J. Agric. Sci. Mansoura Univ., 27(1): 405 - 415, 2002.

PREPARING AND EVALUATING AKARA MADE FROM COWPEA PASTE FORTIFIED WITH BLACK CUMIN AS A NON-CONVENTIONAL MEAL

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ABSTRACT

Akara is a popular meal for Western Africans, which is produced from cowpea paste, then fried in deep oil, similarly like falafel meal " a faba bean product well known in Egypt and some Arab countries". The study was conducted to investigate the using of cowpea paste with added black cumin (*Nigella sativa* L.) as a non-conventional spice for Akara meal. Chemical analysis (moisture, crude protein, crude ether extract, crude fiber, ash, carbohydrate, minerals and amino acids) was determined for the black cumin, raw cowpea and Akara. Fried Akara was evaluated organoleptically as a new product for a group of Egyptian panelists.

The results indicated that, cowpea seeds were characterized by a high crude protein content (28.68 %) and low crude ether extract (1.79 %), whereas the black cumin was superior in both of the crude ether extracts and the crude fiber content being 26.31 % and 10.18 %, respectively. The black cumin's minerals content was considerably high in calcium (245.25 mg/100g), where cowpea was (121.7 mg/100g). The essential amino acids except sulfur amino acids in cowpea and black cumin were equal to or higher than the FAO/WHO provisional pattern. Akara products were high in protein and fiber contents, but low in ether extract compared to falafel. It considered as a good source of minerals and essential amino acids. Akara with added black cumin gained the highest organoleptic scores as compared with control Akara and falafel. Akara prepared with added black cumin is suggested as a new product to be introduced to Egyptian families.

Keywords: Akara, cowpea, black cumin, chemical composition, amino acids, minerals, sensory evaluation

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is one of the most ancient human food sources and has probably been used as a crop plant since Neolithic times (Summerfield *et al*., 1974).). It is very palatable, highly nutritious and relatively free of metabolites or other toxins (Kay, 1979; Quass, 1996). Cowpea or black eye peas are usually prepared for consumption all over the world by boiling seeds in water after being soaked in water for few hours. They are eaten as a fresh vegetable during the harvest season and canned or dried for use all over the year.

Akara is a popular African dish made by deep-frying cowpea paste flavored with onion, pepper, and salt. Enwere, *et al.* (1998). It is prepared at homes and by the street vendors in the marketplace as a breakfast or snack food. At present this product (Akara) is unfamiliar and unknown to the Egyptians, though, compared with falafel, there is no appreciable difference in shape and the cooking method. McWatters and Flora (1980), reported that, The processing of the paste from cowpea to make Akara meal will reduce the preparation time and effort, and it can be prepared with equipment which is readily available in home and institutions.

Falafel (Taamia) is one of the most popular foods consumed by the majority of the population in Egypt (Hussein, 1983), which is mainly made from Faba Bean. Hussein, (1982) and Griffiths, (1984) reported that Faba Bean contains numbers of anti-nutritional factors such as trypsin inhibitors, vicine and convicine. Vicine and convicine are implicated as the responsible factors in faba beans for an acute hemolytic disease (Favism) that affects certain susceptible individuals following ingestion of the bean. According to Sosulski and McCurdy (1987), vicine and convicine appear to be associated only with faba beans and are not present in other common legumes.

Black cumin (*Nigella sativa* L.) is used commonly for many medicinal purposes whether as seeds or oil. The *Nigella* seeds possess a high nutritive value and it contains also a crystalline compound named Nigellone, which has protective action against many diseases. Moreover, oleic and linoleic acids are the major fatty acids in Nigella sativa oil (Abdel Aal and Attia, 1993a). Therefore, the present study was conducted aiming to use cowpea and black cumin as a non-conventional source of Akara meal as a product similar to falafel. Moreover, chemical composition, nutritive value and organoleptic properties of the Akara product were considered.

