Supplementationof Pan Bread with Some Cereals Gluten Free to Decrease Risk of Celiac Diseases

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Abstract: The present work was conducted to evaluate pan bread blends gluten-free that was obtained using *Nigella sativa*, sesame and white rice as potential healthy ingredients. The carboxymethyl cellulose and Arabic gum were added separately at levels 3.0 and 1.0 % to the blends as alternative gluten to equal weight levels 10, 20 and 30% from *Nigella sativa* and sesame plus 80, 60 and 40% rice mill to improve the nutrition value of gluten-free pan bread. Also, in the present work pan bread blends which were evaluated chemically, nutritionally and organoleptically properties, compared with control samples made from rice mill with carboxymethyl cellulose and Arabic gum were added separately at level 3.0 and 1.0 %. The results showed that the *Nigella sativa* and sesame had contained the highest protein, total fats, ash, crude fibers and minerals content compared with rice mill. Also, rice mill contained the highest of total carbohydrates. The sensory evaluation of pan bread showed that the highest score in pan bread blend made from equal weight of *Nigella sativa*and sesame at 10% and 20% plus 80% and 60% rice mill and 3.0% CMC as alternative gluten. The same prepared blends with 1.0% Arabic gum were very closely similar to the pan bread made from 3.0% CMC in all sensory evaluation. These results were paralleled with alkaline water retention capacity and specific volume in pan bread. It may be concluded and recommended that the pan bread prepared from equal weight of *Nigella sativa*and sesame at 10 and 20% levels with 3.0% CMC and 1.0% Arabic gum led to an acceptable quality and high nutrition value for manufacturing of bakery products for celiac patients.

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1. Introduction

New recent epidemiological data show that celiac disease (CD) is a common disease in the world. It's now understood to affect as many as 1:266 people worldwide. However, its symptoms are common to many other conditions and can range in severity. Celiac disease is often overlooked or misdiagnosed, often as irritable bowel syndrome, chronic fatigue syndrome or fibromyalgia. Consequently, individuals may remain undiagnosed and untreated for many years **(Saturni, 2010).**

Canadian Celiac Association and Dietitians of Canada (2009) noticed that the gluten-free diet (GFD) also reduces the risk of developing osteoporosis, reduced fertility, lymphoma and potentially other autoimmune disorders. Even if celiac patients are symptom free, they must follow the diet to reduce the risk of these long-term complications.

Nigella sativa seeds are extensively used as spice, condiment and aroma enhancer which can be added to tea, coffee, or breads. In addition, *Nigella sativa*seed may potentially be an important nutritional source of essential fatty acids sinceabout 84% of the fatty acids in the seedsare unsaturated fatty acids, predominantly linoleic and oleic acids **Caponio *et al.* (2008).** Moreover, Saudi Arabia *Nigella sativa*seeds contained 20.85% protein, 38.20% fat, 31.94% carbohydrates, 4.37% ash and 7.94% fiber. The mineral elements of iron, calcium, phosphorous, zinc, magnesium and potassium were 0.15, 0.04, 1.8, 0.06, 0.03 and 7.6 mg/ 100g respectively **(Qari, 2002).** While, **Randhawa (2008)** analyzed chemical constituents of Egyptian *Nigella sativa*and revealed that the protein, fat, carbohydrate, ash and fiber were 21.37–22.37%; 35.42-36.09%; 22.00–37.78%; 4.50-4.55% and 8.25-15.76% (g/100g dry weight), respectively. The mineral contents of iron, calcium, phosphorous, zinc, magnesium and potassium were 9.73–11.73; 133.80–298.70; 615.00–667.20; 0.50–6.80; 79.91-242.25 and 147.92-155.00 (mg/ 100g dry weight), respectively.

Sesame (*Sesamumindicum* L.) seeds have been grown in tropical regions throughout the world since prehistoric times. Sesame seed, a rich source of protein, is one of the first crops processed for oil production. Its non-culinary application includes its use as an ingredient in soap, cosmetics, lubricants and medicines. Sesame seeds also contain two unique substances: sesamin and sesamolin known to have a cholesterol lowering effect in humans and to prevent high blood pressure. The oil has wide medical and pharmaceutical applications. It is mildly laxative, emollient and demulcent **(Pal, 2010).** Moreover, sesame is a very old cultivated crop and there are many foods in which sesame is an ingredient. It's eaten raw or toasted and used in desserts such as candy and in baked products. Bread, breadsticks, cookies, chocolate, and ice cream are ideal products for toasted natural sesame seed. Sesame seed has high protein and it contain three times more calcium than a comparable measure of milk and it improves taste of the products, and it is also considered to be a beneficial food to health **(Randhawa, 2008).**

