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Nutritional and Biochemical Studies on Roasted and Irradiated Sesame Seeds (*Sesamum Indicium L.*)

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SUMMARY

The main objectives of the present work are to study the effect of treated sesame seeds (*Sesamum Indicium L*) with roasting at 180^{0}c for 15 min. and exposure to gamma irradiation at dose level of 2.5, 5 and 10 KGy on the antinutritional factors as well as evaluation of some biochemical analysis. In the present study groups of 10 rats were assigned to receive one of six experimental diets (i.e. raw roasted and irradiated sesame seeds up to 10 KGy diet, along side casein diet).

The statistical analysis indicated that there were significant results ($p<0.05$) decreased in the trypsin inhibitors, tannins of roasting and irradiated sesame seeds. There were no significant differences in the phenol compounds of sesame seeds processed compared with raw samples. The obtained data showed that the level of total serum protein and albumin were significantly lowered in rats fed raw sesame seeds (5.24 and 4.15 g dl^{-1}) as compared with those fed casein diet (6.03 g dl^{-1}). Moreover, the rises of total serum protein of irradiation processing of sesame seeds up to 10 KGy was successful due to reducing the antinutritional factors by increasing irradiation process. With respect to the total serum albumin in rats fed irradiated sesame seeds at 5 and 10 KGy was close to that rats fed casein diet, followed with significant ($p<0.05$) decrease in the group of rats received in their diets irradiated sesame seeds at 2.5 KGy roasting and raw samples when compared with those fed casein diet. The statistical analysis showed that there were no significant variation in the liver enzymes (ALT and AST) between rats fed dry heated sesame seeds and those fed raw samples. But the level of liver enzymes (ALT and AST) decreased when rats fed sesame seeds irradiated up to 10 KGy as compared with rats fed raw seeds. Results

showed significant decrease in total cholesterol, Triacylglycerol and low density lipoprotein cholesterol (LDL-C) and the results reflected increase in the high density lipoprotein (HDL-C) for rats received dry heated and irradiated (up to 10 KGy) sesame seeds when compared with those fed raw samples.

INTRODUCTION

Sesame (*sesamum indicum.L*) is one of the oldest cultivated plants in the world that is mainly grown for its oil rich edible seeds. The seeds are widely used as spice globally. Sesame seed may be the oldest condiment known to man and probably was the first crop grown for its edible oil *(Suja et al 2004)*. Sesame seeds contain a wide range of chemical constituents which act as antinutritional factors. They have a great effect on enzyme activity, digestibility and of these in turn, have a side effect on nutrition and human health. The major antinutritional factors in sesame seeds are trypsin inhibitors, Phytic acid tannins, phenols and lipoxygenase enzyme *(Guillan and Ruiz 2004; Hemalatha and Ghafeerunissa 2007)*

A member of lipid soluble antioxidants has been isolated from sesame seeds including sesamin, sesaminol and sesamolinol (*Siddhurajer et al 2002; Joshi et al 2005*). These compounds present in sesame have physiological effect acting as antioxidants (*Noguchi et al 2001; Ikeda et al 2003)* and decreasing blood pressure (*Nakano et al 2003*) and reducing serum lipids (Takashi *et at 2001;* Reshma *et al 2010*). Various interesting physiological effect of sesame lignan such as decrease hypocholestermic activity, suppressive activity of chemically induced cancer and enhancing effect on various liver activities (Takashi *et al 2001*).

The roasting process is an important step since roasted seeds are often added to backed wheat flour foods such as biscuits, breads and crackers due to its flavor and containing high nutritive value of its protein and lignan *(Yusuf et al 2007; Seung et al 2010)*.

Food irradiation is recognized as a safe and effective process for a range of specific application. It can substitute for chemical fumigants in disinfesting cereals, grains and dry beans. Radiation treatment could upgrade the nutritional quality of certain food and feed ingredients (*Farag, 2008*).

The main objectives of this study are to investigate the direct effect of gamma irradiation in dose of 2.5, 5 and 10 KGy or roasting treatment at 180^0c for 15 min. on the content of antinutritional factors in sesame seeds and the biochemical parameters of rats fed raw, roasted or irradiated sesame seeds after eight weeks.