MATERIALS AND METHODS

Materials:

New strain of cowpea seeds (*Vigna unguiculata* L.) known as cream 7 was obtained from the selected program, Hassan (1996). The dry seeds were packed at harvest time, sorted to remove stones and other impurities, and kept in airtight containers at 4ºC, until used. The black cumin (*Nigella sative* L.) was purchased from a retail market in Alexandria, Egypt. The seeds were cleaned and ground to pass through a 40-mesh screen.

Methods:

Preparation of Akara:

The method adapted for Akara preparation as used in Nigeria as a traditional food (Fig 1) according to McWatters and Flora (1980), was followed with slight modification with adding black cumin according to Nasr El-din, (1999), at level of 1 %. Table (1). Illustrates the ingredients of Akara meal.

Table (1): The ingredients used for Akara preparation

Ingredient	Akara	
	Control	Experimental
Cowpea	110 g	110 g
Water	79 ml	79 ml
Onion	18 g	18 g
Green pepper	18 g	18 g
Salt	4 g	4 g
Corn starch	2.3 g	2.3 g
Black cumin	--	1.1 g

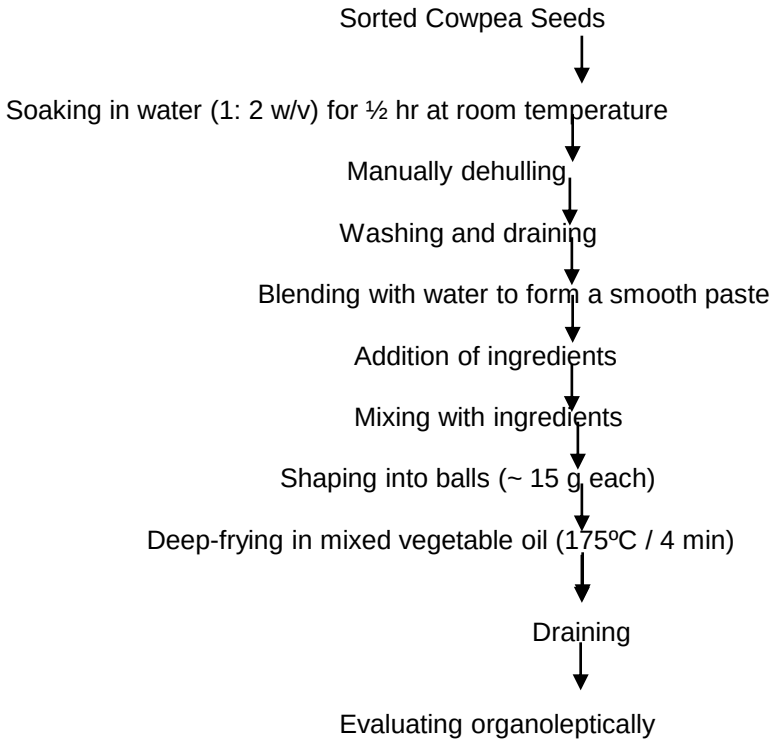

Fig (1): Flow sheet for the preparation of Akara product

Chemical composition:

Moisture, crude protein, crude ether extract, crude fiber and ash content were determined according to A.O.A.C. (1995). Minerals content (Ca, K, Na, Mg, Fe, Cu, Zn and Mn) were determined using the Atomic Absorption Spectrophotometer (Shimadzu AA- 6650). Amino acids were determined after acids hydrolysis according to the method of Moore *et al*, (1958), using a Beckman Amino Acid Analyzer (Model 119 CL).

Sensory evaluation:

Twenty-five Panelists were asked to rank the samples on a hedonic scale of 1 (very poor) to 10 (excellent) for color, taste, aroma, texture, and overall acceptability of the products as followed by McWatters and Brantley (1982).

Statistical analysis:

Analysis of variance and least significant difference were used for the statistical analysis of data according to Stategraphic program (1987).

