf life are represented in the figures from (1-4), that indicate the moisture content of the roasted crunchy at zero time. All samples fall in the range between 1.7% and 4.0% which is the standard moisture content of that product according to the Egyptian standards. This range of moisture guarantees that there is no influence of moisture on the deterioration of lipids as a synergist that found in agreement with Lima and Concalves , (1994)

From figures (1-4), it is easily to conclude that the liquid oils represented by sunflower oil recorded the lowest shelf life and lowest oxidative resistance for finished product, the same trend was found with all oil levels which turned rancid just after one week of storage, due to its high unsaturation degree (Fig. 1), while partially hydrogenated soy showed the best shelf life with all ratios and heat treatments (Fig.2).

These findings are extremely correlated with the analysis results were shown in tables (1- 4) that explain sunflower oil as lowest stability indices either crude or after heat treatment in agreement with Hsu and Chu (1997), Aziz *et al.*(2002) and Gerhard (2003)

The level of fatty matters in bakery product has obvious impact on the shelf life, the graphs of shelf life illustrated that the shelf life of crunchy toast decline by increasing adding ratio of any fatty matter particularly more than 10% adding ratio as the adding ratio clearly affects the stability indices , Tables (4-7).

From the present study, all figures illustrated that the highest temperature with short time (170 º C /15 min.) and the lowest temperature with long time (110º C/ 1 hr) were the most effective in acceleration of rancidity and shelf life reduction. On the other hand, the treatment of 110 º C/1hr recorded the shortest shelf life in most of the samples which may refer to more importance of heating time than heating temperature as indicated by Kazutoshi and Takyuki , (2004)

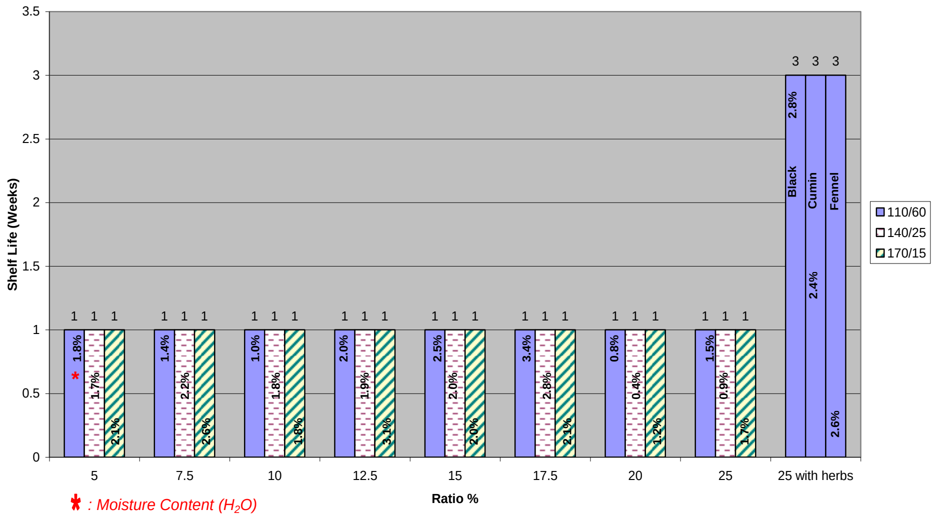

Figure (1): Effect of using sunflower oil on shelf life of the crunchy toast.

From the figures presented for shelf life and chemical constants of extracted oils after baking and roasting (Table 11), it can be concluded that the shelf life of crunchy toast was enhanced clearly by adding the herbs seeds. This improvement was observed with all fatty matters subjected to the test as sunflower crunchy shelf life increased to 3 weeks instead of one without herbs. The rest of (25%) fatty matters crunchy toast shelf life increased to nearly attain the same shelf life of 10% fat crunchy toast. This may return to enhancement of stability indices due to the phenols and the antioxidative compounds found in these herbs that increase the oxidative and thermal stability and enhance the tocopherols shelf life .These results are in agreement with those of Jagait, (1996).