The seed is rich in protein and the protein has disable amino acid profile with good nutritional value similar to soybean. The chemical composition of sesame showed that the seed is an important source of oil (44-58%), protein (18-25%), carbohydrate (~13.5%) and ash (~5%) **(Borchani*et al.,* 2010).** Sesame seed is approximately 50 percent oil (out of which 35% is monounsaturated fatty acids and 44% polyunsaturated fatty acids) and 45 percent meal (out of which 20% is protein) **(Ghandhi, 2009).**

Gluten free starchy materials such as maize, rice and potato are usually used in the manufacturing of bread, pasta, biscuits using different combinations of thickening (guar gums and carboxymethyl cellulose) and particular food processing procedures different from the conventional ones **(Thompson, 1999).**

Gum is polymeric material that can be dissolved or dispersed in water to give thickening and/or a gelling effect. Among the leading materials in decreasing order of use in food are pectin's, gum Arabic, alginates, guar gum, carboxymethyl cellulose (CMC), carrgeenan, locust bean gum and modified starches. These gums have valuable properties and many commercial foods contain different amounts of gums. As they are not hydrolyzed by the human digestive enzymes they are classified under the term dietary fiber **(Selvendran, 1984).** The rheological properties of two varieties of rice with hydroxy propyl methyl cellulose (HPMC) added as gluten substitute were studied using a farinograph and a rheometer and compared with wheat dough to find its suitability for making rice bread **Sivaramakrishnan et al. (2004).**

The objective of the present study is to investigate the carboxymethyl cellulose and Arabic gum as alternative gluten at levels 3.0 and 1.0% with added separately tonigella sativa and sesame to equal weight 10, 20 and 30% to prepare pan bread, moreover chemical and nutritional were determined.

2.Material and Methods

Material:

Black cumin (*Nigella sativa*), sesame seeds (*Sesamumorientalel* L.) and white rice (*Oryza sativa* L.), were obtained from local market west zone in Saudi Arabia.

Arabic gum, broad bean hull and active dry yeast (Fermipan, Delft, Holland) were purchased from local market. Carboxymethyl cellulose (CMC) was prepared in a Laboratory from broad bean hull.

Methods:

Black cumin, sesame seeds and white rice were milled in a Laboratory Mill Junior to give a fine power to be used as a whole meal.

Chemical constituents of raw materials:

Protein, total fats, ash and crude fibers were determined in raw materials (*Nigella sativa*, sesame and white rice) according to the method outlined in **AOAC (2000).** Minerals contentof sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe) and zinc (Zn) were determined in the diluted solution of ash raw materials using the atomic absorption spectrophotometer (3300 Perkin-Elme) as described in **AOAC (2000)** method.

Identification of fatty acids content from sesame and nigella sativa:

The oil extracted from sesame and *Nigella sativa*using n-hexane (40-60) at room temperature for 48 h. The extracts were filtrated and evaporated according to **AOAC (2000).** Oil from sesame and *Nigella sativa*was saponified and methylated with diazomethane as detailed by **Vogel (1975).** Fatty acids content were identified using the Sigma 3B Gas Chromatography equipped with dual flame ionization detectors. The separation conditions are reported by **Farag *et al.* (1981).**

Preparation of carboxymethyl cellulose (CMC).

Broad bean hull were treated with sodium hydroxide solution at pH 8-10 for one hour at 100^{o}C. The mixture was washed while, the residue was bleached and the wet bleached residue was dried to give fiber cellulose according to the method described by **Inglett (1997).** Carboxymethyl cellulose was prepared according to **Abdel-Akher *et al.* (1966)** as follows; a mixture of the fiber cellulose sample (30 g) and sodium chloroacetate (13.5 g) was added followed by isopropanol (300 ml) to prevent dough formation. Sodium hydroxide solution (80%) was added gradually, and then neutralized with glacial acetic acid in methanol (1:9). The insoluble matter was washed followed by drying pressure.

Preparation of gluten-free pan bread in different blends.