RESULTS AND DISCUSSION

The chemical composition:

A) Raw seeds:

Table (2) demonstrates the proximate analysis of raw cowpea seeds as compared to faba bean and black cumin. Cowpea was characterized by a high crude protein content (28.68%) and low crude fiber content (4.0 %) compared to values of (24.1%) and (6.9%), respectively for that of faba bean as reported by The Nutrition Institute of Cairo (1996). Sefa-Dedeh, *et al* (2001), reported that the proximate compositional data for cowpea were: protein (21.1 – 24 %), fat (1.1 – 1.4 %) and ash (3 – 3.5 %) on wet basis. The black cumin was superior in both of the crude ether extract and crude fiber content (26.31%, 10.18%), respectively compared with that of cowpea and faba bean. Abdel-Aal and Attia (1993a) reported that black cumin seeds contain up to 38.7 % crude fat, 21 % crude protein and 13.9 % crude fiber.

Table (2): The Chemical composition of raw seeds of cowpea, faba bean, and black cumin (% on dry weight basis)

Chemical Composition (%)	Cowpea seeds	*Faba bean seeds	Black cumin seeds
Dry matters	85.43 ± 0.31	89.70 ± 0.71	93.56 ± 0.26
Crude Protein	28.68 ± 0.33	24.10 ± 0.41	21.67 ± 0.54
Crude ether extract	1.79 ± 0.24	1.50 ± 0.21	26.31 ± 1.01
Crude Fibers	4.00 ± 0.35	6.90 ± 0.12	10.18 ± 1.01
Total ash	4.19	3.20	5.99

	± 0.39	± 0.32	± 0.19
Carbohydrate**	61.34 ± 0.44	64.30 ± 0.41	35.85 ± 0.37

*** Nutrition Institute of Cairo (1996).**
**** Calculated by difference.**

B) Akara products:

Table (3) shows the chemical composition of the Akara products compared with Falafel as a similar product. The products showed slightly difference between the control and the experimental Akara. Whereas the product characterized with high content of crude protein and crude fiber (28.87% and 5.15%), respectively, and low content of crude ether extract (22.17%) compared with Falafel.

These findings of Akara product were discriminated in their protein, fiber and extracted ether content than reported by Ziena, *et al,* (1988) for falafel product. Moreover, it was reported by McWatters and Flora (1980), that protein and oil contents of Akara product were (18.8 % and 24.5 %), respectively.

Table (3): The chemical composition of Akara products (% on dry weight basis).

Chemical composition(%)	Control Akara	Experimental Akara	*Falafel
Dry matters	55.96 ±0.28	56.42 ±0.31	67.6
Crude Protein	28.68 ±0.19	28.87 ±0.17	17.2
Crude ether extract	21.21 ±0.16	22.17 ±0.14	37.9
Crude Fibers	5.24 ±0.20	5.15 ±0.20	2.2
Total ash	4.82 ±0.18	4.80 ±0.17	3.9
Carbohydrate**	40.05 ±0.21	39.01 ±0.19	38.8

***Nutrition Institute of Cairo (1996).**
**** Calculated by difference**

Minerals contents

A) Raw seeds:

The mineral content of the raw seeds of cowpea, faba bean, and black cumin are given in Table (4). The table showed that the mineral contents of faba bean were remarkably high in most of the minerals contents except potassium (748 mg/100g), which was low, compared to the cowpea content (994.9 mg/100g). Our finding of cowpea is in the range reported by Kay, 1979; Tindall, 1983; Quass, 1995. Concerning black cumin mineral content it was considerably high in calcium content (245.25 mg/100g), regarding cowpea and Faba bean content were (121.7 mg/100g, 220mg/100g), respectively. Similar results of black cumin were reported by Abdel-Aal and Attia (1993a).