MATERIAL AND METHODS

1. Material:

A. Sesame Seed:

Sesame seed samples were obtained from the Agricultural Research Center, Ministry of Agriculture, Giza, Egypt.

B. Animals:

Male albino rats, Sprague-Dawley strain, with an initial weight of about of 80 ± 5 g were used. They were obtained from Helwan breeding farm belonging to Vaccine and Sera Institute, Cairo, Egypt. The animals were housed individually in plastic cages with wire mesh bottoms at a room temperature of 25°C and water *ad libitum* for eight weeks. Groups of 10 rats were then assigned to receive one of six experimental diets (i.e. raw, roasted, and irradiated sesame seeds at 2.5, 5, and 10 KGy diet, alongside casein diet).

2. Methods:

A. Roasting Treatment:

Sesame seeds were treated with exposed to dry heat by using oven at about 180^0 C for 15 min. and left for half an hour to cool at room temperature, and then was packed in polyethylene bags. Each bag contained about one kg.

B. Radiation Treatment:

Sesame seeds were freed of husk, stone, etc. and were packed in polyethylene bags, and sealed by heat. Each bag contained about one kg. Then they were subjected at ambient temperature to gamma irradiation from Co-60 at National Centre for Radiation Research and Technology at Nasr City, Cairo, Egypt. The facility used was Gamma Chamber 400 A, Co-60 facility of India. The applied doses were 2.5, 5, and 10 KGy delivered at dose rate of 1.91 KGy *I* h as calibrated using small pieces of radio chromic film *(Mclaughlin et al 1985)* at the time of experimentation. The samples were stored at 5°C until used.

C. Determination of Antinutrtional Factors of Sesame Seeds:

Trypsin inhibitor activity was determined according to (Roy and Bhat, *1974*), tannins content determined as method described by (Burns, *1971*) and phenolic compounds was carried out by method of (Swain and Hillis, *1959*).

D. Animal Feeding Experiments:

Six groups of ten young male Albino rats of initial body mass about 80 ± 5 g were used in the study, they were given a 10% casein protein control diet, and water ad libitum for 8 weeks. Groups of rats were assigned to receive one of six experimental diets raw roasted and irradiated sesame seeds as outlined in Table (1) and according to the standard method of *(A.O. A. C., 2003)*. Vitamin-mineral mixture was prepared by mixing analytically pure vitamin compounds with mineral salts and kept at 4°C until used.

Table (1): Composition of the experimental diets (g/kg)

Ingredients	Diets (g/kg)	
	Casein	Sesame seeds
Sesame seeds [a]	-----	432
Casein [b]	115.0	-----
Corn oil	80.0	-----
Cellulose	10.0	10.0
Sucrose	125.0	242.5
Corn starch	560.0	242.5
Water	50.0	26.0
Vitamin mixture [c]	10.0	10.0
Mineral mixture [d]	50.0	37.0
Total	1000.0	1000.0
Crude protein	100.0	100.0

a. Raw, roasted, and irradiated sesame seeds at 2.5, 5, and 10 kGy were incorporated at the same level.
b. High nitrogen casein (crude protein 10%).
c. The mixture provides the following (mg $100g^{-1}$ ration):
Vit, A, 2000 IU; Vit. D, 200 IU; Vit. E, 10 IU; Menadione, 0.5; Choline. 200; p-Aminobenzoic Acid, 10; Insitol, 10; Niacin, 4; Ca D-Pantothenate, 4; Ribofalvin, 0.8; Thiamine, HCl, 0.5; Pyridoxine-HCl, 0.5; Folic Acid, 0.2; Biotin, 0.04; Vito B_{12}, 0.003; Glucose, To make 1000.
d. The mixture provides the following: 139.3 g NaCl; 0.79 g KI; 389.0 g KH_2P0_4; 57.3 g $MgS0_4$ anhyd.; 381.4 g $CaCO_3$; 27.0 g $FeS0_4$. 7H20; 4.01 g $MnS0_4$.f-hO; 0.548 g $ZnS0_4$.7H20; 0.477 g $CuS0_4$.5H20; and 0.023 g $CoCl_2 \cdot 6H_20$.