The ingredients of raw materials(sesame, nigella sativa and white rice) were used in preparing ofpan bread blends gluten-free according to **Kent-Jones and Amos (1976).** The following blends were used as follows:

Control (1) made from 100% white rice and 3.0% CMC. Blend (1) prepared from 10% nigella sativa and 10% sesame plus 80% white rice with 3.0% CMC. Blend (2) prepared from 20% *Nigella sativa*and 20% sesame plus 60% white rice with 3.0% CMC. Blend (3) prepared from 30% *Nigella sativa* and 30% sesame plus 40% white rice with 3.0% CMC.

Control (2) made from 100% white rice and 1.0% Arabic gum. Blend (4), (5) and (6) were prepared according to obviously methods and 1.0% Arabic gum. Baking was carried out in an oven at210-230°C for a relatively short time (15-20 minutes). Pan bread was aerated at room temperature for at least 30 min. After baking and cooling the sensory evaluation was determined according to **AACC (2002)** by twenty experienced panelists from the staffs of Nutrition and Food Dept., Umm El-Qura Univ., Saudi Arabia.

Quality characteristics on pan bread:

The average of weight loaves was recorded after cooling and the loaf was measured by rapeseed displacement method as described by **AACC (2002).** Moreover, specific volume (cm^3/g) was calculated by dividing volume of the loaf by its weight according to **Colims *et al.*(1982).**

The staling of pan bread loaves was determined by alkaline water retention capacity according to **Kitterman and Rubenthaler (1971).**

Statistical analysis:

The data obtained were analyzed by using SPSS statistical software (version 13 SPSS Inc., Chicago. USA). Data were expressed as mean ± SD. Tested for significance using one-way analysis of variance "ANOVA" according to **(Armitage and Berry, 1987).**

3.Resultsand Discussion

Chemical compositions and minerals content of raw materials:

Chemical compositions and minerals contentwere determined in sesame, *Nigella sativa* and rice millon dry weight basis and the results are reported in Table (1). The following parameters in Table (1) indicated that the *Nigella sativa*and sesame had the highest content of protein (21.34 and 19.73%) and lipid (35.15 and 45.67%), followed by crude fiber (9.8 and 8.43%) compared with rice mill. Its mean, both sesame and *Nigella sativa* had the highest nutrimental values compared with other raw materials. From the same table it can be pointed out that white rice mill had the highest content of total carbohydrates (90.74%), and the lowest content of ash and crude fiber (0.38 and 0.84%). Sesame had the highest content of minerals Na, K, Ca, Mg, Fe and Zn (55, 488, 976,351, 14.55 and 7.75 mg/100g, respectively) followed by *Nigella sativa* had contained 32.2, 216, 193.5, 4.01, 9.7 and 2.73 mg/100g, respectively, compared with rice mill 12.3, 185.64, 32.39, 1.02, 4.5 and 2.3 mg/100g, respectively.

Dietary protein intake should represent about 15% of total calories. In gluten diet free the main dietary source of protein are animal foods such as meat, milk and dairy products, eggs and fish. Plant foods which are useful sources of protein include legumes, nuts, seeds and gluten free cereals **Gorinstein *et al.* (2004).**

Sesame seed (*Sesamumindicum* L.) is an oilseed with a chemical composition of about 50-52% oil, 17-19% protein and 16-18% carbohydrate **(Tunde-Akintunde and Akintunde, 2004).** Its seed contains about 42-54 % quality oil, 22-25 % protein, 20-25 % carbohydrates and 4-6% ash. Sesame seed contains antioxidants which inhibit the development of rancidity in the oil. In the food industry, where synthetic antioxidants are used extensively, there is an increasing demand for more of these natural products **(Bennet, 2011).** Sesame oil has been found to inhibit the growth of malignant melanoma *in vitro* and the proliferation of human colon cancer cells **(Smith and Salerno, 1992).** In the tissues beneath the skin, this oil neutralizes oxygen radicals. It penetrates into the skin quickly and enters the blood stream through the capillaries. Molecules of sesame seed oil maintain good cholesterol (high density lipoprotein, HDL) and lower bad cholesterol (lowdensity lipoprotein, LDL) **(Sirato-Yasumoto *et al.*, 2001).**

Rice, being one of the most produced and consumed cereals in the world, has an important role in the relation between the diet and health. Several compounds with antioxidant activity have been identified in rice, including phenolic compounds, tocopherols, tocotrienols and γ-oryzanol **(Iqbal *et al.*, 2005).** Rice contains potentially antioxidant compounds, notably in the outer layers of the grain. Significant quantities of vitamin E and γ- oryzanol can be extracted from rice **(Xu *et al.*, 2001).**

Table (1) Chemical analysis of raw materials (on dry weight basis).