Table (4): The mineral composition (mg/100g) of raw seeds of cowpea, faba bean and black cumin

Mineral Content Mg/100g	Cowpea seed	* Faba bean seeds	Black cumin seeds
Ca	121.7	220	245.25
K	994.9	784	159.40
Mg	159.2	281	57.50
Na	23.4	297	27.35
Fe	7.9	6.60	6.20
Mn	1.6	2.30	2.65
Zn	12.5	11.70	7.25
Cu	0.6	2.50	1.00

*** Khalil and Mansour (1995).**

B) Akara products:

As shown in Table (5), the control and experimental Akara products showed closed similarity in mineral contents except in both calcium and magnesium (45 mg/100g and 73mg/100g), respectively. Whereas the contents of experimental product in both calcium and potassium (45mg/100g and 330 mg/100g) showed as twice quantity as Falafel contents (24mg/100g and 158 mg/100g), respectively as it reported by Nutrition Institute of Cairo (1996).

Table (5): The mineral contents (mg/100g) of Akara products

Mineral Content mg/100g	Control Akara	Experimental Akara	* Falafel
Ca	38	45	24
K	321	330	158
Na	619	625	624
Fe	1.5	1.9	1.4
Mn	1.0	1.1	--
Mg	68	73	--
Zn	9.7	9.9	--
Cu	1.5	1.7	--

*** Nutrition Institute of Cairo (1996).**

Amino Acids content

A) Raw seeds:

The results in Table (6) illustrated the amino acids content for cowpea, faba bean and black cumin. Generally, the data showed a noticeable difference in the total amino acid contents between both cowpea and faba bean (40.36 mg/100g, 35.8mg/100g), respectively. Isoleucine and valine contents were higher in cowpea than faba bean, whereas lysine, theronine, and total aromatic amino acids were slightly higher in cowpea than in faba bean. It is worth to mention that the essential amino acids contents were higher in the present results than those reported by Luse, (1979) except for sulfur amino acids. This can be attributed to the selected new strain of

cowpea used in the present work as a replacement for faba bean for making falafel.

The black cumin showed a high level of tyrosine content regarding both cowpea and faba bean. Notwithstanding, the essential amino acids except sulfur amino acids in cowpea and black cumin were equal to or higher than that of the FAO/WHO pattern (1991). The aforementioned data are more or less in accordance with essential amino acids of black cumin as reported by Abdel-Aal and Attia (1993b).

Table (6): Amino acids composition (mg/100g) of raw seeds of cowpea, faba bean, and black cumin compared to FAO/WHO provisional pattern (1991).

Amino Acids	Cowpea	* Faba Bean	Black Cumin	FAO/WHO
Essential Amino Acids				
Lysine	8.06	7.30	5.23	5.50
Methionine	0.86	1.10	1.61	
Cystine	0.11	1.30	0.18	
T. Sulfur AAs	0.96	2.40	1.79	3.60
Theronine	4.40	4.10	4.77	4.00
Isolucine	7.85	3.30	4.83	4.00
Lucine	6.22	7.20	7.30	5.50
Phenylalanine	4.91	4.20	0.91	
Tirosine	3.20	3.60	5.77	
T.Aromatic AAs	8.11	7.80	6.68	6.30
Valine	4.76	3.70	5.89	5.00
Non-Essential Amino Acids				
Aspartic acid	12.12	12.90	9.70	
Serine	5.32	5.80	4.78	
Glutamic acid	13.97	15.80	19.72	
Proline	9.46	4.90	5.86	
Glycine	3.62	4.70	6.11	
Alanine	4.16	5.10	5.61	
Histidine	4.97	3.20	4.06	
Arginine	6.57	10.70	7.47	
TAAs	100.55	98.90	99.80	
TEAAs	40.36	35.80	36.49	

*** Khalil and Mansour (1995).**

B) Akara products:

The data in Table (7) showed the amino acids content of the Akara products compared with the Falafel as a traditional food and FAO/WHO provisional pattern. It is obviously remarked that there were an approximate similarity in amino acid contents in both the control and the experimental Akara. On the other hand, the product made from cowpea and black cumin exhibited much higher contents in most of the essential amino acids compared to Falafel made from faba bean. Whereas the experimental product attains predominance than FAO/WHO provisional pattern in the essential amino acids except in sulfur amino acids. Mbofung, *et al,* (1999),

reported that Akara made from composite paste (cowpea and Phaseolus) had a relatively better amino acid profile. Moreover, Al Gaby (1998), found that there was an abundance of lysine and valine contents in cake made from faba bean meal supplemented by Nigella sativa.