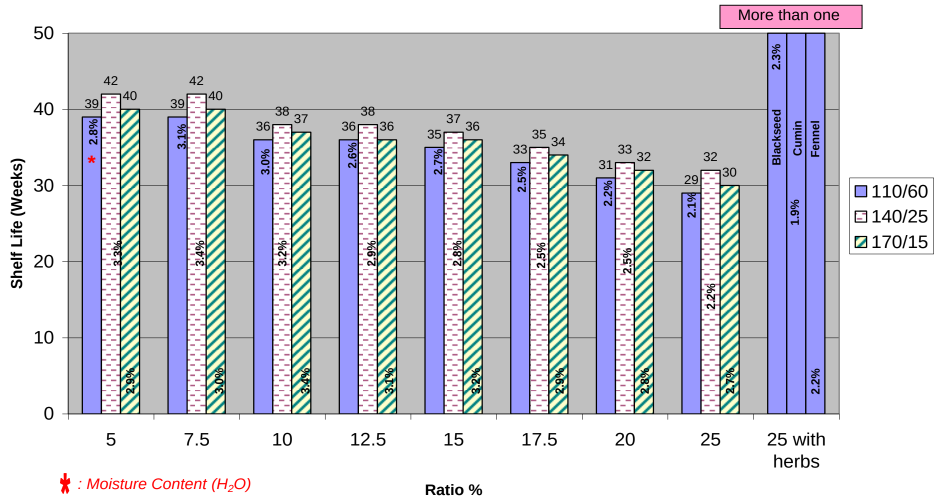

Figure (2): Effect of using partially hydrogenated soy oil on shelf life of the crunchy toast

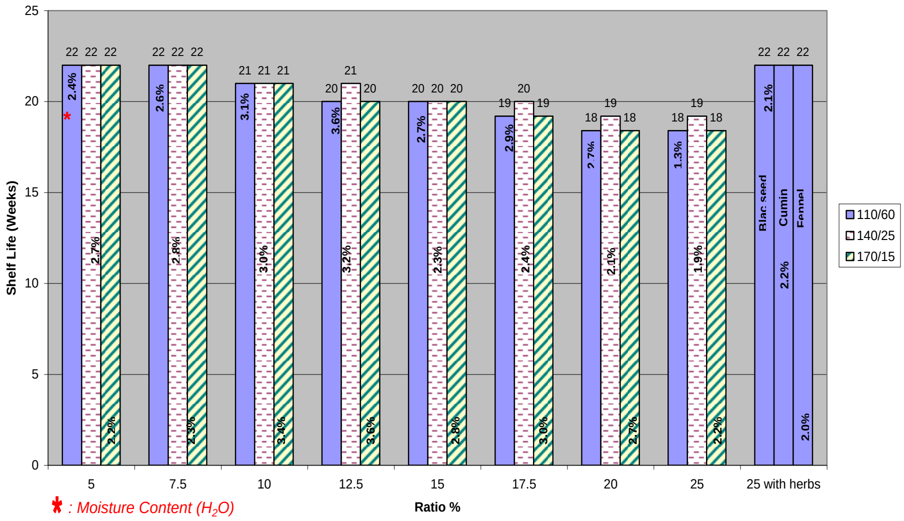

Figure (3): Effect of using palm oil on shelf life of the crunchy toast

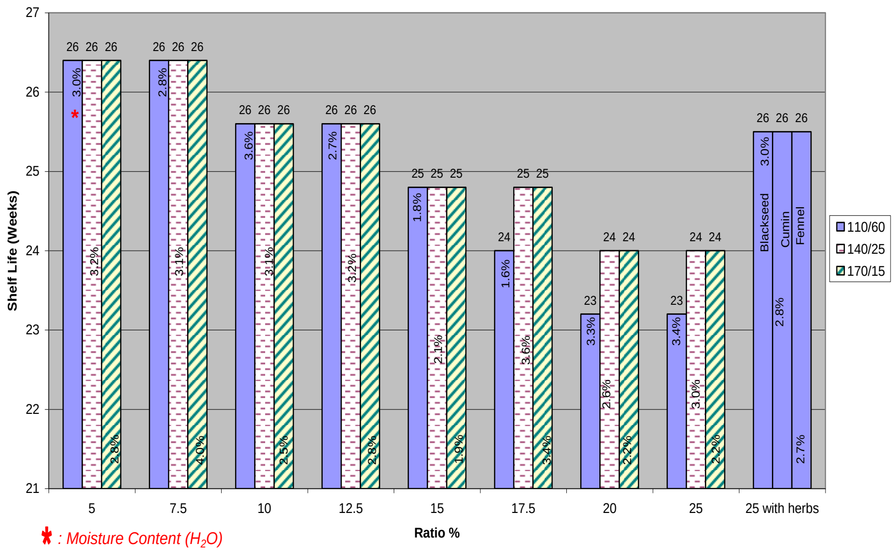

Figure (4): Effect of using soft margarine on shelf life of the crunchy toast

REFERENCES

AACC (2002). Approved methods of the American association of cereal chemists , 10th edition.

AOAC (2005). Association of Official Analytical Chemists Official methods of analysis(18th Ed.),Washington ,DC,USA.

Akgul, A. and Ayer, A. (1993). Antioxidant effects of Turkish spices. Doga Turkish J. Agric. And Forestry, 17(4): 1061-1068.

Aziz,T. ; Melih,C. ; Hulya, K. and Muammer K. (2002). Trans fatty acid and solid fat contents of margarines marketed in Turkey. JAOCS, 79(5):443- 445.

