# CHEMICAL AND TECHNOLOGICAL STUDIES ON BLACK CUMIN SEEDS

## 1- Enrichment of some bakery products using black cumin (*Nigella sativa* L.) seeds and their flours.

**El-Nemr, K.M.*; A. M. Abd El-Hamid*; M.A. Owon* and R. M. Mahmoud ****

* Food Sci. and Techn. Dept. Fac. of Agric. Kafr El-Sheikh, Egypt.

** Food Sci. and Techn. Dept. Fac. of Agric. Techrin Univ. Syria.

## ABSTRACT

The present study was designed to evaluate the black cumin seed from chemical and nutritional properties. This work was designed also to study the effect of adding black cumin seeds and their flour on the chemical composition of some bakery products such as kaiser bread and bread sticks on the nutritional and sensory evaluation of these products. The results indicated that black cumin seed contained higher percentage of lipids, proteins, crude fiber and carbohydrates. The seeds contained higher amounts of minerals. The results cleared that black cumin seed proteins contained higher amounts of indispensable amino acids. The results indicated also that addition of black cumin seeds and their flour improved the baking quality of kaiser bread and bread sticks. Product weight tended to increase as the amount of seeds increased to 2%. The results indicated that, moisture loss during baking and cooling was in opposite correlation with increasing the added seed. The eating quality of bakeries contained black cumin seeds were generally satisfactory with little amounts (0.5 and 1%). Using raw black cumin seeds in kaiser bread and bread sticks gave products with better external shape, crust character, grain texture and crumb colour. Adding of black cumin seeds caused raising in protein content. Addition of black cumin seeds improved the chemical and nutritional values of kaiser bread and bread sticks. Addition of black cumin seeds raised the amounts of lysine, methionine and cysteine.

## INTRODUCTION

Black cumin seeds widely distributed in countries bordering the Mediterranean sea, western Asia, Middle Europe and Northern Africa. It is cultivated in different areas of Egypt and Syria for purpose of its seeds **(Ibrahim, 1999)**.

Nowadays, many reports and articles have been introduced indicating the significant role of black cumin seed oil in increasing immunity and maintaining good health. In view of the fact, that black cumin seeds were used as natural food ingredient without any known toxic effects, this may be promising source of natural antioxidants for food use **(Pomeranz and Shellenberger, 1971; Sych *et al.*, 1987 and Owon, 1998)**.

Products such as snacks and kaiser bread are becoming popular and their keeping quality is very limited. Although many countries allow the use of antimolds in bread making to increase its shelf-life, such materials, are not used in Arabic countries on the commercial scale, additionally its side effect may cause more problems. There are many modes of deterioration which appear in the bakery products during their preservation; nutritional losses in bread and baked products are probably not of much concern after baking and during storage. since during baking process, the most of nutritional losses occur (**Pomeranz and Shellenberger, 1971**). As stated earlier, during normal shelf-life of bread, minimal losses of its nutrients occure (**Neukom and Rutz, 1981**).

Another nutritional consideration includes the destruction of lysine in the protein fraction of bread. Gluten is low in lysine and further destruction of lysine would occur during baking as well as during storage but in a lower rate. On the other hand, many authors concluded that, black cumin seed proteins contained higher amounts of amino acids, especially the essential one (**Babayan *et al.* 1978, El-Badrawy, 1996 and Ibrahim, 1999**).

The effect of added black cumin seeds as preservative agents and flavouring materials in making bakery products is not yet studied. In consideration of potential utilization, detailed knowledge of the composition of black cumin seeds is very important. So, the present study have been designed to evaluate such seeds from chemical and nutritional properties. This work was designed also to study the effect of adding black cumin seeds and their flour on the chemical composition of some bakery products (Kaiser bread and bread sticks), also on the nutritional value and sensory evaluation of these products.

## MATERIALS AND METHODS

### MATERIALS :

**Black cumin seeds (*Nigella sativa*, L.) :**

Two different samples of black cumin seeds, which were grown in two countries, (Syria and Egypt) were obtained from the local market. The Syrian sample was cultivated in El-Forat Basin region while the Egyptian sample was cultivated in upper Egypt region.

**Wheat flour :**

Wheat flour with 72% extraction was used, the another ingredients such as dry yeast, salt, sugar, fats and emulsifiers were obtained from the local market.