Table (7): Amino acid composition (mg/100g) of Akara products compared to FAO/WHO provisional pattern (1991).

Amino Acids	Control Akara	Experimental Akara	* Falafel	FAO/WHO
Essential Amino Acids				
Lysine	7.67	7.77	7.05	5.50
Methionine	0.98	1.04	0.83	
Cystine	0.16	0.18	--	
T. Sulfur AAs	1.14	1.22	0.83	3.60
Theronine	4.69	4.75	4.49	4.00
Isolucine	8.40	8.35	5.83	4.00
Lucine	7.21	7.33	8.30	5.50
Phenylalanine	5.25	5.30	4.87	
Tirosine	3.49	3.54	3.92	
T. Aromatic AAs	8.74	8.84	8.79	6.30
Valine	4.93	4.98	6.771	5.00
Non-Essential Amino Acids				
Aspartic acid	10.98	10.91	5.82	
Serine	5.21	5.18	6.22	
Glutamic acid	13.58	13.26	18.01	
Proline	8.69	8.96	5.77	
Glycine	3.16	3.13	5.62	
Alanine	4.04	4.08	6.30	
Histidine	4.97	4.92	4.87	
Arginine	6.41	6.34	10.52	
TAAs	99.82	100.02	105.13	
TEAAs	42.78	43.24	42.00	

*** Ziena, *et al* (1988).**

Sensory evaluation:

Data presented in Table (8) indicate that Akara experimental product acquired the highest score (43.7) compared to the control Akara product (38.95). Concerning Taste, texture, and overall acceptability were significantly different ($p \leq 0.05$), this may be due to the addition of black cumin which enhance these characteristics. Regarding Akara product and traditional Falafel, it was obviously remarked that all panelist declared that all sensory attributes of Akara attain their acceptance but color (Fig 2). Alobo, (1999) reported that, Akara from autoclaved Bambara groundnut (BGN) seeds was more highly preferred by panelists compared to control cowpea Akara, except for appearance and color, no significant differences were found. It is worth to mention that our findings were in conformity with Nasr El din (1999), which was apparent that the black cumin strengthens the acceptance of Falafel product. Akara prepared with added black cumin is suggested as a new

product to be introduced to Egyptian markets particularly those suffering from Favism.

Table (8): Scores for the organoleptic properties of the Akara products

Sensory Characteristics	Akara products		Traditional Falafel (Taamia)
	Control	Experimental	
Color	8.2 ± 0.18 [a]	8.85 ± 0.19 [a]	7.9 ± 0.21 [a]
Taste	7.7 ± 0.25 [a]	8.85 ± 0.18 [b]	7.6 ± 0.23 [ac]
Aroma	8.0 ± 0.24 [a]	8.9 ± 0.25 [a]	7.5 ± 0.19 [b]
Texture	7.65 ± 0.27 [a]	8.75 ± 0.20 [b]	6.7 ± 0.29 [c]
Overall acceptability	7.6 ± 0.19 [a]	8.85 ± 0.18 [b]	6.6 ± 0.18 [c]
Total score	38.95 ± 0.67 [a]	43.7 ± 0.72 [b]	35.9 ± 0.61 [c]

Different letters were significant at (P ≤ 0.05).

