J. Agric. Sci. Mansoura Univ., 33 (4): 2693 - 2701, 2008

EVALUATION OF FUNCTIONAL CAKES CONTAINING MARJORAM (*M. hortensis* L.) LEAVES AND BLACK CUMIN (*N. sativa* L.) SEEDS POWDER

El-Soukkary, F. A. H.
Food Sci. Dept., Fac. of Agric., Minia Univ., El-Minia

ABSTRACT

Two potential medical plants were examined of Marjoram (*Majorana hortensis* L. leaves) and black cumin (*Nigella sativa* L. seeds) to determine their suitability for supplementing cakes.

Nutritional bioassay was done to evaluate 1 and 2% of *M hortensis* L. leaves and 1 and 2% of *N sativa* L. seeds powder compared with control in the experimental feeding of albino rats (six weeks age). The results showed that most of supplemented meals kept of their high nutritive values without any harmful effect on rat liver functions. However, 2% of *M hortensis* L. leaves utilized the best values in the nutritive measurements when compared to control and other supplied meals. The sensory evaluation of cakes supplemented with 1 and 2% of *M hortensis* L. leaves and 1 and 2% of *N sativa* L. seeds powder showed that there were no significant ($p \leq 0.05$) differences between control cake and supplemented samples as regard to texture and overall acceptability, except color and taste whereas the control was slightlymore acceptable ($p \leq 0.05$). On the other hand, there were no significant ($p \leq 0.05$) differences between the control and supplemented cakes as regard to protein, crude fiber and carbohydrate, except for 2% of each of *N sativa* L. seeds and *M hortensis* L. leaves which were the highest in total lipids, ash and polyphenol contents. As regard to essential and limiting amino acids, the addition of 1and 2% of each of *M. hortensis* L. leaves and *N sativa* L. seeds powders caused slight reductions in some essential amino acids. On the other hand, the 2% of *M hortensis* L. leaves powder was the best because it hasn't any limiting amino acids.

INTRODUCTION

Cake ingredients and balance of its formula are important in evaluating its final quality.

Supplementation of cake with protein, minerals, vitamins and some edible medical plants are important to overcome the malnutrition and others human diseases particularly in the developing countries (Singh, 1991).

Supplemented sources should not affect cake structure and also able to improve its biological quality (Almana and Mohamed, 1991 and El-Malky and Kerolles, 2000). Latif and Abdel-Naem (2004) supplemented cake with truffle protein which acts as antifungal agent against *R. stolonifer*. Wolever *et al.,* (1992) found that supplementation food with mungbean-starch and wheat germ oil lowered triglycerides and cholesterol in the serum of the experimental animals.

According to Shaker *et al*., (1995) medical plants contain many of the natural bioactive components such as antioxidants which inhibit the formation of free radicals forming during metabolism pathway.

Therefore, the aim of this study was to manufacture supplied cake with different levels of *M. hortensis* L. and *N. sativa* L. The biological effects

of the powders of the leaves of *M. hortensis* L. and seeds of *N. sativa* L. were assayed before using in cake supplementing which was also sensorial and nutritional evaluated.

MATERIALS AND METHODS

Materials:

Wheat flour (72% extraction), whole eggs, skimmed milk powder, corn oil, sugar powder, baking powder and salt were purchased from a local market in El-Minia governorate, Egypt. *Majorana hortensis* L. leaves powder and *Nigella sativa* L. seeds powder were collected from Agricultural Research Center, Giza governorate, Egypt.

Biological evaluation of *M. hortensis* L leaves and *N. sativa* L. seeds:

1- Test animals: Thirty male of albino rats aged 6 weeks with a mean initial weight of 60 ±5g were divided into 5 groups of about equal weight. The rats in each group were hosted individually in metal cages.

2- Control and experimental diets:

The rats were fed for a week as adaptation period on the control diet consisting of 70% corn starch, 10% casein, 10% corn oil, 4.8% cellulose, 1% vitamin mixture, 0.2% choline chloride and 4% salt mixture (Al-Nagdy, *et al,.*1974). After this period, the animals were switched to the experimental diets which contained 1 and 2% of the *M. hortensis* L leaves and *N. sativa* L. seeds instead of such levels of corn starch.