### METHODS

**Chemical analysis :**

Moisture, ash, crude fiber, protein, total nitrogen, non protein nitrogen (inorganic nitrogen) and lipids were determined according to the methods

described in **A.O.A.C. (1990)**. Carbohydrate contents were calculated by difference.

All minerals except total phosphorus were estimated after ashing using a unicom atomic absorption spectrophotometer model (929). The conditions for analysis was as described by **Farag *et al.* (1990)**. Total phosphorus of black cumin seeds was determined by spectrophotometeric methods, as reported by **A.O.A.C. (1990)**.

Amino acids were determined in the acid hydrolzate according to the method described by Pellet and Young (1980), using Beckman Amino Acid Analyzer (Model 119 CL) as described by **Youssef *et al.* (1986)**. Tryptophan was determined using spectrophotometer method as described by **Sastry and Tummuw (1985)**.

**Preparation of kaiser bread using black cumin seeds.**

The basic formula used in preparation of kaiser (for each 100 units) was shown as follows: white wheat flour (1 kg) dry yeast (15 gm), salt (4 g), sugar (6 gm), emulsifier (4 gm) and water.

Black cumin seeds were added to kaiser dough at different levels 0.5, 1 and 2% (w/w) of the total ingredients. The whole seeds were added in two phases internal and external. At the same time another mixture of wheat flour and black cumin seeds flour was used in preparing another type of kaiser bread at the same previous levels 0.5, 1 and 2%.

**The straight dough procedure for producing kaiser bread was as follows:**

Sugar, dry yeast, salt and dough improver was added to both types of flour with warm water. Ingredients were added together into the mixer along with the rest of the water (450-500 ml). Mixing continued at the lower speed for 4 min., then at the higher speed for 6 min. The formed dough was given 10 min rest time. Dough was divided into pieces, each piece was rounded and given 10 min proofing time. Kaiser dough was shaped to the final form and given 1.5 hours fermentation time at 35-39°C and 80-90% relative humidity. Fermented kaiser doughs were baked at 220°C for 10 min. After baking, kaiser loaves were weighed and left for one hour at room temperature (25°C) to cool down and weighed again. The volume of kaiser loaves and the other bread properties were determined (**Aper and Bezaro, 1990**).

**Preparation of bread sticks using black cumin seeds :**

The basic formula used in the preparation of bread sticks was as follows: white wheat flour (50 kg), sugar (4 kg), fat and oil (5 kg) emulsifier (250 gm), salt (250 gm) and dry yeast (300 gm).

After mixing, the bread sticks dough was shaped to the final form and given ½ hour fermentation time at 40°C and 90% relative humidity. Fermented snack doughs were baked at 170°C for ½ hour. The same steps were followed as previously done with kaiser concerning the mixing with black cumin seeds and flour. After baking, snack loaves were weighed and left for one hour at room temperature to cool down and weighed again **(Aper and Bezaro, 1990)**. The volume of bread sticks loaves and other bread properties were determined,.

**Sensory evaluation of bakery products:**

The organoleptic evaluation of the products with and without black cumin seeds and their products were carried out by ten panelists to evaluate differences in flavour, texture, colour, taste and overall acceptability according to **El-Nemr (1976)**. The data obtained from sensory evaluation were statistically analyzed using (SX test) according to **Steel and Torrie (1980)**.

## RESULTS AND DISCUSSION

**Gross chemical composition of black cumin seeds:**

The chemical composition of black cumin seeds (*Nigella sativa* L.) was evaluated. The moisture content of black cumin seeds was found to be 6.59% for Syrian seeds and 6.98% for Egyptian seeds,as shown in Table (1).

**Table (1):** Gross chemical composition of different cultivars of black cumin seeds (as dry weight basis).

| Constituents % | Syrian seeds | Egyptian seeds |
|---|---|---|
| Moisture | 6.59 | 6.98 |
| Lipid | 41.37 | 36.61 |
| Crude protein | 20.07 | 21.13 |
| None protein nitrogen | 0.31 | 0.32 |
| True protein | 19.76 | 20.81 |
| Ash | 4.50 | 5.92 |
| Crude fiber | 8.86 | 8.73 |
| Carbohydrates* | 25.20 | 27.61 |

* Carbohydrate contents were determined by difference.

