J. Agric. Sci. Mansoura Univ., 34 (10):9979 - 9985, 2009

STUDIES ON TIGER NUT AND IT'S PRODUCTS

El Tellawy, F. M. * ; Mona N. Zake * ; A. M. Korshed ** ; M. F. Hessin* and Areeg S. A. Salem*****

*** Faculty of Specific Education, Ain Shames Univ.**

**** Food Technol. Research Institute, Agric res. Center, Gize**

***** Faculty of Specific Education, Minia Uviv.**

ABSTRACT

The study aimed to know the nutritional value of defatted tiger nut flour and tiger nut oil . Also, use tiger nut flour in cake and biscuit and analysis oil form tiger nut .

The study showed that the defatted tiger nut flour had a relatively good amounts of protein (10.1 %) result to extract fat and decreases in fiber. Good amounts of essential amino acids which indicate the high nutritional value of these flour and the results showed a very good source of Iron.. The fatty acid pattern revealed that the saturated fatty acid content was (19.1%) while the unsaturated fatty acid content was (80.9 %).

Also the wheat flour was replaced by 25 , 50 and 75% of defatted tiger nut flour and effect of this replacement on the gross chemical composition, mineral and amino acid content. The sensory evaluation of cake and biscuit products (all mixtures) were highly acceptable and having good sensory attributes

INTRODUCTION

Tiger nut or Chufa, earth chestnut, earth almond, yellow nut grass, ground almond and rush nut, historically was an important food crop in ancient Egypt and cultivated today in West Africa, Span and China. Currently, in the central and southern United States, chufa is used for. Wildlife habitat improvement, particularly as a winter food source for deer and wild turkeys; Negbi. (1992).

Tiger nut is a very fast growing perennial grass-like plant from the rush family, and is very easily grown in warm climates in moist or wet soils. The small round tubers found along the roots have a slightly almond flavor and are eaten raw or cooked. The plant's tubers contain high levels of protein, carbohydrate and oleic acid, and contain 20 to 28 percent of their mass in the from of a non – drying oil. The oil is obtained by pressing the cleaned tubers, in the same manner as traditional olive-oil extraction. The oil has a mild, pleasant flavor and considered as a food oil to be similar but of superior quality, to olive oil. Mosquera. *et al*. (1996).

In parts of Africa, Europe and Asia, chufa is grown for its edible tubers. The tubers contain protein, carbohydrates, sugars, and lots of oil and fiber. The chufa nut is good for human health, containing high levels of iron and potassium, and no sodium. Lapham, Jon and Drennan (1990).

Even today the Egyptians are cultivating a native species of Cyprus in moist soils or sandy shores for their edible tubers." These are called "tiger nuts" and are first fried, and then soaked in water. The Milky-looking aqueous extract of chufa pleasant and characteristic flavor of vanilla and almonds.' Chufa is potentially a commercial source of high-oleic acid vegetable oil and high-carbohydrate tuber cakes Mosquera *et al*. (1996). Its tubers are also used as aphrodisiac, carminative, diuretic, stimulant and tonic Oladele and

Aina (2007). Moreover, tiger nut has also been reported to be used in the treatment of flatulence, indigestion, diarrhea, dysentery and excessive thirst Chevallier,(1996).

Tiger nuts are regarded as a digestive tonic having a heating and drying effect in digestive system and alleviating flatulence. They also promote urine production. The nuts are said to be stimulant and tonic and also used in the treatment of indigestion, colic diarrhea, dysentery and excessive thirst**.** Belewu and Abodunrin (2006). In addition, tiger nut has been demonstrated to contain higher essential amino acids than those proposed in the protein standard by the FAO/WHO for satisfying adult needs Bosch *et al.* (2005)

The aim of this study was clarified the importance of tiger nut tubers or a rich source for protein , fat , carbohydrate and minerals and the possibility of using it's flour in difference nutrition products.