Chemical composition	Rice mill	Sesame	*Nigella sativa*.
Protein	7.72	19.73	21.34
Total fat	0.68	45.67	35.15
Ash	0.38	4.45	4.47
Crude fiber	0.48	9.8	8.34
Total carbohydrates	90.74	20.35	30.7
Minerals mg/100g			
Na	12.30	55.00	32.20
K	185.64	488.0	216.5
Ca	32.39	975.0	193.5
Mg	1.20	351.0	4.01
Fe	4.51	14.55	9.70
Zn	2.30	7.75	2.73

Fatty acids contents in sesame and ***Nigella sativa*****:**

Fatty acids are vital to human health. Data presented in Table (2) pointed out the percent of fatty acids in raw materials. Sesame and *Nigella sativa* had the highest percentages of polyunsaturated fatty acids (linoleic) 43.80 and 55.50% and monounsaturated fatty acids (oleic) 40.30% and 25.10% respectively. The same raw materials had the lowest percentages of saturated fatty acids; the values were recorded 9.90% and 12.30% for palmitic acid and 4.80% and 3.50% for stearic acid in sesame and nigella sativa respectively, confirmed by **Caponio *et al.* (2008).**

The seed of *Nigella sativa*has over 100 different chemical components, including mucilage, crude fiber, reducing sugars, resins, alkaloids, flavonoids, organic acids, sterols, tannins and saponins, in addition to the high content of unsaturated fatty acids, especially linoleic acid (18:2) and oleic acid (18:1) and proteins. It also has yellowish volatile (essential) oil **(Gilani*et al.,* 2004).** It is known that the biological activity of nigella sativa seeds is attributed to its essential oil components **(Gorinstein *et al.,* 2004).**Total fat intake should represent about 25-30% or less of total calories. The intake of unsaturated fat (monounsaturated and polyunsaturated) should be preferred. Monounsaturated and polyunsaturated fatty acids should provide more than 15% and 10% of total calories, respectively (50% and 25% of total fat). In fact, monounsaturated fats and omega-3 fatty acids intake hasbeen associated with reduced cardiovascular disease risk **(Temple, 1996).**

Table (2): Percent of fatty acids content in sesame and nigella sativa.

Fatty acids %	Sesame	*Nigella sativa*
Palmitic 16:0	9.90	12.30
Stearic 18:0	4.80	3.50
Oleic 18:1	40.30	25.10
Linoleic 18:2	43.80	55.50
Linolenic 18:3	0.30	0.30
Arachidonic 20:4	0.4	0.30
Eicosadiemoic 20:5	-	2.30

Organoleptic evaluation of gluten-free pan bread:

Results in Tables (3 and 4) indicated that there are significant differences between various blends pan bread with 3.0 and 1.0% CMC and Arabic gum compared with control samples made from rice mill were added to themseparately3.0 and 1.0% CMC and Arabic gum. From the results it could be noticed that the addition of equal weight from negilla sativa and sesame at level 10% and 20% plus rice mill 80 and 60% exhibited very close sensory properties than equal weight 30% from *Nigella sativa*and sesame plus 40% rice millin blend.These data agree with **Zandonadi *et al.* (2009)** who found celiac patients are to develop appropriate recipes to fit within their dietary restriction, in addition, modified foods often have undesirable sensory characteristics**.**

Sensory characteristics can be affected by the efficiency of flavor ingredients in dough and its concentrations. In fact, *Nigella sativa*and sesame with CMC at 3.0 % was acceptable to most members regarding taste and odor, texture, color and general appearance when compared to control pan bread. On the contrary, pan bread supplemented with 1.0% Arabic gum with equal weight10 and 20% from *Nigella sativa* and sesame, led to a significant increasing showing the highest score in taste, odor, texture, color and general appearance when compared with control pan bread gluten-free. In fact, these changes in dough properties were greater using different concentrations of ingredients (sesame and *Nigella sativa*to rice mill) which caused significant differences for overall acceptability and had good acceptance to most members compared with control.

Nowaday there is an increasing interest toward the potential health benefits of medicinal plants. Commercially prepared gluten-free products are expensive and difficult to find. Products such as those used in this study allow patients to consume healthful and tasty products made at home and with low cost because gluten free ingredients, CMC and Arabic gum can be found in drugstores and markets at reasonable prices.