The feeding period on the experimental diets was continued for 21 days. Feed and water were available to the rats during the experiment. At the end of the experimental period, the body weight gain was calculated by difference, the rats were sacrificed after 14 hours of fasting. The blood samples were collected from each sacrificed animals and mixed with heparin as a blood anticoagulant in glass centrifugal tubes, left for 10 min. then centrifuged at 1000 rpm for 20 min. at 4 °C to separate serum from plasma. The obtained serum was kept at -20°C until analysis. The sacrificed rats were dissectioned to get the liver. Weight of liver was recorded.

The protein efficiency ratio (PER) was calculated using the following equation: PER = Weight gain / Protein intake.

The activities of aspartic trans aminase (AST) and alanine trans amine (ALT) of liver were determined according to the method of Reitman and Frankel (1957). Serum cholesterol was conducted according to the method of Allian *et al*., (1974). Triglycerides were measured according to the method described by Fossati and Prencipe (1982). Phospholipids were assayed by the method of Ziversmit and Davis (1950).

Preparation of cake:

Five cakes were prepared according to the method of Hess and Setser (1983), one control, two containing 1 and 2% *M. hortensis* L leaves powder and the last ones having 1 and 2% of *N. sativa* L seeds powder instead of the same ratio of the wheat flour.

Wheat flour, eggs, milk powder, palm shortening, sugar powder, baking powder, salt and water were gradually mixed in a blinder. The resulted

dough was poured into the butter grassed and floured metal pan and backed at 180 °C for 30 min. in a conventional oven. The obtained cakes were allowed to cool to room temperature and wrapped in polyvinyl plastic bags until used.

Sensory evaluation of cakes:

The prepared cakes were presented to 10 judges of the graduate students and staff members in the department of Food Technology, Minia University. Each judge was asked to evaluate the color, taste, texture and overall acceptability of cakes. Sensory quality attributes were evaluated using a 9-point rating scale (Amerine *et al*., 1965).

Chemical analysis:

The crude protein, total lipids, crude fiber and total ash of the prepared cakes were analyzed on dry weight basis according to the method of AOAC (1995). Essential amino acids of cakes were determined after acid hydrolyzing according to the method described by Boulter and Donland (1968). Tryptophan content was conducted according to Blauth *et al*., (1963). Amino acids score was calculated referring to the content of a corresponding provisional amino acid patterns of FAO/WHO (1973).

Statistical analysis:

Data were analyzed by student t-test and one way ANOVA using SPSS package according to SAS (1985). Results were given as mean value of replicates with their standard divisions (SD). Differences were considered significant at $p \leq 0.05$.

RESULTS AND DISCUSSION

1- Biological evaluation of *M. hortensis* L. leaves and *N. sativa* L. seeds powders when added at 1 and 2% levels to the basic rat diet:

Results in Table (1) indicated that increasing the level of the addition of 2% of *M. hortensis* L. leaves and *N. sativa* L. seeds powders caused a significant ($p \leq 0.05$) reduction in both BWG and PER values. This may be due to the less of rat appetite resulting from the changes in the flavor of the basic diet due to such ratio of addition. On the other side, the weight of liver of the different rats groups feeding on different diets was very closed. Also it was cleared from the data in Table (1) that only addition of 1 or 2% of *N. sativa* L. seeds to the basic diet activated from the AST and ALT liver enzymes.

According to Ramadan (2007) Nigella sativa L. seeds and its oils had been shown to be anticancer, anti-diabetic, antiradical, antimicrobial, anti-inflammatory and renal protective. The seeds were also aiding digestion and relieve gases in the stomach and intestines. It has a strong hot peppery taste.

