CHEMICAL AND TECHNOLOGICAL STUDIES ON MANGO SEED KERNELS FOR ENHANCING THE ORGANOLIPTIC AND KEEPING QUALITY OF ONE BAKERY PRODUCTS.

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The current work is interested in evaluating mango seed kernels (MSK) for the gross chemical composition. Also, carotenes and riboflavin contents and some elements(Fe- K- Ca- and Zn) are determined. The fractionation of both fatty acids and amino acids contents are also investigated.

Resultant data showed that the seeds contained high levels of protein, fat, fibers and ash in MSK compared to wheat flour 72% ext. There was also a considerable amount of riboflavin. Soaking has an obvious reduction effect on the contents of tannins and phytic acid. Fractionation of fatty acids revealed that there was considerable amounts of omega oils and the stearic acid was the main saturated fatty acid and oleic was the main unsaturated one in unsoaked mango seed kernels; this content has a little reduction in soaked ones. There was a superior in valine and leucine in MSK compared to FAO/WHO reference, these values were nearly equivalents in lysine.

On the applied side, MSK flour used as a partial substitute with wheat flour in making pizza base at levels of 5,10,15,20 and 25% (w/w). Physicochemical analysis revealed that there was a high loss in moisture during baking, meanwhile, this loss have reduced in magnitude by increasing the substituted kernel flour up to the level 25 % supplementation. On the other hand, baking time has increased with the graduate increasing of mango seed flour up to the ratio 25% treatment. The shelf-life gave a magnitude values towered increasing the storage keeping quality that has been elongated by 20 and 39 days at room temperature and the refrigerator respectively.

Sensory evaluation illustrated that chewing, appearance and grain and texture scored the highest degrees of all parameters up to the level of 10% replacement MSK compared to the control the acceptance degree for flavor and chewing characters were nearly equaled to the control up to the ratio 15% replacement. On the other hand, The scores for the other parameters have gradually reduced by increasing the addition of mango seed kernel flour up to the ratio of 20% replacement but they were acceptance. Therefore, it could be use mango seed kernel flour in making pizza base up to 20% (w/w)replacement of wheat flour without affecting on its organoliptic properties.

Introduction

Mango is one of the most popular, delicious and nutritive fruit. Therefore, huge amounts of mango seeds are discarded as wastes. Thus , many efforts have to do as means to overcome the resultant pollutions of these wastes. Mango seed kernels represents from 10 to 25% of the whole fruit weight (***Helmavathy et al.,1988***). The kernels inside the seed represent from 45 to 75% of the whole seed and about 20% of the whole fruit ***(Arogba, 1997).*** However, more than 32,7000 ton of mango fruit were produced in 2004 ***(FAO,2004)***.Depending on there varity, mango seed kernels contain 6.0% protein,11%fat,77%carbohydrates,2.0% crude fibers and 2.0%ash ***(Zein et al.,(2005).*** The lipids of mango seed kernel consists of about 44-48% saturated fatty acids and the majority was stearic.52-56%were unsaturated and the majority was oleic.(***Mohamed & Girgis,2005***).

Many studies have reported that mango seed kernels have the antioxidant and antimicrobial activities ***(Parmar & Sharma,(1986) and Abdalla et al., (2007)***. Mango seed kernels were shown to be a good source of polyphenols, phytosterols such as campsterol, B-sitsterol and tocopherols (***Soong, et al.,2004***).The chemical analyses showed that Mango Kernel Extract (MKE) contained 79.5% polyphenols ***(Kabuki, et al.,(2000)*** Mango seed kernels ethanol extract **(MKE)** showed an antimicrobial activity against both gram-positive and gram- negative bacteria except for Lactic acid bacteria (LAB) at 2500 ppm. Among these pathogens were ***E. coli, Campylobacter jujoni Yarsinia enterocolitica ,Staphylococcus aurous, Bacillussp Clostridium sp.*** **and** ***Listeria monocytogenes.***

The present study presents some chemical, nutritional, anti-nutritional and antimicrobial characteristics of mango seed kernel flour as a promising by -product and the ability to use it in incorporating with the

wheat flour in an attempt to enhance some physicochemical properties and shelf life of one bakery products such as pizza base loaf to get rid of this by- product that cause a huge pollution and in the same time to achieve a highly benefit in overcoming the malnutrition risk in nutrients in undeveloped countries.