E. Biochemical Analysis:

Four rats from each group were randomly selected for biochemical analysis. Blood was obtained by cardiac puncture. The blood samples were then centrifuged at 5000 rpm for 15 min., after which serum could be separated and collected using Pasteur pipettes. Total serum protein was determined according to Domos, (1975), serum albumin was determined by Baure, (1982), hemoglobin was determined according to Dacie and Lewis, (1984), serum Alanine Transaminase (ALT) and Aspartate Transaminase (AST) was determined according to Reitman and Frankel, (1957). Tatal lipid determined by Schmit *et al* (1965), cholesterol was determined by Richmond, (1973) and serum triacylglycerol was determined by Bablok, (1988). High density lipoprotein cholesterol (HDL-C) determined by method (Richmond, 1973) and low density lipoprotein cholesterol (LDL-C) were estimated according to (Friedwald *et al 1972*).

F. Statistical Analysis:

All analysis were conducted using the general linear model Procedure of the Statistical Analysis System Institute, Inc.,

(SAS, 1989) where appropriate treatment means were separated using the Duncan's Multiple Range Test (*Duncan, 1995*). The α-level for significance was p≤0.05.

RESULTS

Effect of dry heated and irradiation processing on the antinutritional factors of sesame seeds:

Results presented in Table (2) showed that trypsin inhibitor activity of raw sesame seeds was 11.40 TIU / g $^{-1}$ (trypsin inhibiting unit's g-^{1}). Trypsin inhibitors content for roasting and irradiated sesame seeds at 2.5, 5 and 10 KGy were significantly (p<0.05) decreased by 50.00, 34.56, 41.22 and 51.75 %, as compared with raw sesame seeds. There were no significant (p< 0.05) variation between roasting and irradiated sesame seeds at 10 KGy. Tannis were significant P< 0.05 reduced by 33.33, 11.11, 22.23 and 33.33% respectively for sesame seeds were roasted and irradiated up 10 KGy.

But, there were no significant difference for phenol compounds sesame seeds processed compared with untreated seeds.

Table (2): Effect of roasting and irradiation processing on antinutritional factors of sesame seeds (*sesamum indicum,L.*)

Treatment	Trypsin Inhibitor activity (TIU)	Tannins (mg/100g)	Phenols (mg/100g)
Raw	11.40^{a}±0.15	0.18^{a}±0.0005	5.45^{a}±0.011
Dry heat	5.70^{d} ±0.11	0.12^{d}±0.0005	5.38^{a}±0.005
2.5 KGy	7.46^{b}±0.08	0.16^{b}±0.001	5.37^{a}±0.011
5 KGy	6.70^{c}±0.11	0.14^{c}±0.0005	5.34^{a} ±0.011
10 KGy	5.50^{d}±0.11	0.12^{d}±0.0005	5.27^{a}±0.011
P Values	0.0001	0.0001	0.0001

Values are means of triplicate analysis, on dry matter. $^{a-c}$ Means within the column, with no common superscript differ significantly (P<0.05).

Effect of dietary supplementation by raw, dry heated and irradiated sesame seeds on liver function and hemoglobin.

The statistical analysis in Table (3) indicated that there were significant (p<0.05) decrease in the level of serum total protein and albumin by 5.24 g kg^{-1} and 4.15 g dl^{-1} respectively for rats fed raw seeds compared with those fed casein diet. The rises of total serum protein for rats fed irradiated sesame seed up to 10 KGy was 5.98 g kg^{-1}, 6.02 g kg^{-1} and 6.05 g kg^{-1} respectively compared with those fed raw seeds. With respect to the total serum albumin in rats fed irradiated sesame seeds at 5 and 10 KGy was close to that rats fed casein diet, followed in significant (p<0.05) decrease in the groups of rats received in their diet irradiated sesame seeds at 2.5 KGy, roasting and raw samples when compared with those fed casein diet.

Regarding to the results presented in Table (3), the level of alanine transaminase (ALT) was 21.00 units/ml) and asparate transaminase (AST) was 30.00 units/ml in blood serum of male albino rats fed casein for eight weeks were significantly ($p<0.05$) lower than those fed raw, dry heated and irradiated sesame seeds (up to 10 KGy). The results in Table (3) reached the highest level activity of ALT (33.66 units/ml) and AST (45.66 units/ml) were found in the group of rats fed dry heated sesame seeds compared with those received casein, raw and irradiated sesame seeds (up to 10 KGy).