Barbanti, D.; Pizzirani, S. and Dalla R. M. (1994). The cooking of food in oil frying. 2:Chemical and Physicochemical Modifications in the Oil. Ind. Aliment. (Pinerolo, Italy) 33(324), 318-324, C.A. vol. 121(19), P.2293045.

Choe, Y.O. and Min, D.B. (2005). Chemistry and Reactions of Reactive Oxygen Species in foods. Journal of Food Science, 70:142-159.

Dachtler, M.; H.M. Frans,H.M. and Fritsche, J. (2003) Characterization of sesame oil extracts and assessment of their antioxidants activity. Eur. J. Lipid Sci. Tech. 105:488-496.

El-Gammal, R.A. (2006). Studies on Stability of Oils and Fats. PhD Thesis, Faculty of Agric. Mansoura univ. Egypt.

El-Shattory,Y. ;EL-Wafa, G.A. ; and Aly S.M.(2008). Utilization of Natural Antioxidants for Improving Physicochemical Changes of Soybean Oil During Heating Processes. 3rd International conference "Nutirition Status , and Food Sciences in Arab countries" NCR, Cairo, 3-5 November 2008.

El-Wafa, G.A. (2001). Studies on physicochemical changes and quality of some oils during heating processes. M.Sc. Thesis. Faculty of Science. Ain Shams Univ.,Cairo, Egypt.

Farooq, A.; Bhanger, M.I. and T.G. Kazi (2003). Relationship between Rancimat and active oxygen method values at varying temperature for several oils and fat. JAOCS, 80(2):151-155.

Gerhard, K. and Robert O. D. (2003). Dependence of oil stability index of fatty compounds on their structure and concentration and presence of metals. JAOCS, 80(10):1021-1026.

Hafiz, N.E.; El-Wakeil, F.A.; Alian, A.M. and Awad, A. M. (1995). Effect of continuous and intermittent heating of crude oils of some sunflower cultivars cultivated in Fayoum, Egypt. J.Food Sci. 21(3), 279-290

Haryati,T.; CHe, Y.P.; Man, H.M. ; Ghazali, B.A ; and Buana, L. (1998). Determination of Iodine value of palm oil based on Triglyceride composition. JAOCS, 75 (7):789- 792.

HO, C.C. and Chow, M. C. (2000). The effect of the refining process on the interfacial properties of palm oil. JAOCS, 77(2):191- 199.

Hsu , H.F. and Chu, Y.-H(1997). Quality evaluation of corn, palm, soybean and sunflower oil during heating. Zhongguo Nongye Huaxue Huizhi 35(1):1-8, Chinese Agricultural Chemical Society; C.A. 126 (26): P.3426989.

Igor V. K. ; Glen R. R.and Charles R. H. (2006). Measurement of soybean fatty acids by near-infrared spectroscope: linear and nonlinear calibration methods. JAOCS, 83(5):421-427.

Jagait, C. (1996). An investigation into the use of herbs and spices preserving vitamin E during the heating of soybean oil at 60ºc. Food Science and Technology Today 10(3):153-156.

Kambiz C. S. ; Preeyanooch, T. and William, E. A. (2002). Comparison of low-linolenic and a partially hyderogenated soybean oil using pan-fried Hash Browns. JAOCS, 79(12):1197- 1200.

Kazutoshi, F. and Takyuki, S.(2004). Formation of Genotoxic Dicarbonyl compounds in dietary oils upon oxidation. Lipids,39(5):481- 486.

Lima, J.R. and Goncalves, L.A.G. (1994). Parameters for evaluation of the quality of soybean oil used for frying. Quim. Nova 17(5), 392-396.

Lim, Y.H.; Lee, H.Y. and Jang, M.S. (1993). Quality of yu-kwa (rice cookies) in relation to the frying time of soybean oil 22(2), 186-189;CF C.A.120 (1), P.72206.

Niall, Y. and Paul, W. (2008). Food Emulsifier and their Applications. Second Edition . p. 307.G.L.Hasenhuttland R.W.Hartel ,Springer Science & Business Media LLC.

Ozcan, M. and Akgul, A. (1995). Antioxidant activity of extracts and essential oils from Turkish spices on sunflower oil. Acta Alimentaria, 24 (1): 81-90.

Robards, K.; Paul, D. Prenzler; G. Tucker and W.Glover (1999). Phenolic compounds and their role in oxidative processes in fruit. Food Chem., 66,401-436.

Satio, Y. ; Kimura, Y. and Sokamoto, T. (1976). Studies on the antioxidant properties of spices. 111. the antioxidant effect of petroleum ether soluble and insoluble fraction from spices. J.Jap.Soc. of Food nutrition, 29 (9): 505-510. (C.F.FSTA 11(12) T687, 1977).