MATERIALS AND METHODS

Materials:

Fresh samples of tiger nut tubers were purchased from farmer in Rasheed, Egypt .Whereas,Wheat flour (72%), sugar, egg, vanilla, baking powder,milk and shortening were purchased from market in Minia Government.

Methods:

Extraction of oil from tiger nut tubers:

Tiger nut oil was extracted throw the fixed apparatus of extraction of soybean oil used in the Food Technology Research Institute, Agricultural Research Center ,Giza, Egypt as described in the AOCS Official Method (1998).

Fatty acids composition:

Preparation of fatty acid methyl esters .The fatty acids methyl esters were prepared using trans - etherification with cold methanol solution of potassium hydroxide IOOC(2001). Identification of the fatty acids methyl ester was done by using the G.L.C. Gas liquid chromatography (Pye- Unicom. Model 104) equipped with a FID and glass coiled column(2.5 X 4mm)Peaked with 10% PEGA and supported an chromosorb W-AW 100-200 mesh , was used. The samples (1ml) were injected into the column using a Hamilton microsyringe The gas chromatography condition were used for isothermal analysis were : temperature : program 120ºc 240ºc , FID 300ºc and injector 280ºc, flow rate : hydrogen 33 ml/ mm, nitrogen 30ml/ min and air 330ml/ min.

Preparation of blends:

The blends were prepared by adding different levels from defatted tiger nut flour (25, 50 and 75%, respectively) to wheat flour (72% extraction) to give three blends. Whereas, control sample prepared from wheat flour free addition.

Chemical Analysis:

Moisture, protein, fat, ash and fiber contents were determined in tiger nut and wheat flour(72% extraction) and its blends according to the method

described by AOAC. (2006).Whereas, total Carbohydrates were calculated by difference .

Determination of minerals content:

All minerals such as calcium, iron, potassium, sodium and magnesium were determined by the use of atomic absorption spectrophotometer (type unicom- 929) after dry ashing according to the methods of A.O.A.C (2006). While phosphorus was determined after dry ashing by the colorimetric molybdenum blue method using hydroquinone according to Lorenz *et al.* (1980) .

Determination of amino acids:

The amino acids compositions of different samples were determined in amino acid analyzer according to AOAC (2006).

The PER was calculated as the equations described by Alameyer *et al.*(1974) as fallows :

PER = – 0.684 + 0.456 (leucine) − 0.047 (proline)

Biological value was estimated to using the equation following by Oser, (1959).

B.V = 49.9 + 10.53 PER

Preparation of cake and biscuits:

The basic ingredient blends for cake and biscuits are given in Table (1) according to Mizukoshi *et al.* (1979) and Waode(1988).

The cake products were baked at 191 C for 25 min. in an electric oven. Also, the biscuits products were baked at 200 C for 7.0 min and tested by ten panelists according to AACC (1985).The results were statistically analyzed using the method reported by Steel and Torri (1980).

Table(1): The ingredient of cake and biscuits:

Ingredients	Biscuits	Cake
Flour	270	270
sugar	70	150
egg	100	200
butter	200	125
milk	0.0	125
vanilla	1	2
baking powder	5	10

RESULTS AND DISCUSSION

Fatty acids composition of tiger nut oil:

From the results in table(2) it could be observed that, the fatty acids composion of tiger nut oil were palmatic, stearic, oleic, linoleic and linolenic acids had contained 13.9, 5.2, 67.9, 12.3 and 0.7 %, respectively. The presence of high amount of oleic acid means that this oil is highly valuable healthy oil which shows a good potential as a supplement to or substitute for olive oil can be classified in the oleic-linoleic group such as pesnut, sesame, olive, corn, cottonseed and sunflower seed Glew *et al.* (2006).