Data in Table (2) showed that addition of 2% *M. hortensis* L. leaves powder to the basic rat diet caused significance ($p \leq 0.05$) reduction in total lipids and total cholesterol of the plasma of the rats. Meanwhile the use of the same level (2%) of *N. sativa* L. seeds powder in rats feeding led to a significance ($p \leq 0.05$) rise in total cholesterol, phospholipids and triglycerides of the rat plasma. Generally similar results were mentioned by Abdel Galil and Latif (2003) for the addition of *N. sativa* L. seeds powder for rat feed.

1-2

2- Evaluation of cakes containing 1 and 2% powders of M. hortensis L. leaves and *N. sativa* L. seeds

1- Sensory properties:

As seen in Table (3) no significant differences (p≤0.05) were observed by panelists between the texture and overall acceptability of cakes free and containing 1 and 2% powder of *M. hortensis* L. leaves and *N. sativa* L. seeds. In the other side, both color and taste of control cake were slightly more acceptable (p≤0.05) by panelists than that containing either 1 or 2% of *M. hortensis* L. leaves and *N. sativa* L. seeds powder. The addition of the previous plant powders caused slight darkening in color and slight change in taste of cake. No significant (p≤0.05) notes in such properties noticed between the addition of two plants at either 1 or 2% level.

2- Proximate composition and polyphenols:

The results in Table (4) showed that there were no significance (p≤ 0.05) differences observed between the control cake and those containing 1 or 2% of *M. hortensis* L. leaves and *N. sativa* L. seeds powders in protein, crude fiber and carbohydrate.

Replacing 2% of wheat flour of cake with 2% of *N. sativa* L. seeds powder caused a significant (p≤ 0.05) rise in total lipids, ash and polyphenol contents of cake. The same observation was noticed for total lipids and polyphenols in cake containing 2% *M. hortensis* L. leaves powder instead of 2% wheat flour. Presence of polyphenols in cakes increased from its storage stability and improved from its resistance to fat oxidation. In the other hand, may affect the color and taste of cake.

Similar results were reported for cakes containing *N. sativa* L. seeds reported by El-Malky and Kerolles (2000) and Abdel-Galil and Latif (2003).

According to El-Sayed *et al*., (1998) polyphenols play an important role as anti-oxidant.

3- Essential and limiting amino acids:

Data in Table (5) showed that addition of 1 or 2% powders of *M. hortensis* L. leaves and *N. sativa* L. seeds caused a slight reduction in lysine, leucine, isolucine, tyrosine and phenyalanine and rise in in threonine of cakes.

The sulphur containing amino acids were the limiting amino acids in control and these containing 1 and 2% *N. sativa* L. seeds powder. Meanwhile cake containing 1% *M. hortensis* L. leaves powder had a leucine as a limiting amino acid. The rise of the addition of such leaves powder to 2% gave cake free from any limiting amino acids. This effect was previously pointed by Hassan and El-Shewey (1999) and Abdel Naem *et al*., (2003) for other food containing such leaves.

3-4

Table (5): Essential and limiting amino acids of cakes

Essential amino acids (g/100 g protein)	Control	Cakes containing				Provisional pattern of amino acids*
		M. hortensis L.		*N. sativa* L.		
		(1%)	(2%)	(1%)	(2%)	
A- Essential AA						
Lysine	6.3	5.9	5.7	5.9	5.6	5.50
Leucine	7.1	6.6	7.0	7.0	7.0	7.00
Isolucine	4.3	4.1	4.0	4.2	4.1	4.00
Methionine	2.2	2.2	2.4	1.9	2.1	3.50
Cysteine	1.1	1.30	1.2	1.3	1.2	
Threonine	4.1	4.8	4.6	4.6	4.5	4.00
Tyrosine	5.1	5.0	4.6	4.5	4.4	6.00
Phenylalanine	2.5	2.1	1.9	2.0	1.9	
Valine	5.8	5.9	5.6	5.4	5.2	5.00
Tryptophan	1.0	1.00	1.1	1.1	1.00	1.00
B- Limiting AA						
First	S.A.A.**	Leucine	-	S.A.A.	S.A.A.	-
Second	-	-	-	-	-	-

***FAO (1973)**
****Sulfur containing amino acids**

Conclusion

Generally it can be concluded that supplied cakes with 2% of *M. hortensis* L. leaves powder was the best supplementation to manufactured cake because this treatment improved some physiological qualities such as lowering lipids and cholesterol in the serum of the experimental animals and kept the nutritive qualities of the supplemented cake. Generally, the addition of proposed medical plants powder to manufactured cake gave higher nutritive quality and good acceptability of these cakes.