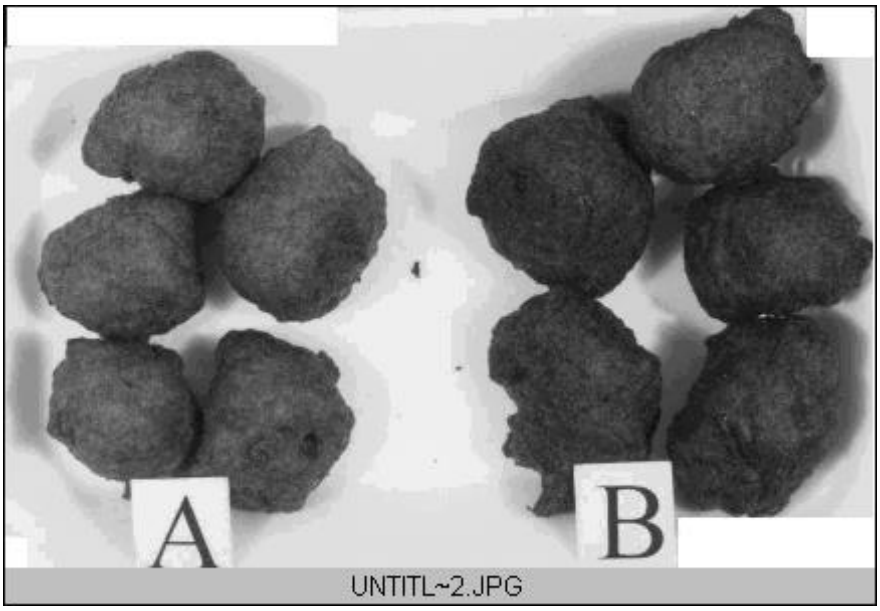

Fig (2): The control and experimental Akara products
A: Control Akara product
B: Experimental Akara product

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إعداد وتقييم الأكارا المصنعة من عجينة اللوبيا والمدعمة بحبة البركة كوجبة غير تقليدية

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تعتبر الأكارا غذاء شعبى لبلدان غرب إفريقيا ، وهى تصنع من عجينة اللوبيا ثم تقلى فى زيت عميق مثل الفلافل فى طريقة إعدادها. وأجريت هذه الدراسة بهدف بحث مميزات استخدام عجينة اللوبيا المدعمة بحبة البركة كطريقة غير تقليدية لإعداد وجبة الأكارا لإختبار مدى تقبلها لدى الأسر المصرية. وقد تم إجراء التحليل الكيماوى (الرطوبة ، والبروتين ، والدهن ، والألياف ، والرماد ، والكربوهيدرات ، والمعادن ، والأحماض الأمينية) لكلٍ من بذور اللوبيا وحبة البركة الخام ، ولمنتج الأكارا سواء كان للعينة الضابطة أو المختبرة. كما تم إعداد وجبة الأكارا ودراسة الخصائص الحسية لها بواسطة المحكمين، حيث أوضحت النتائج أن بذور اللوبيا تميزت بمحتواها المرتفع من البروتين (٢٨,٦٨ %) وإنخفاض محتواها من الدهن (١,٧٩ %) ، بينما كانت حبة البركة فائقة فى محتواها فى كلٍ من الدهن والألياف (٢٦,٣١ %، ١٠,١٨ %) على التوالى. وأشارت النتائج إلى إرتفاع محتوى حبة البركة من الكالسيوم (٢٤٥,٢٥ مجم/١٠٠جم) بينما كان محتوى اللوبيا (١٢١,٧ مجم/١٠٠جم) ، فى حين تبين أن محتوى الأحماض الأمينية الأساسية فى كلٍ من اللوبيا وحبة البركة كان مساويا أو مرتفعا عن نمط الهيئات الدولية المقترح FAO/WHO ، فيما عدا محتواهما من الأحماض الأمينية الكبريتية. كما تبين أيضا أن محتوى البروتين والألياف لمنتج الأكارا (الضابطة والمختبرة) كان مرتفعاً ، فى حين أن محتواها من الدهن كان منخفضاً مقارنةً بالفلافل. وقد إتضح أيضاً أنها مصدر جيد لكلٍ من المعادن والأحماض الأمينية الأساسية. وعند دراسة الخصائص العضوية الحسية، فقد نالت العينة المختبرة أعلى درجة فى التقبل العام لدى المحكمين عن العينة الضابطة وكذا عينة الفلافل ، حيث كانت الإختلافات معنوية بينهما.