Rats fed irradiated sesame at dose 2.5, 5 and 10 KGy, there were significant ($p<0.05$) decrease in the level of ALT by 25.00, 24.00 and 23.66 units/ml respectively as well as the significant decrease in the level of AST by 38.00, 36.00 and 35.00 units/ml respectively compared with those received raw samples.

The results presented in Table (3), the statistical analysis demonstrated that there were significant ($p<0.05$) decrease in the level of hemoglobin (Hb) by 8.65 g dl^{-1} of rats fed raw sesame seeds compared with those fed casein diet. Also, there were no significant variation in the Hb value of rats fed dry heated sesame and those received casein diet. Meanwhile, irradiation process of sesame seeds significantly increase the Hb value as the dose or irradiation increased up to 10 KGy by 10.92, 11.71 and 11.83 g dl^{-1} respectively compared with rats fed raw samples.

Table (3): Effect of diet containing roasting irradiated sesame seeds on liver function and hemoglobin.

Diet Regimes	TotalProtein (g kg^{-1})	Albumin (g dl^{-1})	ALT (Units/ml)	AST (Units/ml)	HB (g dl^{-1})
Casein	$6.03^{a}\pm0.13$	$5.53^{ba}\pm0.13$	$21.00^{c}\pm0.00$	$30.00^{d}\pm1.15$	$13.12^{a}\pm0.49$
Raw	$5.24^{b}\pm0.10$	$4.15^{d}\pm0.46$	$29.00^{ba}\pm0.00$	$41.33^{b}\pm0.66$	$8.65^{c}\pm1.18$
Dry heating	$5.42^{ba}\pm0.15$	$4.69^{bc}\pm0.09$	$33.66^{a}\pm1.33$	$45.66^{a}\pm0.33$	$13.08^{a}\pm0.4$
2.5 kGy	$5.98^{a}\pm0.22$	$4.24^{ba}\pm0.33$	$25.00^{bc}\pm2.30$	$38.00^{bc}\pm0.57$	$10.92^{b}\pm0.16$
5 kGy	$6.02^{a}\pm0.13$	$5.20^{ba}\pm0.44$	$24.00^{bc}\pm3.00$	$36.00^{c}\pm1.15$	$11.71^{ba}\pm0.32$
10 kGy	$6.05^{a}\pm0.30$	$5.59^{ba}\pm0.05$	$23.66^{bc}\pm2.66$	$35.00^{c}\pm1.15$	$11.83^{ba}\pm0.47$
P Value	0.0355	0.0350	0.0048	0.0001	0.2326

Values are means of ten animals. $^{a-d}$ Means with the column, with no common superscript differ significantly ($p<0.05$).

Effect of roasting and radiation processing of sesame seeds fed to albino rats for eight weeks on lipid profile.

The results demonstrated in Table (4) showed that significantl increase in the total lipids concentration of rats fed raw, dry heated and irradiated (up to 10 KGy) sesame seeds when compared with rats fed casein diet. However, there were no significant difference in the serum total lipid of rats fed diet containing raw dry heated dry heated and irradiated (up to 10 KGy) sesame seeds.

The serum total cholesterol for rats fed casein diet were significantly increased, the

hypercholestrolemic (320.24 mg dl^{-1}) when compared to those received in their diets both raw and processed sesame seeds (i.e. roasted or irradiated sesame seeds up to 10KGy).When the total cholesterol in rats fed dry heated and irradiated samples at 2.5, 5 and 10 KGy were significantly ($p<0.05$) decreased by 253.07, 257.41, 247.1 and 236.51 mg dl^{-1} respectively compared with those received raw materials.

The serum triacylglycerol contains of rats fed casein diet (175.53 mg dl^{-1}) was higher than those received other processed sesame seeds. There were significant decrease in the total triacylglycerol of rats fed dry heated and irradiated (up to 10 KGy) sesame seeds compared with rats received raw samples and casein diet.

The data from Table (4) proved that there were no significant variation in the level high density lipoprotein-cholesterol (HDL-C) for rats fed casein diet and those fed raw samples. Considering this connection, the results reached significant increase in the HDL-C for rats fed irradiated sesame seed (up to 10 KGy) followed by those received dry heated sesame seeds. Whereas the highest increase in the level of HDL-C was reached when rats fed irradiated sesame seeds at 10 KGy by 31.33 mg dl^{-1} when compared with rats received raw samples.