REFERENCES

Abd El Galil, M. and Latif, S. (2003). Nigella sativa seeds as a potential food additive source. J. Agric. Sci. Mansoura Univ., 28 (7): 5803-5814.

Abd El Naem, G., Kerolles, S., Kenawi, M. and El Sayed, M. M. (2003). Bioevaluation of supplied animal and plant protein sources in some human food mixtures. J. Environ. Sci., 26 (2): 319.

Allian, C.; Poon, L. Chan, C. Fu, P. and Paul, C. (1974). Enzymatic determination of total serum cholesterol. Clin. Chem., 20: 470.

Almana, H. and Mohamed, R. (1991). Effect of date syrup on starch gentimization and quality of layer cakes and cereal foods. Amer. Assoc. of Cereal Chemistry, 36: 12.

Al-Nagdy, S., Granhari, A., El-Sabbagh, M. and Eisa, A. (1974). Biochem. Physiol., 47, 843.

Amerine, A.A., Sangborn, R.M. and Rossler, E.B. (1965). Principles of sensory evaluation of food. Academic Press, New York, NY.

AOAC (1995). Official Methods of Analysis of the Association of Official Analytical Chemists., Sixteen Edition. Official of Analytical Chemists International, USA.

Blauth, O., Choreinski, M. and Herbee, H. (1963). A new rapid method for determining tryptophan. Anal. Biochem., 8: 69.

Boulter, D. and Donland, M. (1968). An investigation to automatic amino acid analyzer with plant extracts. Technician Instrument Company Limited, England, p.931.

El-Malky, W. and Kerolles, S. (2000). Chemical and biological studies on *N. sativa* L. seeds and its defatted meal cake. J. Agric. Sci. Mansoura Univ., 25 (7): 4693.

El-Sayed, M. M., Faraghaly, M. and El-Sherref, S. (1998). Effect of inoculation combined with micronutrients on some chemical constituents of soyabean. J. Agric. Sci. Mansoura Univ., 23 (9): 4117-4127.

FAO/WHO (1973). Food and Agricultural Organization, Nutritional Meeting Report No. 52, Energy and protein requirements. World health Organization, Technical Report Survey, No., 522.

Fossati, P. and Prencipe, L. (1982). Serum triglycerides determined coloremetrically with an enzyme that product H_2O_2. Clin. Chem., 28: 2077.

Hassan, F. and El-Shewey, M. (1999). Effect of an enhanced mixed diet of mungbean and wheat flour protein on male albino rats. Egyptian J. of Nutr., 14 (1): 41-58.

Hess, D. and Setser, C. (1983). Alternative system for sweeting layer cakes using aspartame with and without fructose. Cereal Chemistry, 60 (5): 337.

Latif, S. and Abd El-Naem, G. (2004). Biochemical and nutritional evaluation of supplemented cakes with truffle protein. Minia J. of Agric. Res. and Develop., 24 (1): 139-156.

Mitsuda, H., Yasumoto, K. and Iwami, K. (1966). Antioxidative action of indole components during the autoxidation of linoleic acid. Eiyoto Shohuryo, 19: 210.

Osawa, T. and Namiki, M. (1981). A novel type antioxidant isolated from leaf wax of eucalyptus leaves. Agric. Biot. Chem., 45: 735.

Ramadan, M.F. (2007). Nutritional value, functional properties and nutraceutical applications of black cumin (Nigella sativa L.); An overview. International J. of Food Science and Technology, 42, 1208-1218.