Black cumin seeds have low quantity of moisture which make them not highly susceptible to microorganism attack. The moisture content of black cumin seeds is quite low and falls with the range of moisture contents of oil seeds. This might be advantageous in terms of the shelf life of the black seeds. It could be seen from such results, that there were little differences in moisture content of seeds collected from the two investigated cultivars. Our findings were agree with those of **(Cevdet and Semih 1993)**.

Total lipids were found in relatively high amount in black cumin seeds. It could be seen from Table (1), that lipids contents were 41.37 and 36.61% for Syrian and Egyptian samples, respectively.

**Menounos *et al.* (1986)** reported that total lipids content was 38.0%, which agreed with the results of our Syrian samples. The results obtained by **Abdel Aal and Attia (1993)** are agreed with our findings for Syrian seeds.

Table (1) show that the protein content of black cumin seeds was 20.07 and 21.13% as crude protein in Syrian and Egyptian samples, respectively.

Higher value of protein (31.9%) was concluded by **Daw and Abdel-Moein (1996)**. While the mean values of total protein published by **El-Badrawy (1996)** were 22.4. **Ibrahim (1999)** mentioned that such seeds obtained crude protein between 16.42 to 21.42%. The inorganic nitrogen contents of black cumin seeds were found to be 0.31% for Syrian sample and 0.32% for Egyptian sample as shown in Table (1). The obtained results are in good agreement with those concluded by **Abdel Aal and Attia (1993).**

The ash content was 4.50% for Syrian seeds and 5.92% for Egyptian seeds as shown in Table (1). The crude fiber content was 8.86 and 8.73% for Syrian and Egyptian seeds, respectively. The obtained results for ash and crude fiber were relatively agreed with those reported by **Al-Jassir (1992)** and **Daw and Abdel-Moein (1996)**. The total carbohydrates content in the analyzed samples was calculated by difference as shown in Table (1). The values were 25.20 and 27.61% in Syrian and Egyptian cultivars, respectively. Higher values were obtained for carbohydrates content in black cumin seeds by **Babayan *et al.* (1978)**.

**Mineral contents:**

The minerals content of Syrian and Egyptian samples of black cumin seeds were determined and the obtained results are shown in Table (2). The manganese (Mn) content was the lowest in the two investigated samples. On the other hand, the highest values of minerals were 880.80 and 830.30 mg/100 g of calcium (Ca) for Syrian and Egyptian samples, respectively.

**Table (2) :** Mineral contents of black cumin seed cultivars (mg/100 g).

| Minerals | Black cumin seed cultivars | |
|---|---|---|
| | Syrian | Egyptian |
| Iron (Fe) | 8.00 | 7.40 |
| Zinc (Zn) | 4.70 | 4.80 |
| Calcium (Ca) | 880.80 | 838.30 |
| Sodium (Na) | 560.60 | 766.10 |
| Manganese (Mn) | 0.45 | 0.50 |
| Magnesium (Mg) | 340.8 | 372.2 |
| Potassium (K) | 102.9 | 98.95 |
| Phosphorus (P) | 765.2 | 780.6 |
| Copper (Cu) | 1.30 | 1.21 |

The results in Table (2) indicated that black cumin seeds contained higher amounts of iron, calcium, sodium, magnesium, potassium and

phosphorus. Egyptian black cumin seeds contained higher percent of zinc, sodium, magnesium and phosphorus than that of Syrian samples. On the other hand, Syrian black cumin seeds contained higher amounts of calcium, potassium and iron than those of Egyptian samples (Table 2).

These variations in chemical composition could be due to the varietal characteristics, locational and climatic differences structure and condition of soil or the difference in the seeds storage conditions.

**Effect of adding different concentrations of black cumin seeds on the baking quality of kaiser bread and bread sticks:**

The baking results of some baked goods namely, kaiser bread and bread sticks made from wheat flour with different levels of black cumin seeds are present in Tables (3 and 4).