Table (2) Percent of fatty acids composition of tiger nut oil:

Fatty acids	Tiger nut oil	*Olive oil
Palmatic acid C 16 : 0	13.9	15.75
Stearic acid C 18 : 0	5.2	1.12
Oleic acid C 18 : 1	67.9	69.42
Linoleic acid C 18 : 2	12.3	12.90
Lenolenic acid C 18 : 3	0.7	0.75
TSFA	19.1	16.87
TUFA	80.9	83.13

TSFA Total saturated fatty acid.
TUFA Total unsaturated fatty acid.
***Ibrahim *et al.* (2006)**

Chemical composition of wheat and defatted tiger nut flour and its blends:

The results presented in Table (3) show that the defatted tiger nut flour is a good source of protein (10.10%). Whereas, the blends showed that the fat contents increased by increasing tiger nut flour, while the protein, carbohydrate and fiber contents decreased by increasing tiger nut flour.

The minerals composition in the same table showed that the all minerals had increased with increase the amounts of tiger nut flour in the blends. The highest minerals composition of the blend contained 75% tiger nut flour and 25% wheat flour, it may be the highest minerals content in defatted tiger nut flour and it decreased in wheat flour.

Table (3):Chemical composition and minerals (mg/100g) of defatted tiger nut flour and wheat flour and its blends on dry weight basis.

Analysis	♂Wheat flour	Tiger flour	Blends		
			25	50	75
Protein	11.3	10.10	11.0	10.7	10.4
Fat	1.1	6.18	2.37	3.64	4.91
Fiber	0.45	4.28	1.41	2.37	3.31
Ash	0.56	2.95	1.16	1.76	2.35
Carbohydrate	86.59	76.49	84.0	81.5	79.1
Sodium	6.0	141.7	39.0	73.0	107
Potassium	120.0	1020.	345	57.0	795
Calcium	18.0	120.0	43.0	69.0	94.5
Phosphorus	92.0	320.0	145	206	263
Iron	0.85	9.0	2.9	4.9	7.0
Magnesium	22.0	195.0	65.0	109	152

Amino acids analysis in defatted tiger nut and wheat flour and its blends (g/100g protein):

The amino acids content in defatted tiger nut and wheat flour and its blends are reported in Table (4). The results showed that the major essential amino acids of defatted tiger nut flour were leucine and lysine (7.12 and 6.12%).Also, the major non essential amino aci1ds were glutamic and aspartic acids (16.88 and11.76 %). As well as the results of amino acid in the blends showed that the all essential amino acids increased by increasing tiger nut flour except phenylalanine. Also, it could be seen that the amino

acids, argentine, tyrosine and praline increased by increasing tiger nut flour. While, cystine, histidine, glysine, aianine, glutamic and aspartic acids were decreased by increasing tiger nut flour.

Table (4):Amino acids composition of defatted tiger nut and wheat flour and its blends (g/100 g protein:

Amino acids	Wheat flour	Tiger nut	Blends		
			25	50	75
Isolucine	3.24	3.88	3.40	3.56	3.72
Lucine	5.58	7.12	5.96	6.35	6.73
Lycine	2.85	6.12	3.67	4.48	5.30
Methionine	1.38	1.65	1.45	1.52	1.59
Phyenylalanine	4.88	4.64	4.82	4.76	4.71
Thyronine	2.84	3.71	3.10	3.28	3.49
Tryptophan	1.27	1.32	1.28	1.29	1.31
Valine	4.15	4.47	4.23	4.31	4.39
Total A.A.	26.19	32.91	27.91	29.55	31.23
Cystine	1.77	1.67	1.75	1.72	1.70
Argenine	4.41	10.76	6.00	7.85	9.17
Histidine	2.62	2.41	2.57	2.51	2.46
Tyrosine	2.65	2.94	2.72	2.79	2.87
Serine	4.36	4.76	4.46	4.56	4.66
Glutamic	25.62	16.88	23.44	21.25	19.02
Aspartic	15.71	11.76	14.72	13.74	12.75
Glysine	4.79	4.18	4.64	4.49	4.33
Alanine	4.92	4.53	4.82	4.73	4.63
Proline	1.43	4.53	2.21	2.98	3.76
Total N.E.A.A.	68.28	62.86	67.33	66.62	65.40

Biological value (B.V) and protein efficiency ratio (P.E.R) of blends from defatted tiger nut and wheat flour:

The data reported in Table (5) indicated that the best biological value and protein efficiency ratio in the blend 75% defatted tiger nut flour (73.17 and 2.21, respectively). This means the biological value and protein ratio increased by increasing tiger nut flour.