With respect to the level of low density lipoprotein cholesterol (LDL-C) significantly increased when fed diet casein compared with those received processed seeds rats. There were no significant variation between the level of LDL-C for rats fed raw samples and those fed dry heated sesame seeds.

In general, rats fed irradiated (up to 10 KGy) sesame seeds offers good treatment for decreasing the level of LDL-C when compared with those received raw samples.

Table (4): Effect of diets containing roasting and irradiated sesame seeds on serum lipid profile and lipoprotein.

Diet Regimes	Total Lipids (mg dl^{-1})	Total Cholesterol (mg dl^{-1})	Triacyl- glycerol (mg dl^{-1})	HDL-C (mg dl^{-1})	LDL-C (mg dl^{-1})
Casein	467.66 ^{b}±3.38	320.24 ^{a}±10.35	175.53 ^{a}±1.70	22.52 ^{b}±1.64	277.02 ^{a}±0.00
Raw	490.33 ^{a} ±2.33	264.22 ^{b}±21.29	149.35 ^{b}±6.29	22.07 ^{b}±1.04	144.23 ^{ba}±19.91
Dry heat	491.00 ^{a}±3.05	253.07 ^{c}±12.22	132.09 ^{c}±29.55	27.82 ^{ba}±1.35	144.95 ^{ba}±12.70
2.5 kGy	491.00 ^{a}±1.52	257.41 ^{c}±17.74	135.22 ^{bc}±14.57	30.27 ^{a}±3.88	140.01 ^{ba}± 0.00
5 kGy	487.33 ^{a}±1.45	247.10 ^{c}±18.30	133.30 ^{bc}±18.18	30.83 ^{a}±1.76	138.81 ^{ba}±28.41
10 kGy	492.0 ^{a}±1.52	236.51 ^{c}±5.43	105.50 ^{c}±15.82	31.33 ^{a}± 3.53	128.84 ^{b}±43.48
P Values	0.0322	0.0016	0.0134	0.0262	0.3812

Values are means of ten animals, $^{a-c}$ Means with the column, with no common superscript differ significantly ($p<0.05$).

DISCUSSION

The present work was undertaken to evaluate the beneficial effect of gamma irradiation and roasting process on the antinutritional factors as well as the biochemical parameters of growing rats as being affected by feeding processed sesame seeds for eight weeks.

Along with antinutritional factors of sesame seeds treated with dry heated and irradiation processing (up to 10 KGy). Results exhibited significant decrease in the level of trypsin inhibitor activity and tannins when compared with the untreated sesame seeds. There were no significant variation in the level of phenol compounds for processed sesame seeds and raw samples. In this respect, Mahdi, (2003) and Devarajan, (2005) recorded the same on the inactivation of antinutritional factors through radiation processing or roasting treatment.

The obtained results proved that there were significant decrease in serum total protein and albumin when rats fed raw sesame. This can be due to the decrease in protein digestibility and it could be an indication of reduced albumin synthesis in liver (Osman, 2002 and De Toledo *et al* 2007).

The rises in the serum protein and albumin of rats fed irradiated (up to 10 KGy) sesame compared with those fed raw seeds. This could be due to radiation process up to 10 KGy used in this study, was successful to reduce the antinutritional factors of raw seeds and induce no deleterious effect on protein digestion and absorption through intestinal tract as proofed by the physiological and biochemical responses (Jeong *et al* 2004 and Farag 2008).

The results of liver enzyme activities of transaminases (ALT and AST) concluded that dry heated sesame seeds had negative effect on the liver function and this had been reflected by the higher value of ALT and AST. On the light of the results of serum transaminases, the lower level of ALT and AST in the group rats received sesame seeds irradiated up to 10 KGy, suggest that irradiated treatment at the above dose levels did reduce the activity of the bio-toxi factors in sesame seeds. Among these active are trypsin inhibitors that cause stressed liver function and degeneration of hepatocytes that release their enzymes in blood serum (Farag, 1999).