Table (3): Effect of adding different concentrations of black cumin seeds on baking quality of kaiser bread.

| Characteristics / Black cumin seeds conc. % | Means | | | Moisture loss % | |
|---|---|---|---|---|---|
| | Loaf weight (gm) | Loaf volume ($cm^3$) | Specific volume ($cm^3/gm$) | During baking | During cooling |
| Control 0.0% | 50 a | 320 | 6.4 a | 22.85 | 1.57 |
| 0.5% | 50 a | 320 | 6.4 a | 21.42 | 1.42 |
| 1% | 55 b | 320 | 5.8 b | 20.00 | 1.28 |
| 2% | 55 b | 320 | 5.8 b | 18.14 | 1.14 |
| L.S.D. at 0.05 | ** | NS | ** | | |

L.S.D. = Least significant difference

Table (4): Effect of adding different concentrations of black cumin seeds on baking quality of bread sticks.

| Characteristics / Black cumin seeds conc. % | Means | | | Moisture loss % | |
|---|---|---|---|---|---|
| | Loaf weight (gm) | Loaf volume ($cm^3$) | Specific volume ($cm^3/gm$) | During baking | During cooling |
| Control 0.0% | 30 a | 250 | 8.33 a | 36.00 | 1.20 |
| 0.5% | 30 a | 250 | 8.33 a | 36.00 | 1.20 |
| 1% | 35 b | 250 | 7.14 b | 34.00 | 1.00 |
| 2% | 40 c | 255 | 6.37 c | 32.00 | 0.92 |
| L.S.D. at 0.05 | ** | NS | ** | | |

L.S.D. = Least significant differences

There are no significant differences in loaf weight and loaf volume between control product and products containing 0.5 to 2% black cumin seeds in each kaiser bread and bread sticks.

On the other hand, specific volume of kaiser loaves and bread sticks showed significant variations, product weight tended to increase as the amount of seeds increased to 2%. Also there was a noticed change in moisture loss during baking and cooling as a function of the seed content,

moisture loss was in opposite correlation with increasing the added seeds quantity.

**Effect of adding black cumin seeds, on the organoleptic properties (senesory evaluation) of kaiser bread and bread sticks:**

The baked products with added raw seeds or mixed milled seeds were scored by an Egyptian panel with respect to organoleptic characteristics, external shape, crust character, grain texture, crumb color and eating quality as described in the part of materials and methods.

The analysis of variance of the panel scores is shown in Tables (5 and 6). The results showed no significant differences occurring between the

**Table (5) :** Effect of black cumin seeds levels on the organoleptic properties (sensory evaluation) of kaiser bread.

| Black cumin seeds ratio % | | Means | | | | | Total score (50) |
|---|---|---|---|---|---|---|---|
| | | External shape (10) | Crust character (10) | Grain texture (5) | Crumb color (10) | Eating quality (taste + odor) (15) | |
| Control | 0.0 | 8.25 ab | 8.50 ab | 3.91 cd | 8.50 a | 12.46 | 41.62 |
| External | 0.5 | 8.79 a | 8.95 a | 4.37 a | 9.00 a | 12.88 | 43.99 |
| | 1.0 | 8.00 ab | 8.33 ab | 4.16 abc | 7.37 bc | 11.79 | 39.65 |
| | 2.0 | 8.25 ab | 8.62 ab | 4.33 ab | 8.16 ab | 12.63 | 41.99 |
| Internal | 0.5 | 8.04 ab | 7.75 bc | 4.16 abc | 7.00 cd | 11.42 | 38.37 |
| | 1.0 | 8.41 ab | 8.45 ab | 4.25 abc | 8.50 a | 12.83 | 42.44 |
| | 2.0 | 7.37 b | 7.04 c | 3.95 bc | 6.12 d | 11.21 | 36.69 |
| Milled | 0.5 | 5.20 c | 5.50 d | 3.54 de | 4.16 e | 10.83 | 29.23 |
| | 1.0 | 4.45 c | 5.00 d | 3.54 de | 3.58 e | 9.83 | 26.40 |
| | 2.0 | 4.16 c | 5.08 d | 3.37 de | 3.70 e | 9.08 | 25.39 |
| Significance at 0.05 | | ** | ** | ** | ** | NS | |