Materials and Methods

Ingredients:

wheat flour (72% extraction)was obtained from North Cairo Mills Company. Mango seeds were obtained from a big shop making fresh fruit juices in Cairo. Fresh hen eggs , corn oil , butter , sugar and yeast were obtained from local market in Tanta city.

Methods:

Preparing mango seed kernels(MSK) Manually the hasting were done to remove the hard seed coat from the kernels. Some of mango seed kernels were soaked in distilled water for 72 hr. The soaking water was changed twice daily. The soaked kernels were partially grinded in a wooden mortal and then were dried in sun ,then grinded to a powder form using a blender.

Preparing of pizza dough:

Salt and sugar are dissolved in a little amount of worm mixing water. The compressed baker's yeast was also dissolved in a little amount warm water ,butter and oils were combined with the whole eggs and the sifted wheat flour and then the other ingredients were added asin the illustrated ratios in table (1) according to ***Khater &Hellal (2002)***.Mixing tab water was added for the control and the treatments by the amounts illustrated in the above table. The combined ingredients were knead (hand mixed) for 5 minute, until stretchened or giving best dough texture, then let rest in a warm place for an hour for leavening. The leavened dough was classified into equaled balls and let for further leaven for half an hour, then rolled and left for anther 30 min. at room temperature. The rolled dough were baked in a baking oven at 250^0 C for 5-6 minutes. The produced pizza loaves were packaged in clean polyethylene sucks and tested for shelf-life at both room temp. and at the refrigerator.

Table (1): The formula of the pizza base dough for the control and the treatments(g)/100g.

Ingredients	Control wheat flour	%5 MSK	10% MSK	15% MSK	20% MSK	20% MSK
Wheat flour. MSK flour	100 0	95 5	90 10	85 15	80 20	75 25
Whole eggs	10	10	10	10	10	10
Corn oil and butter	5	5	5	5	5	5
Sugar	2	2	2	2	2	2
Salt	2	2	2	2	2	2
Yeast	4	4	4	4	4	4
Mixing water(ml)	55	60	70	80	95	98

Organoliptic evaluation,

The baked loaves were evaluated for eating quality**,** the crumb color, crust character and grain and texture by 8 panelists according to ***El-Nemr, (1976)*** with some modifications

Chemical analyses:

The sun dried mango seed kernel flour. Wheat flour and whole eggs were analyzed for moisture, crude fibers and crude protein according to the ***AOAC (1995***), while the fat contents was determined according to ***Folich et al., (1957)***, but the reducing sugars determined according to ***Holme &Peck (1983).*** Fatty acids were determined according to ***Radwan***, ***(1978***) using GC Model,Shimadzu-8A,equipped with FID detector and glass column2.5mX3mmi.d. The amino acids determined according to ***Moore& Stain, (1958)*** . Seeds flour was also analyzed for some mineral content by the atomic absorption (ca, fe, zn, and k) according ***to Ronald and Ronald (1981***), The ant-nutritional factors (tannins and phytic acid) were also measured according ***to Burns(1971)*** and ***Camire & Clydesdale(1982)*** respectively. Caroteinoids were determined by HPLC Method according to ***David and John Scott (1995)***.Riboflavin also was determined according to ***Soledad et al.,(1997).***

Results and Discussion

Table (2) revealed the gross chemical composition of mango seed kernel flour before and after soaking. and also of wheat flour. The obtained data illustrate the richness of protein, fat, crude fibers and ash in MSK compared to wheat flour 72% extraction that increase the nutritional value in the produced bakery product and enhance the organoliptic quality up to certain replacement of wheat flour. These results were in general in an agreement with those of ***Zein et al., (2005)*** and ***Ahmed et al.,(2007)***, with the exception of fat and ash that showed a bit little value compared to their results.