Warner, K. ;Neff,W.E. ; List, G.R. and Peter, P. (2000). Electro-chemical hydrogenation of edible oil in a solid polymer electrolyte reactor. Sensory and compositional characteristics of low trans soybean oils. JAOCS, 77(10):1113-1118.

تأثير ثبات المواد الدهنية على ثبات و صلاحية التوست المقرمش.

ابو بكر محمد حسن، ممدوح محمد ربيع، مسعد ابو ريه، احمد عزت و اسامة العدل*
قسم الصناعات الغذائية – كلية الزراعة – جامعة المنصورة ٢٠٠٩.
*** شركة المخابز الحديثة (ريتش بيك) – ٦ اكتوبر - مصر**

- توجد الزيوت النباتية فى ثلاث اقسام رئيسية هى الزيوت السائلة ، الزيوت الصلبة/النصف صلبة (سمن) والمارجرين وتختلف هذه الاقسام فى انواع ونسب الزيوت الداخلة فى تصنيعها والخواص الطبيعية والكيميائية.
- وقد تم استخدام زيت عباد الشمس ، سمن زيت النخيل ، زيت الصويا المهدرج جزئياً (سمن الصويا) والمارجرين اللين ليمثلوا هذه الاقسام المختلفة فى هذه الدراسة.
- وقد تم تجهيز خلطات مختلفة للتوست المقرمش (خبز توست محمص ذو محتوى دهنى عالى) بإستخدام نسب مختلفة من الزيوت والدهون المذكورة (٥% ، ١٠% ، ١٥% ، ٢٠%، ٢٥%).
- واستخدامت معاملات حرارية مختلفة فى عملية التحميص وهى ١١٠° م لمدة ساعة ، ١٤٠ ° م لمدة ٢٥ دقيقة ، ١٧٠ ° م لمدة ١٥ دقيقة.
- وبدراسة خواص الزيت المستخلص من المنتج النهائى ودراسة خواصه بعد المعاملات الحرارية المختلفة ونسب المواد الدهنية المختلفة للوقوف على مدى ثبات الزيت وافضل العوامل المؤدية الى هذا الثبات وتأثير ذلك على مدة صلاحية المنتج النهائى.
- **اظهرت النتائج الاتى:-**

(١) يتأثر ثبات الدهون فى منتجات المخابز المحمصة (التوست المقرمش) وكذلك صلاحيتها بنوعية المادة الدهنية ونسبة إضافتها وكذلك طبيعة المعاملة الحرارية أثناء التحميص.
(٢) زيت الصويا المهدرج جزئياً سجل أفضل درجات الثبات تحت المعاملات الحرارية المختلفة كما سجل أطول مدة صلاحية للمنتج النهائى فى جميع نسب إضافته مقارنة بالمواد الدهنية الاخرى المستخدمة.
(٣) زيت عباد الشمس والذى يمثل الزيوت السائلة فى الدراسة سجل أقل درجات الثبات تحت المعاملات الحرارية المختلفة وأقل مدة صلاحية للمنتج النهائى.
(٤) طول مدة المعاملة الحرارية للتحميص هى الاكثر تأثيراً على خواص المادة الدهنية وهى التى سجلت أقل مدة صلاحية للمنتج.
(٥) إضافة نسبة ١,٥% من بذور التوابل (كمون ، شمر، حبة البركة) المجروشة يزيد بشكل واضح من ثبات المواد الدهنية المختلفة وكذلك مدة صلاحية منتجات المخابز المصنعة منها بشكل ملفت.

Table (11): Effect of Adding Herbs on Chemical constants of Fat extracted after Baking and roasting from highest concentration (25%)

Chemical parameters	Sunflower oil				Palm Oil					HSBO				Soft Margarine		
	110ºC	110ºC Fennel	110ºC Cumin	110ºC Black seeds	110ºC	110ºC Black seeds	110ºC Cumin	110ºC Fennel	110ºC	110ºC Black seeds	110ºC Cumin	110ºC Fennel	110ºC	110ºC Black seeds	110ºC Cumin	110ºC Fennel
FFA	0.878	0.247	0.394	0.24	0.388	0.301	0.31	0.312	0.496	0.384	0.38	0.372	0.473	0.399	0.38	0.384
AV	1.747	0.491	0.784	0.477	0.7722	0.598	0.616	0.62	0.988	0.764	0.756	0.74	0.941	0.794	0.756	0.764
PV	335.92	192.47	182.5	177.53	4.96	3.76	3.82	3.78	3.505	2.276	2.272	2.269	10.56	7.03	6.88	6.03
IV	96.181	96.092	95.095	73.062	44.081	41.27	41.52	41.33	64.113	60.08	61.00	60.56	69.59	58.57	57.44	58.83
TBA	954.2	244.2	235.3	263.5	14.3	13.9	17.9	18.6	16.1	12.9	15.9	28.3	37.7	42.2	40.7	15.6