**Table (6) :** Effect of black cumin seeds levels on the organoleptic properties (sensory evaluation) of bread sticks.

| Black cumin seeds ratio % | | Means | | | | | Total score (50) |
|---|---|---|---|---|---|---|---|
| | | External shape (10) | Crust character (10) | Grain texture (5) | Crumb color (10) | Eating quality (taste + odor) (15) | |
| Control | 0.0 | 8.55 a | 8.60 a | 4.22 b | 8.79 a | 13.45 a | 43.61 |
| External | 0.5 | 9.09 a | 9.09 a | 4.68 a | 9.18 a | 14.09 a | 46.13 |
| | 1.0 | 8.55 a | 8.91 a | 4.41 ab | 9.09 a | 13.27 a | 44.23 |
| | 2.0 | 8.82 a | 8.82 a | 4.41 ab | 8.82 a | 13.23 a | 44.10 |
| Internal | 0.5 | 9.09 a | 9.18 a | 4.68 a | 9.09 a | 13.86 a | 45.90 |
| | 1.0 | 8.64 a | 8.64 a | 4.36 b | 9.00 a | 13.23 a | 43.87 |
| | 2.0 | 7.64 b | 7.18 b | 3.73 c | 7.82 b | 11.95 b | 38.32 |
| Milled | 0.5 | 5.82 c | 5.64 c | 4.27 b | 6.46 c | 11.00 bc | 33.19 |
| | 1.0 | 5.91 c | 5.50 c | 3.73 c | 6.00 d | 10.23 d | 31.37 |
| | 2.0 | 5.36 c | 4.91 c | 3.23 d | 5.46 d | 10.50 d | 29.46 |
| Significance at 0.05 | | ** | ** | ** | ** | ** | |

different treatments or levels in eating quality (odor and taste) for kaiser bread only. The eating quality of bakeries contained black cumin seeds were generally satisfactory with little amounts (0.5, 1.0%) mixed internal or external the doughs, but when seeds were in milled case. it was unacceptable.

Using raw black cumin seeds in kaiser bread and bread sticks gave products with better external shape, crust character, grain texture, and crumb color (Tables 5 and 6). The results showed significant differences. The highest score with all studied properties was with adding 0.5% raw seeds, it was better than the others including the control products.

Baking tests with these various wheat dough-black cumin seeds produced more acceptable products with adding 0.5% raw seeds, therefore, these seeds could be recommended as a favourable additive in this concentration.

**Effect of adding black cumin seeds on moisture, protein and lipid content of kaiser bread and bread sticks :**

Moisture, protein and lipid contents in kaiser bread and bread sticks baked with studied levels of black cumin seeds, are given in Table (7). Naturally the highest values of moisture and protein contents were found in kaiser bread, while the highest values of lipid contents were found in bread sticks, these results according to recipes of baked products.

Table (7): Effect of adding black cumin seeds on moisture, protein and lipid contents of kaiser bread and bread sticks.

| Gross chemical composition / Bakery products | Moisture % | Protein % | Lipid % |
|---|---|---|---|
| Kaiser bread (control sample). | 30.59 | 24.41 | 1.46 |
| Kaiser bread with 1% black cumin seeds. | 30.64 | 24.53 | 1.44 |
| Bread sticks (control sample). | 11.11 | 18.19 | 1.42 |
| Bread sticks with 1.5% black cumin seeds. | 11.31 | 18.41 | 1.46 |

On the other hand, the values in Table (7) explained that the adding of black cumin seeds, caused raising in protein content, while, slightly decrease was found in lipid content of kaiser, bread. No marked differences were found in the moisture content after the addition of the black cumin seeds.

**Effect of adding black cumin seeds on amino acids composition of wheat flour:**

The black cumin seeds contained eight indispensable amino acids and ten dispensable amino acids. Black cumin seed proteins contained higher amounts of lysine, methionine, thrionine, phenylalnine and tryptophan (Table 8).

The amino acids composition of protein in wheat flour and composed flour with (1% black cumin seeds) are given in Table (8). The calculation showed that the black cumin seeds addition to wheat flour raised the amounts of lysine, methionine, cysteine. These findings, had higher levels of most of the essential amino acids (tryptophan, leucine, phenylalanine, thrionine, and valine) than FAO provisional pattern, except for methionine.