Table(2): Gross chemical composition of mango seed kernel flour and wheat flour(gm/100gm)

Treatment	Moisture	Crude protein	Fat	Crude fibers	Ash	T. carbohydrates	Reducing sugars
MSK before soaking	**5.23**	**6.03**	**9.90**	**3.82**	**1.62**	**73.40**	**8.65**
MSK after soaking	**5.90**	**6.10**	**8.30**	**4.65**	**1.85**	**73.20**	**3.55**
Wheat flour 72%extraction	**13.10**	**1.12**	**0.95**	**0.62**	**0.67**	**83.21**	**-**

Table (3) illustrates mango seed kernel contents of riboflavin and carotenes after soaking in distilled water based on wet weight and some minerals (zn, Fe, K and Ca) based on dry weight. Resultant data showed that mango seed kernel is a good source of B–carotenes, riboflavin zinc, iron, potassium and calcium.

Table (3): Mango seed kernel contents of riboflavin and carotenes and some minerals.

Treatment	*B-carotenes mg/g	*Riboflavin mg/g	**Zn mg/kg	Fe ppm	K mg/kg	Ca mg/kg
MSK after soaking	**12.60**	**0.005**	**5.00281**	**51.1169**	**8598.182**	**194.468**
***Wheat flour (72% ext.)mg/100g	---	---	2.12	2.82	168.00	51.01

***Based on wet weight. ** Based on wet dry weight**
****** source: Bessar et al., (2008)***

Anti nutritional factors (tannins and phytic acid) contained in mango seed kernel were given in table (4). The results showed that although mango seed kernel flour contains considerable amounts of these factors, soaking in water reduces it to the safe level hence the soaking reduces tannins from 4.65 to only 0.65% (by 4.00%) and phytic acid from 3.80 to 1.93% (by 1.07%) respectively. These results were nearly in agreement with those of ***Zein et al., (2005).***

Table (4): The effect of soaking on the anti nutritional factors (phytic acid and tannins) content in mango seed kernel

Treatments	Phytic acid g/ 100g	Tannins (g/ 100g)
MSK before soaking	2.80	4.65
MSK after soaking	1.93	0.65
Wheat flour (72% ext.)*	0.0167	--

Source**: ***Besaar et al.,(2008)

Data in table (5) presented the fractionation of fatty acids content of mango seed kernel.These results showed that the main saturated fatty acid was stearic acid (38.337%) before soaking and 36.801% after soaking. At the same time the main unsaturated fatty acid was oleic(w_9) (45.205%) before soaking and (40.546%) after soaking. These results were in agreement with those of ***Girgis,(2005) and Abdalla et al., (2007).*** The same

table illustrated that the total essential fatty acid (omegas) achieved considerable levels ranged from (2.004-8.890%) of total fat.

Table(5): Fatty acids content in mango seed kernels before soaking and after soaking (g/100gm)

Fatty acid	before soaking	after soaking
Myristic C14:0	0.222	0.241
Palmitic 16:0	8.001	8.209
Palmitoleic C16:1	0.722	0.481
Stearic C18:0	38.337	36.801
Oleic(w_9) C18:1	45.205	40.546
Linoleic(w_6) C18:2	2.178	2.084
Linolenic(w_3) C18:3	2.778	2.004
Arachidic C20:0	8.890	6.413
Arachidonic C20:1	1.667	1.203
Total saturated %	55.45	53.664
Total unsaturated %	52.550	46.318

The amino acids content of mango seed kernel are demonstrated in table(6).Data in this table showed that valine and leucine achieved higher values compared to the ***FAO/WHO*** reference followed by therionine, lysine and phenylalanine which were somewhat equaled to the reference. On the other hand, arginine and glutamic acids revealed the highest values of all non essential amino acids in MSK content. Meanwhile , both prolin and alanin were relatively closed and histidine, serine, glycine and ammonia contents gave the lowest values.