Table (5): Biological value (B.V) and protein efficiency ratio (P.E.R) of defatted tiger nut and wheat flour and its blends:

Samples	B.V.	P.E.R.
Wheat flour	68.80	1.79
Tiger nut flour	74.64	2.53
25%	70.20	1.93
50%	71.70	2.07
75%	73.17	2.21

Sensory evaluation of cake and biscuits produced from defatted tiger nut and wheat flour:

From the data presented in tables (6and 7) it has been showed that the sensory evaluation of the cake and biscuits mad from defatted tiger nut and wheat flour at different ratios (25, 50 and 75%). The cake and biscuits had the highest score of the sensory evaluation parameters at levels 25 and 50% and exhibited the highest acceptability compared with the same products at levels 75%.

From the aforementioned results, it could be suggested that the blends made from 25 and 50% defatted tiger nut flour had significant improvement of cake and biscuits characteristics

Table (6): Sensory evaluation of the cake produced from tiger nut and wheat flour:

Characters	Control	Blends		
		25%	50%	75%
Color	8.8 ± 0.43	5.8 ± 0.64	8.1 ±0.52	7.7±0.47
Taste	8.7 ± 0.54	8.7 ± 0.67	8.4 ± 0.77	8.0 ±0.58
Texture	8.7 ± 0.48	8.6 ± 0.63	8.3 ± 0.64	8.0 ± 0.68
Odor	8.4± 0.68	8.8 ± 0.53	8.8 ± 0.47	8.6± 0.52
Overall	8.7 ± 0.68	8.8± 0.49	8.5 ± 0.41	8.3 ± 0.48

Control mad from wheat flour 72% extraction.

Table (7): Sensory evaluation of the biscuits produced from tiger nut and wheat flour:

Characters	Control	Blends		
		25 %	50 %	75%
Color	8.7± 0.42	8.6 ± 0.39	8.1± 0.34	7.6±0.54
Taste	8.7 ± 0.65	8.4 ± 0.51	8.2±0.35	7.6 ±0.43
Texture	8.5 ± 0.45	8.7 ± 0.54	^.4±0.61	8.1±0.56
Odor	8.6 ± 0.46	8.5 ± 0.44	8.1±0.44	7.7±0.36
Overall	8.4 ± 0.34	8.3 ± 0.41	8.3±0.54	7.9±0.58

REFERENCES

Alsmeyer R.R. , Cunnigham and Happich M.T. (1974) Equations predict PER from amino acid analysis. Food Tech , 28 (7) 34:40 .

A.O.A.C. (2006). Association of Official Agricultural Chemists official Methods vol. 1 edition 18 th by the A.O.A.C., Washington DC.

AOCS (1998) .American Oil Chemists Society , Official and Tentative Methods of the American Oil Chemists Society, 35 East Waker Drive, Chicago, Illinois , USA.

Belewu M.A. and Abodunrin O.A. (2006).Preparation of Kunnu from Unexploited Rich Food Source Tiger Nut (Cyperus esculentus) , University of Ilorin ; Nigeria World Journal of Dairy & Food Sciences 1 (1): 19-21,

Bosch L, Alegria A, Farre R (2005). RP-HPLC Determination of tigernut and Orgeat amino acid contents, University of Valencia, Spain ,Food Science . Technology International . 11(1): 33-40.

Chevallier A (1996). The Encyclopedia of medicinal plants. Dorling Kindersley. London. ISBN. 9: 980751-303148.

Glew R.H., R.S. Glew, L.T. Chuang , Y.S. Huang, M. Millson , D. Constans and D.J. Vanderjagt,(2006). Amino Acid, Mineral and Fatty Acid Content of Pumpkin Seeds (Cucurbita spp) and Cyperus esculentus Nuts in the Republic of Niger.