Table (8): Amino acids composition of wheat flour protein and mixture of wheat flour with 1% black cumin seed (gm/100 gm protein).

| Samples / Amino acids | Wheat * flour (72%) | Wheat flour with 1% black cumin seeds ** | FAO provisional pattern ** | Black cumin seeds * |
|---|---|---|---|---|
| **Indispensable amino acids:** | | | | |
| Tryptophan | 1.008 | 1.012 | 0.700 | 2.464 |
| Lysine | 2.55 | 2.556 | 4.20 | 13.978 |
| Leucine | 7.67 | 7.671 | 4.80 | 0.583 |
| Isoleucine | 4.00 | 4.004 | 4.20 | 2.335 |
| Methionine | 1.21 | 1.224 | 2.20 | 7.616 |
| Phenylalanine | 5.23 | 5.230 | 2.80 | 5.254 |
| Thrionine | 2.96 | 2.963 | 2.80 | 7.043 |
| Valine | 5.55 | 5.550 | 4.20 | 0.508 |
| **Dispensable amino acids :** | | | | |
| Arginine | 4.12 | 4.126 | | 3.032 |
| Histedine | 2.57 | 2.580 | | 5.605 |
| Tyrosine | 3.07 | 3.074 | | 1.967 |
| Cystine | 1.57 | 1.650 | | 21.96 |
| Alanine | 3.65 | 3.650 | | 0.167 |
| Glycine | 3.70 | 3.704 | | 2.297 |
| Proline | 12.37 | 12.384 | | 7.718 |
| Glutamic acid | 33.13 | 33.137 | | 3.886 |
| Serine | 6.73 | 6.732 | | 0.962 |
| Aspartic acid | 5.41 | 5.439 | | 16.145 |

* by determination
** by calculation

These data also support the results illustrated in Table (7), the results indicate that lysine and methionine contents of mixture have been found to be higher than those of wheat, this result suggests that protein quality of black cumin seeds is partially superior to that of wheat.

## REFERENCES

**Abdel Aal, E.S.M and Attia, R.S. (1993a)**. Characterization of black cumin (*Nigella sativa* L.) seeds. 1. Chemical composition and lipids. Alex. Sci. Exch., 14(4): 467-482.

**Al-Jassir, M.S. (1992)**. Chemical composition and microflora of black cumin (*Nigella sativa* L.) seeds growing in Saudi Arabia. Food Chemistry 45: 239-242.

**A.O.A.C. (1990)**. Official Methods of Analysis of Association of Official Agriculture Chemists. 12th Ed. Association of Official Agriculture Chemists Washington

**Aper, P. and Bezaro, V. (1990).** Manual decettes boulangeres *et* patissieres. L'Ecole de Boulangrie du Caire. 118 p.

**Babayan, V.K.; Koottungal, D. and Halaby, G.A. (1978).** Proximate analysis fatty acid and amino acid composition of *Nigella sativa* L. seeds. J. of Food Sci. 43(4): 1314-1315 and 1319.

**Cevdet, N and Semih, O. (1993).** Chemical composition of *Nigella sativa* L. seeds. Food Chemistry 48(3): 259-261.

**Daw, Z.Y. and Nadia M. Abdel-Moein (1996).** Chemical and biological values of black cumin seeds. Mansoura Univ. J. of Agric. Sci. 21 No. (11): 4149-4159.

**El-Badrawy, Y.B.S. (1996).** Biochemical studies on some natural products. Ph.D. Thesis. Biochemistry Dept. Fac. Agric. Mansoura Univ. Egypt.

**El-Nemer, I.M. (1976).** Investigation of the effect of various grain meals that could be employed in preparing Egyptian wheat bread. Ph.D. Thesis. Hungarian Academy Sciences, BP, Hungary.

**Farag, R.S.; Ali, M.N. and Taha, S.H. (1990).** Use of some essential oils as natural preservation for butter. J. Amer. Oil Chem. Soc. 68(3): 188-191.

**Ibrahim, A.E. (1999).** Chemical, Microbial and Biological Studies on *Nigella sativa* seeds. Ph.D. Thesis. Food Sci. and Tech., Fac. of Agric. Cairo Univ. Egypt.

**Menounos, P.; Staphylakis, K. and Gegiou, D. (1986).** The sterols of *Nigella sativa* seed oil. Phytochemistry 25(3): 761-763.

**Neukom, H. and Rutz, W. (1981).** Observation on starch retrogardations and bread staling. Cereal Chem. 14 (16): 292-295.