Table (6): The amino acids contained in mango seed kernel based on dry weight compared to the FAO/WHO reference. .

Essential amino acids	(gm/100g)	FAO/WHO reference (gm/100g)	Non essential amino acids	(gm/100g)
Therionin	3.46	4.00	Histidine	2.19
Cystine	0.08	----	Arginine	14.27
Valine	6.07	4.20	Aspartic	8.66
Methionine	0.38	2.20	Glutamic	15.66
Leucine	5.06	4.80	Seirne	3.94
Isolucine	2.68	4.20	Proline	4.50
Tyrosine	2.74	4.00	Glycine	2.81
Phenylalanine	2.75	2.80	Alanine	4.86
Lysine	3.94	4.20	Amonia	1.07

Table 7 illustrates the loss in moisture during baking and storage ,baking time and shelf- life at both room temperature and the refrigerator(5±1C) These data showed that blending mango seed kernel flour with wheat flour increased baking time and the loss in moisture during baking up to the ratio 25%of MSK, but this loss in moisture decreased during storage at both room temp. and the refrigerator. The same table revealed that the shelf-life has increased in magnitude levels by increasing the incorporated ratio in treatments at both the room temp.(by 20 days) and at the refrigerator (by 39 days). These results may be related to the many inhibitory phenolic compounds contained in this promising by product against microorganisms ***(Beuchat,1994)*** and the antioxidant agents***, Soong et al.,(2004***) who suggested that mango seed kernels could be used as a potential source for functional ingredients due to its high quality of fat and protein as well as high levels of natural antioxidants and antimicrobials. These results agreed with those of Ahmed et al.,(2007) who found that MSK contained 112 mg total polyphenols per 100g dry seed kernel powder .

Table (7): Effect of blending mango seed kernel flour with wheat flour on baking time , loss in moisture during baking and storage and shelf-life at room temp. and the refrigerator.

Variables / Treatments	Loss in moisture during baking	Loss in moisture during storage		Baking time in min.	Shelf- life in days	
		Room temp.	Refrigerator		Room temp.	Refrigerator
100% wheat flour (control)	13.57	0.120	0.090	4.830	5.0	10.0
5% MSK	14.33	0.10	0.080	5.00	9.00	14.00
10% MSK	14.83	0.093	0.080	5.33	14.00	25.00
15% MSK	14.97	0.095	0.075	5.50	19.00	35.00
20% MSK	15.33	0.087	0.067	5.67	21.00	42.00
25% MSK	15.67	0.075	0.058	5.67	25.00	49.00

Data in table 8 reveal the score of sensory evaluation of the produced pizza base loaf made by blending mango seed kernel flour at levels of 5,10,15, 20 and 25% (w/w) with wheat flour. The resultant data appeared that chewing, crust character, crumb color and grain and texture have improved at levels of 5and 10% treatments compared to the control, at the same time , there was graduate drop in the score of the appearance, crust character, the crumb color and grain & texture at the levels of 15and 20but they were acceptance in both flavor and chewing. On the other hand, the

treatment 25% replacement had the lowest score for all parameters. The addition of mango seed kernel flour up to 15% did not affect on eating quality characters. This result was in agreement with the investigation of ***El-Soukkary et al.,(2000).***

Table (8): Effect of blending mango seed kernel flour with wheat flour on the sensory evaluation of pizza base loaf.

Variables Treatments	Eating quality		Appearance	Crust character	Crumb color	Grain & texture
	Flavor	Chewing				
100% wheat flour control)	9.00	8.16	8.33	8.50	8.67	8.00
5% MSK	8.67	8.83	9.00	8.67	8.33	8.33
10% MSK	8.67	8.50	8.00	7.50	7.00	7.33
15% MSK	8.00	8.00	7.33	6.67	6.50	6.33
20% MSK	7.00	7.33	6.50	6.50	5.53	5.50
25% MSK	6.16	5.50	6.00	5.00	5.33	5.83