Farag (2008), had suggested that doses of irradiation up to 10 KGy reduce trypsin inhibitors activity that cause stressed liver and degeneration of hepatocytes that release their enzyme in blood serum.

Concerning lipid profile, the statistical analysis exhibited that the level of serum total cholesterol, triacylglycerol and HDL-C were significantly decreased when rats fed dry heated and irradiated sesame seeds up to 10 KGy compared with those received raw samples. The

reduction induced in the blood cholesterol level of rats fed raw and processed sesame seeds can be attributed by sesamin (sesame lignan) who plays an important role in reduced the activity of hepatic 3-hydroxy-3- methylglutaryl CoA reductase, the key enzyme in the cholesterol synthesis (Kushiro *et al* 2002) . In general, these beneficial effects of sesame seeds on hypercholesteremic rats appeared to be due to its fiber, sterol, polyphenol and flavonoid content enhancing the fecal cholesterol excretion and bile acid production as well as increasing the antioxidant properties such as (sesamin, sesamolin and sesamol) and enzyme activities, these compounds also have inhibitory effect on membrane lipid peroxidation (Joseph & Karim, 2007 and Mrinal *et al* 2010). In this study, the reduction of triacylglycerol of raw, dry heated and irradiated (up to 10 KGy) sesame seeds was due to the dietary fibers which caused inhibition of hepatic lipogenesis. Also, the saturated fatty acid content of sesame seed could have influenced the triacylglycerol as substrates for triacylglycerol synthesis (Venkatesan *et al* 2003).

CONCLUSION

Much attention to increase consumption of sesame seeds as the minor constituents of daily health especially in nutritional and physiological aspects. Concluding from this study that, dry heated and irradiation process of sesame seeds exhibited reduction in the antinutritional factors as well as observed marked decrease in serum transamines activities, total cholesterol, triacylglycerol and LDL-C as compared with increase in hemoglobin total serum protein and albumin plus HDL-C due to enhancing the antioxidants properties and enzyme activities.

REFERENCES

A.O.A.C. (2003): Official methods of analysis of the association official analytical chemists. 17 th Edn. Publ. by the Association of Official Analytical Chemists, Inc. Arlington, Virginia, USA.

Bablok, W. (1988): General regression procedure for method transformation of triacylglycerol. J. Clin. Chem. Biochem., 26: 787-790.

Baure, J.D. (1982): Determination of serum albumin. Clinical Lab. Methods. USA. 9th Ed.: 495-496.

Burns, E.R. (1971): Methods for estimation of tannin in grain sorghum Agronomy J., 63:511.

Dacie, J.V. and Lewis, S.M. (1984): Practical Hematology, sixth edition, ELBS and Churchill Livingstone, London. U.K.

De Toledo, T.C.F.; Canniatti-Brazaca, S.G.; Arthur, V. and Piedade, S.M.S. (2007): Effect of gamma radiation on total phenol, trypsin and tannin inihibitors in soy bean grains. Radiation Phys. And Chem., 76 (10): 1653-1656.

Devarajan, D. (2005): Chemical composition and nutritional potential of *Vigna Unguiculata*

ssp. And Cylindrica (Fabaceae). J. of Food Biochem., 29: 88-98.

Domes, B.L. (1975): Colorimetric determination of total protein. Clin. Chem., 21 (1): 1159-1166.

Duncan, D.B. (1995): Multiple rang test and multiple F-tests Biometrical, 11:1.

Farag, M. H. (1999): Effect of radiation and other processing methods on protein quality of sunflower meal. J. Sci. food Agric. 79: 1565 – 1570.

Farag, M. H. (2008): Radiation technology and food safety, First Arab Conference on Sanitation and food Safety. Al–Manama. Bahrain Kingdom, 22-24.

Friedwald, W.T.; Levy, R.I. and Ferdrickson, D.S. (1972): Estimation of the concentration of low-density lipoprotein cholesterol in plasma without use of the preparative ultracentrifuge. Clin. Chem., 18:499.

Guillen, M.D.; and Ruiz, A. (2004): Formation of hydroperoxy and hydroxy alkenals during thermal oxidative degradation of sesame oil monitored by porton. J. of Lipid Science and Technology, 106: 680-687.