**Owon, M.A. (1998).** Natural components isolated from *Nigella sativa* L. seeds used as new antioxidants. J Agric. Res. Tanta Univ., 24(2): pp. 160-170.

**Pomeranz, Y. and Shellenberger, J.A. (1971).** Bread Science and Technology. The AVI Publ. Co., West Port, Conn.

**Sastry, C.S.PP. and Tummuru, M.K. (1985).** Spectrophotometric determination of tryptophan in protein. J. Food Sci. Technol., 22: 146-147.

**Steel, R.G. and Torrie, J.H. (1980).** Principles and Procedures of Statistics. 2nd ed. (pp. 120). McGraw-Hill, New York, U.S.A.

**Sych, J.; Castaigne, F. and Lacroix, C. (1987).** Effect of initial moisture content and storage relative humidity on textural changes of layer cakes during storage. J. Food Sci. 52(6): 1604-1610.

**Youssef, M.M.; Hamza, M.A.; Abdel-Aal, M.H.; Laila, A. Shekib and El-Banna, A.A. (1986).** Amino acid composition and *in vitro* digestibility of some Egyptian food made from faba bean. Food Chemic., 22: 225.

## الملخص العربى

# دراسات كيميائية وتكنولوجية على بذور الحبة السوداء
# تدعيم بعض المخبوزات باستخدام بذور الحبة السوداء والدقيق الناتج منها

كمال متولى النمر*، عبدالحميد مليجى عبدالحميد*،
مصطفى أحمد عون*، رامز محمد محمود**
* قسم الصناعات الغذائية – كلية الزراعة بكفرالشيخ – جامعة طنطا – مصر
** قسم الصناعات الغذائية – كلية الزراعة – جامعة تشرين – سوريا

صمم هذا البحث بغرض تقييم بذور الحبة السوداء من حيث الصفات الكيميائية والغذائية، كما أجرى هذا البحث لدراسة تأثير إضافة بذور الحبة السوداء والدقيق الناتج منها على الصفات الكيميائية والغذائية والحسية لبعض المخبوزات مثل خبز الكيزر والبقسماط. أظهرت النتائج أن بذور الحبة السوداء كانت غنية بكل من الليبيدات والبروتين والألياف الغذائية والكربوهيدرات، كما أن هذه البذور غنية بالأملاح المعدنية خاصة الحديد والزنك والكالسيوم والمغنسيوم والبوتاسيوم والفوسفور. أثبتت النتائج أن بروتينات الحبة السوداء غنية بالأحماض الأمينية الأساسية خاصة الليسين والميثونين والثريونين والفينايل الانين والتربتوفان. كما أوضحت النتائج أن إضافة بذور الحبة السوداء سواء كانت فى صورة حبوب كاملة أو الدقيق الناتج منها يحسن من صفات الجودة لخبز الكيزر والبقسماط، وأن استخدام البذور فى تدعيم هذه المخبوزات قد سبب زيادة معنوية فى وزن الرغيف مع زيادة مستوى الإضافة الى ٢% حيث كانت هناك علاقة عكسية بين كمية الرطوبة المفقودة خلال عمليتى الخبيز والتبريد مع كمية البذور المضافة للمنتج فكلما ازدادت نسبة بذور الحبة السوداء فى الخبز قلت نسبة الرطوبة المفقودة خلال الخبيز والتبريد.

وبالنسبة لخواص التذوق لهذه المخبوزات فقد أوضحت النتائج أنها بصفة عامة كانت مقبولة خاصة عندما أضيفت البذور بنسبة من ٠,٥ الى ١%. وأوضحت النتائج أيضاً أن إضافة بذور الحبة السوداء الكاملة لكل من خبز الكيزر والبقسماط يعطى أحسن الصفات من حيث المظهر الخارجى والداخلى والقوام ولون اللبابة. وبينت النتائج أيضا أن تدعيم دقيق القمح ببذور الحبة السوداء قد اسهم فى رفع نسبة البروتين لهذه المخبوزات وكذلك أدى الى تحسين الصفات الكيميائية والغذائية لخبز الكيزر والبقسماط حيث أدى ذلك الى رفع محتوى هذه المخبوزات من الأحماض الأمينية الأساسية مثل الليسين والميثونين والسستئين.