Reitman, S. and Frankel, S. (1957). A colorimetric method for the determination of serum glutamate oxal acetic acid and pyruvic acid transaminases. American J. Clin. Pathol., 28: 56-63.

SAS (1985). SAS User Guide: Statistics version 5 ed. SAS Institute Inc., Cary, Nc.

Shaker, E., Ghazy, M. and Shibamoto, T. (1995). Antioxidative activity of volatile browning reaction products and related compounds in a hexane/ hexanoic system. J. Agric. Food Chem., 43: 1017.

Singh, U. (1991). The role of Pigeon pea in human nutrition in uses of tropical grain legumes. Statistical Package for the Social Science (1990). Spss. Inc. Chicago, 11.

Wolever, T., Jenkins, D. and Vuksan, V. (1992). Beneficial effects of two glycemic index diet in over high NIDDM subjects. Diabetes Care, 15:562-564.

Ziversmit, D. and Davis, A. (1950). Micro determination of plasma phospholipids by trichloroacetic acid precipitation. J. Lab. Clin. Med., 35: 155-160.

تقييم الكيك الوظيفى المحتوى على مطحون اوراق البردقوش (*Majorana hortensis* L.) ومطحون بذور حبة البركة (*Nigella sativa* L.)

فوزى على حسن السكرى

قسم علوم ألأغذية, كلية الزراعة, جامعة المنيا

تم أختبار أثنان من النباتات الطبية الفعالة اوراق نبات البردقوش (*Majorana hortensis* L.) وبذور حبة البركة (*Nigella sativa* L) لتقييم ملأئمتها لتدعيم الكيك. تم عمل أختبار تغذوى لتقييم ١ و٢% من مطحون اواق البردقوش (*M. hortensis* L.) و١ و٢% من مطحون بذور حبة البركة (*Nigella sativa* L.)، بالمقارنة مع الكنترول فى تجربة التغذية على فئران التجارب (عمر ستة أسابيع).

ولقد بينت النتأئج أن أغلب الوجبات المدعمة كان لها قيم تغذوية مرتفعة، بدون اى تأثيرات ضارة على وظأئف كبد فئران التجارب.

مهما يكن، أفادت أضافة ٢% من مطحون اوراق البردقوش (*M. hortensis* L) فى أعطاء القيم الأفضل بالنسبة للقياسات التغذوية، بالمقارنة بالكنترول والوجبات المدعمة الأخرى.

ولقد أظهر التقييم الحسى للكيك المدعم ب ١ و٢% من مطحون اواق البردقوش (*M. hortensis* L.) و١ و٢% من مطحون بذور حبة البركة (*N. sativa* L.) أنة لا يوجد فروق معنوية عند مستوى معنوية ٥% بين كيك الكنترول والعينات المدعمة بالنسبة الى القوام والقابلية الكلية، فيما عدا اللون والطعم حيث كان الكنترول اكثر قابلية عند مستوى معنوية ٥%. على الجانب الأخر، كان لا يوجد فروق معنوية عند مستوى ٥% بين الكنترول والكيكات المدعمة بالنسبة للبروتين، الألياف الخام والكربوهيدرات، فيما عدا ٢% من كل من بذور حبة البركة (*N. sativa* L.) واوراق البردقوش (*M. hortensis* L.) الذين كانت لهم القيم الأعلى من الدهون الكلية، الرماد ومحتوى البولى فينولات.

بالنسبة للاحماض الأمينية الأساسية والمحددة للقيمة الغذأئية، فقد وجد أن أضافة ١ و٢% من كل من مطحون اواق البردقوش (*M. hortensis* L.) ومطحون بذور حبة البركة (*N. sativa* L.) سبب تناقصات قليلة بالنسبة لبعض الأحماض الأمينية الأساسية. على الجانب الأخر، ٢% مطحون اوراق البردقوش كان الأفضل بسبب انة كان لا يحتوى اى أحماض أمينية محددة للقيمة الغذأئية.