Ibrahim ,A.A.; Laila D. El-Mahdy and Nahed M .M. Atta (2006) .Effect of Different Malaxation Times and Temperatures on the Efficiency of Extraction and Quality of olive oil , Food Tech. Res. Inst., ARE, Egypt, J., Agric. Res., 84 (2) , 523:537

IOOC (2001). Method of Analysis of the International Olive Oil Council preparation of the fatty acid methyl esters from olive oil and olive-pomace oil . col/T, 20 Doc No.24.

Lapham, Jon and D.S.H.Drennan (1990The fate of Yellow Nutsedge (Cyperus esculentus) Seed and Seedlings in soil . Weed sci. 38: 125-128.

Lorenz L. , Weelon D. ana Wolb T. (1980). Natural levels of nutrients in commercially mild wheat flour mineral analysis . Cereal Chem . 2:57-65 .

Mizukoshi, M., T. Kawada and N. Matsui (1979). Model studies of cake baking. 1: continuous observations of starch gelatinization and protein coagulation during baking. Cereal Cheam., 56 (4) 305.

Mosquera, L. A., C. A. Sims, R. P. Bates, and S. F.Okeefe.(1996) . Flavor and Stability of "Horchata De Chufas". journal of Food Science. 61: 856-861.

Negbi, Moshe.(19 92) . A Sweetmeat Plant, a Perfume Plant and Their Weedy Relative A Chapter in The History Of *Cyperus esculentus* L. and *C. rotundus* L. Econ. Bot. 46: 64-71

Oladele AK, K Aina JO (2007). Chemical composition and functional properties of flour from two varieties of tigernut (*Cyperus esculentus*). Afr. J. Biotechnol. 6(21): 2473-2476.

Oser, B.L. (1959). An integrated essential amino acid index for predicting the biological values of protein . In Albonese , A.A. (Ed) “Protein and amino acid nutrition “Academic Press , New York .

Steel. R.G. and Torri, J.H. (1980) ,Principal and Procedures of Statistical Biochemical Approach. McGraw Hill Book Company 2nd Ed.

Waode, P. (1988). Biscuits cookies and creakers. Vol. 1. Applied Sci. Publishers Itd, London, U K.

دراسات عن حب العزيز ومنتجاته

فاروق محمد التلاوى * ، منى نبية زكى * ، أحمد محمود خورشيد، محمود فرحان حسين*** و أريج سلامة على سالم *****

*** كلية التربية النوعية- جامعة عين شمس**

**** معهد بحوث تكنولوجيا الاغذية-مركز البحوث الزراعية- جيزه**

*****كلية التربية النوعية- جامعة المنيا**

تهدف الدراسة إلى معرفة القيمة الغذائية لدقيق حب العزيز قليل الدهن والزيت المستخرج من درنات حب العزيز, واستخدام دقيق حب العزيز قليل الدهن فى إنتاج كيك وبسكويت وتحليل الزيت.

أظهرت الدراسة احتواء دقيق حب العزيز قليل الدهن على نسبة جيدة من البروتين (١٠,١%) " وذلك نتيجة لاستخراج الزيت وجود كميات جيدة من الأحماض الأمينية الضرورية التى تشير الى القيمة الغذائية العالية لدقيق حب العزيز قليل الدهن.. كما أظهرت النتائج أن محتوى الأحماض الدهنية المشبعة كان (١٩,١ %) بينما محتوى الأحماض الدهنية غير المشبعة كان (٨٠,٩ %).

أظهرت النتائج أيضا أن الدقيق مصدر ممتاز للحديد (٩٠ %). وكذلك تم استبدال دقيق القمح بنسب ٢٥, ٥٠ ,٧٥ % بدقيق حب العزيز قليل الدهن وتأثير هذا التبديل على التركيب الكيميائى والمعادن والأحماض الأمينية. التقييم الحسي لمنتجات الكيك والبسكويت كانت مقبول وذات مواصفات عالية.