Hemalatha, S. and Ghafoorunissa, M. (2007): Sesame lignans enhance the thermal stability of edible vegetable oils. J. Food Chem. Vol. 105: 1076-1085.

Ikeda, S.; Kagaya, M.; Kobayashi, K.; Tohyama, T.; Kiso, Y.; Higuchi, N. and Yamashita, K. (2003): Dietary sesame lignans decrease lipid peroxidation in rats fed decoscahexaenoic acid. J.

Jeong, S.M.; Kim, S.Y.; Nam, K.C.; Ahn, D.U. and Lee, S.C. (2004): Effect of seed roasting conditions on the antioxidant activity of defatted sesame meal extracts. J. of Food Sci., 5, 69:377- 381.

Joseph, H.R.G. and Karim, A. (2007): Effect of instantaneous controlled pressure drop on the phytate content of lupin. J. Food Sci. and techno., 40 (3): 448-453.

Joshi R, Kumar MS, Satyamoorthy K, Unnikrisnan M K & Mukherjee T. (2005): Free radical reaction and antioxidant activities of sesamol: plus radiolytic and biochemical studies, J. Agric. Food Chem., 53: 2696.

Kushiro, M; Masaoka, T.; Hageshita, S.; Takahashi, Y; Ide, T. and Sugano, M. (2002) : Comparative effect of sesamin and episesamin on the activity and gene expression enzymes in fatty acid oxidation and synthesis. J. Biol. Chem. 270: 16615 – 16618 .

Mahdi, T. (2003): Effect of gamma irradiation on antinutritional factors in broad bean. Radia. Phyc. and Chem, 67 (3-4): 493-496.

Mclaughlin, W. L., Wenxiu, C; Jia, H. and Humphres, J.C. (1985): Response of Radio chromic film dosimeter to gamma rays in different atmospheres. Radiat. Phys. Chem., 25: 793-797.

Mrinal, P.; Amit, K.; Rajalakshmi, V. and Arun, S. (2010): Radiation processing and functional properties of soybean (Glycine max). J. Radiation physics and Chem., Vol., 490-494.

Nakano, D.; Itoh, C.; Ishii, F.; Kawanishi, H.; Takaoka, M.; Kiso, Y.; Tsuruoka, N.; Tanaka, T. and Matsumura. Y. (2003): Effect of sesamin on aortic oxidative stress and endothelial dysfunction in deoxycorticosterone acetate-salt hypertensive rats. Biol. Pharm. Bull., 26:1701-1750.

Noguchi, T.; Ikeda, K.; Sasaki, Y.; Yamamoto, J.; Seki, J.; Yamagata, k.; Nara, Y.; Hara, H.; Kakuta, H. and Yamori, Y. (2001): Effect of Vitamin E and sesamin on hypertension and cerebral thrombogenesis in strokeprone spontaneously rats. Hypertens Res., 24: 735-742.

Nutr. Sci. Vitaminol., 49:270-276.

Osman, N.N. (2002): Biochemical effects of feeding irradiated high and low fat diet in Rabbits, Ph. D Thesis, Biochem. Depart., Fac. of Science, Ain Shams Univ. Cairo, Egypt.

Reitman, S. and Frankel, S. (1957): Colorimetric method for the determination of alanine and aspartate aminotransferase Am. J. Clin. Path., 28:58.

Reshma M., Balachandran C., Arumughan C., Sunderasan A., Sukumaran D., Thomas S. and Saritha S. (2010): Extraction, separation and characterization of sesame oil lignan for nutracutical application. J. Food Chemistry Vol. 120, 1041-1046.

Richmond, W. (1973): Preparation and properties of the cholesterol oxidase from nacrodia sp. and its application to the enzymatic assay of total cholesterol in serum. Clin. Chem. 19: 1350-1355.

Roy, D.N. and Bhat, R.V. (1974): Trypsin inhibitor content in some Varieties of soy bean (Glycine, Max, L.) and sunflower seeds (Helianthus annuus, L.) J. Sci. Food Agric., 25:765.

SAS (Statistical Analysis System, 1989): SAS/STRT User's guide, release 3 Ed, SAS Institute, Cary NC, U S A.