Table (1): Effect of adding powder of *M. hortensis* L. leaves and *N. sativa* L. seeds to the rat basic diet on the body weight gain (BWG), PER, liver weight and some liver enzyme activity of rats*

Rat diets	Level of added powder	BWG (g)	PER %	Liver weight (g)	Activity of	
					AST (IU/L)	ALT (IU/L)
1-Basic or control	-	51.2±0.11a	1.97±0.05a	5.19±0.12a	٧1.3±0.02a	٢٥.9±0.02a
2- Basic containing						
M. hortensis L.	1%	48.9±0.10ab	1.93±0.0ab	5.15±0.15a	٧1.5±0.03a	٢٦.0±0.025a
leaves powder	2%	45.1±0.025b	1.74±0.02c	5.16±0.13a	٧1.3±0.015a	٢٥.9±0.10a
3-Basic containing						
N. sativa L.	1%	47.1±0.09ab	1.91±0.05ab	5.17±0.25a	٧2.4±0.0b	٢٦.8±0.05b
seeds powder	2%	45.7±0.30b	1.83±0.15b	5.18±0.30a	٧2.9±0.015bc	27.2±0.01c

***Mean values of six replicates ±SD, a, b, c and d indicated significant differences at p≤ 0.05.**

Table (2): Effect of adding powder of *M. hortensis* L. leaves and *N. sativa* L. seeds to the rat diet on the lipids profile of rats *

Rat diets	Level of added powder	Total lipids g/dL.	Total cholesterol M mol/L.	Phospholipids M mol/L.	Triglycerides M mol/L.
1-Basic or control	-	4.90± 0.11ab	1.70± 0.03 b	1.10± 0.0a	0.90±0.0a
2- Basic containing					
M. hortensis L.	1%	4.90± 0.09 ab	1.60± 0.05 b	1.10± 0.10a	0.80±0.0a
leaves powder	2%	4.20± 0.0 a	1.20± 0.02a	1.20± 0.15ab	0.80±0.02a
3-Basic containing					
N. sativa L.	1%	4.90± 0.10 ab	1.60± 0.0b	1.30± 0.15b	1.10±0.025b
seeds powder	2%	5.00± 0.32 ab	1.80± 0.10c	1.40± 0.0c	1.30±0.015c

***Means of six replicates± SD, a, b and c indicated significant differences at p≤ 0.05.**

Table (3): Sensory properties of cakes*

Cake	Level of added powder	Color	Texture	Taste	Overall acceptability
Control	-	8.80a	7.80a	8.20a	7.90a
Containing *M. hortensis* L. leaves powder	1%	8.20ab	7.50a	7.30b	7.60a
	2%	8.35ab	7.30a	7.10b	7.30a
Containing *N. sativa* L. seeds powder	1%	8.30ab	7.60a	7.30b	7.60a
	2%	8.25ab	7.20a	7.10b	7.30a
LSD		0.62	0.64	0.42	0.60

***Means in the same column with different letters are significantly different (p≤ 0.05).**

Table (4): Proximate composition and polyphenols of cakes *

Constituents** %	Control	M. hortensis L. leaves		*N. sativa* L. seeds	
		1%	2%	1%	2%
Crude protein	18.04±0.21a	17.21±0.20a	17.60±0.11a	16.95±0.15a	16.43±0.11a
Total lipids	6.64±0.11a	6.11±0.05a	7.10±0.11ab	6.33±0.10a	7.33±0.12bc
Crude fiber	1.95±0.0a	1.00±0.01a	1.92±0.05a	1.81±0.3a	2.02±0.0a
Total ash	2.80±0.05a	2.04±0.01a	2.12±0.10a	2.71±0.10a	3.34±0.21b
Carbohydrate	62.91±0.33a	64.00±0.0a	62.19±0.3a	63.43±0.1a	62.51±0.3a
Polyphenols	0.78±0.0a	0.68±0.0a	0.86±0.02b	0.81±0.03a	1.0±0.0bc

***Mean values of three replicates ±SD, a, b, c had significant differences at p≤ 0.05.**
****On dry weight basis**