Control

5% replacement

5% replacement

15% replacement

20 replacement

25% replacement

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دراسات كيماوية وتكنولوجية على استخدام لب بذور المانجو في تحسين الخواص الحسية وقوة حفظ إحدى منتجات المخابز

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اهتمت هذه الدراسة بدراسة التركيب الكيماوي للب بذور المانجو كأحد مخلفات مصانع ومحلات العصائر ، وذلك بالنسبة للعناصر الكبرى وبعض العناصر الصغرى (الريبوفلافين- الكاروتينات- الكالسيوم –البوتاسيوم- الحديد والزنك) وعلى الجانب الآخر فقد تم تقدير بعض المواد المضادة للتغذية كالتانينات وحمض الفايتيك كما تم تقدير محتوى الأحماض الأمينية الأساسية والغير أساسية والأحماض الدهنية المشبعة والغير مشبعة ومجموعة الأوميجا.

أسفرت النتائج المتحصل عليها من هذه التحاليل. ارتفاع محتوى البذور من البروتين الخام والدهن والألياف والرماد مقارنة بدقيق القمح استخلاص ٧٢٪. ارتفع أيضا محتوى البذور من البيتا كاروتين و كان لعملية النقع تأثير خافض لمحتوى البذور من المواد المسببة للمرارة والتانينات والمواد المضادة للتغذية. أظهرت نتائج تفريد الأحماض الدهنية ارتفاع محتوى البذور من مجموعة أحماض الأوميجا وكان حمض الاستياريك أكثر الأحماض المشبعة وجودا، وحقق حمض الأوليك أعلى نسبة بين مجموعة الأحماض الغير مشبعة. كما أدت عملية نقع البذور إلى خفض هذا المحتوى قليلا.

أظهرت نتائج التحليل الكيماوي أيضا لمحتوى البروتين من الأحماض الأمينية زيادة محتوى البذور في حمض الفالين والليوسين على نظيرهما في مرجع FAO/WHO وتساوت تقريبا في حمض الليسين. أما على مستوى الأحماض الأمينية الغير أساسية فقد تفوق الأرجنين وحمض الجلوتاميك وكذلك حمض الأسبارتيك على الأحماض الأخرى.

وعلى الجانب التصنيعي فقد استخدم مطحون لب البذور في تصنيع رغيف البيتزا بنسب استبدال٥ ، ١٠، ١٥، ٢٠، ٢٥٪ بالوزن مع دقيق القمح استخلاص ٧٢٪ المستخدم في التصنيع. هذا وقد أوضحت نتائج التحليل الفيزوكيميائى والحسي للمنتج الخواص الآتية:

١- ارتفاع معدل الفقد في الرطوبة أثناء عملية الخبيز وانخفاض هذا الفقد أثناء التخزين سواء على درجة حرارة الغرفة ام على درجة الثلاجة بزيادة معدل الاستبدال حتى نسبة ٢٥٪ ، زاد كذلك الوقت اللازم للخبيز.أوضحت النتائج أيضا زيادة فترة الحفظ للمنتج بزيادة معدل

الاستبدال زيادة ملحوظة على درجة الغرفة وزيادة كبيرة على درجة الثلاجة بما يعادل ٢٠ ، ٣٩ يوم على الترتيب.

٢- أوضح أيضا التحكيم الحسي للمنتج تفوق درجات تحكيم خاصية المضغ والشكل الظاهري والتركيب الداخلي حتى نسبة استبدال ١٠٪ بالمقارنة بالكنترول. أما درجات قبول الطعم والمضغ فقد قاربت درجات الكنترول حتى نسبة ١٥٪ . وانخفض تحكيم الثوابت الأخرى تدريجيا بزيادة نسبة الاستبدال حتى نسبة ٢٠٪ ولكنها كانت مقبولة.

من ذلك نرى أنه يمكن استبدال دقيق القمح بمطحون لب بذرة المانجو حتى نسبة استبدال ٢٠٪ دون التأثير على الخواص الحسية للمنتج.