Schmit, J.M.; Drevon, B. and Wilson, J.B. (1965): The sulfo-phosph-Vanillic reaction in the evaluation of the serum lipids and lipoprotein of the monky (Cynocephalus Babuin), comparison With human serum. Soc. Boil. Fill., 158: 778-780.

Seung, W, Min: K , Min H, Soo Y and Jaehwan L (2010): Effect of roasting conditions of sesame seeds on the oxidative stability of processed oil during thermal oxidation. J. Food. Chem. 122: 724.

Siddhurajer, P.; Makkar, H.P, S. and Becker, K. (2002): The effect of ionizing radiation on antinutritional factors and the nutritional value of plant materials with reference to human and animal food. Food Chem., 78 (2) : 187.

Suja k P, Jayalekshmy A and Arumughan C. (2004): Free radical scavenging behavior of antioxidant compounds of sesame (sesamum inelicum. L). J. Agric. Food Chem. 52: 912.

Swain, T. and Hillis, W.E. (1959): The quantitative analysis of phenolic. J. Sci. Food Agric., 10:36.

Takashi, I.; Lakshmikuttyamma, A.; Yoko, T.; Masayo, K.; Nobuhiro, F and Michihiro, S. (2001): Sesamin, a sesame lignan, decreases fatty acid syntyesis in rat liver accompanying the down- regulation of sterol regulatory element binding protein-1. Molecular and Cell Biol. of Lipids. 1534 (1) : 1-13.

Venkatesan, N.; Devaraj , S.N.; Devaraj, H.; (2003): Increasing binding of LDL and VLDL to apo B,E receptors of hepatic plasma membrane of rats treated with fibernat. European J. of Nut., 42: 262 – 271 .

Yusuf, A, Ayedun. H, and sanni, L. (2007): Chemical composition and functional properties of raw and roasted Nigerian benniseed (Sesamum indicum) and bambara groundnut (Vigna Subterranean). Food Chem. 118: 681.

دراسات غذائية وبيوكيميائية لبذور السمسم المعالجة بالحرارة الجافة والإشعاع

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**المركز القومي للبحوث وتكنولوجيا الإشعاع - هيئة الطاقة الذرية

أجريت هذه الدراسة بهدف تأثير الحرارة الجافة أو الإشعاع لبذور السمسم على المواد المعيقة للإستفادة من الغذاء و كذلك تقييم لبعض القياسات البيوكيميائية. حيث تم تعريض بذور السمسم للحرارة الجافة على درجة حرارة ١٨٠ °م لمدة ١٥ دقيقة والتعريض لأشعة جامة بجرعات ٢.٥ ، ٥ ، ١٠ كيلو جراي. كما تم تغذية ستة مجموعات من الجرذان (كل مجموعة ١٠ فئران) لمجموعات الغذاء المختبره (بذور السمسم الجافة ، المعرضة للحرارة الجافة ، المعرضة لجرعات الإشعاع بجانب المجموعة المغذاة على الكازين).

أو ضحت نتائج التحليل الإحصائي أن هناك نقص معنوى للمواد المعيقة للإستفادة من الغذاء لكل من متنبطات التربسين ، التنينات فيما لا توجد إختلافات معنوية في حالة المواد الفينولية. كما أوضحت التحاليل البيوكيميائية زيادة معنوية في البروتينات الكلية والألبيومين في الجرذان المغذاة على بذور السمسم المعرض للحرارة الجافة والإشعاع حتى ١٠ كيلو جراى مقارنة بالجرذان المغذاة على البذور الخام. وتبين من النتائج أنه لم يحدث تغيير معنوي في إنزيمات الكبد (ALT & AST) بالنسبة للجرذان المغذاة على البذور المعالجة بالحرارة مقارنة بتلك المغذاة على البذور الخام. بينما حدث نقص معنوي في هذه الإنزيمات للفئران المغذاة على بذور السمسم المعاملة بالإشعاع حتى ١٠ كيلو جراي مقارنة بتلك المغذاة على البذور الغير معالجة. كما أشارت النتائج أنه حدث نقص معنوي في مستوى الكوليسترول الكلى ، الجليسريدات الثلاثية والبروتين منخفض الكثافة بينما حدث زيادة في البروتين عالي الكثافة بالنسبة للجرذان المغذاة على بذور السمسم مقارنة بالجرذان المغذاة على البذور الخام.