Improving and developing pan bread and other food options with various natural additives (*Nigella sativa* and sesame) are important in increasing the number of products available to help patients with celiac disease adhere to the gluten-free diet. At the same time, it could be concluded that gluten-free pan bread from native starchy flour (broken rice) can be produced with low cost and high quality.

Recent overwhelming attention to natural plants through nutrition education programs should be designed to inform the public about the effect of sesame or *Nigella sativa*at various concentrations incorporation in pan bread, and with different baked products on its quality and participating in decreasing the risk of celiac disease.

Effect of different blends with 3.0%CMC and 1.0% Arabic gum as alternative gluten on specific volume in pan bread.

Table (5) showed that the effect of CMC 3.0% and 1.0% Arabic gum as alternation gluten on pan bread prepared from equal weight of *Nigella sativa* and sesame at 10, 20 and 30% plus 80, 60 and 40% from rice mill. Pan bread produced from all concentration with CMC and Arabic gum were characterized by high weigh, low volume and low specific volume by increasing concentration. Meanwhile, control sample made from equal weight from *Nigella sativa*, sesame and rice mill with addition were the highest weigh

(154.77g) and the lowest loaf volume and specific volume (275 cm^3 and 1.78cm^3/g), respectively. One would rely these results due to the presence of high level of fiber on *Nigella sativa*and sesame. In this respect, **Chen et al. (1988)** reported that as the concentration of fiber material increased the bread weight increased and the loaf volume decreased.

Cereals are staple foods providing major sources of carbohydrates, proteins, B vitamins and minerals for the world's population. Cereals contain a range of substances which may have health promoting effects, these substances are often referred to as phytochemicals or plant bioactive substances **Goldberg (2003).**

Table (3): Organoleptic evaluation of pan bread gluten-freefortified with *Nigella sativa*, sesame andCMC 3.0% as alternative gluten.

Blends	Taste 20	Odor 20	Texture 15	Crust color 15	Crumb color 15	General appearance 15	Overall acceptability 100
Control(1)	17.10^c ±0.76	17.00^c ±0.79	12.35^c ±0.93	12.31^c ±0.64	12.18^c ±0.93	11.20^d ±0.63	82.14
Blend – 1	19.23^a ±0.88	19.00^a ±0.99	14.86^a ±0.47	14.61^a ±0.74	14.31^a ±0.15	14.79^a ±0.42	96.8
Blend – 2	19.15^a ±0.71	18.87^{ab} ±0.44	14.41^a ±0.06	13.12^{ab} ±0.85	12.45^c ±0.62	14.35^a ±0.16	92.35
Blend – 3	18.53^b ±0.55	18.00^b ±0.01	13.97^b ±0.01	12.14^b ±0.78	11.95^d ±0.31	13.71^b ±0.19	88.30

*The different letters is column refer to significant differences.

Table (4): Organoleptic evaluation of pan bread gluten-free fortified with nigella sativa, sesame and Arabic gum 1.0% as alternative gluten:

Blends	Taste 20	Odor 20	Texture 15	Crust color 15	Crumb color 15	General appearance 15	Overall acceptability 100
Control(2)	17.10^c ±0.76	17.00^c ±0.79	11.35^c ±0.93	12.31^c ±0.64	11.18^c ±0.93	11.20^{cd} ±0.63	80.14
Blend – 4	19.00^a ±0.81	18.97^a ±0.97	14.97^a ±0.28	14.51^a ±0.75	14.19^a ±0.07	14.78^a ±0.69	96.32
Blend – 5	18.95^a ±0.06	18.41^b ±0.39	14.23^a ±0.92	12.85^c ±0.78	12.12^c ±0.07	13.98^b ±0.66	90.54
Blend – 6	18.13^b ±0.06	17.82^{ab} ±0.33	13.54^b ±0.37	11.67^{cd} ±0.78	11.23^{cd} ±0.07	12.83^c ±0.45	85.21

Table (5) Effect of different blends with3.0%CMC and 1.0% Arabic gum as alternative gluten on specific volume of pan bread.

Blends	Weight (g)	Loaf volume (Cm^3)	Specific volume (Cm^3/g)_
Control (1)	154.77^a	275^b	1.78^b
Blend-1	143.49^b	430^a	2.99a
Blend-2	152.64^a	430^a	2.82^a
Blend-3	151.79^a	395^{ab}	2.60^{ab}
Control (2)	152.82^a	252^b	1.65$_b$
Blend-4	147.33^b	420^a	2.85^a
Blend-5	149.30^b	410^a	2.75^a
Blend-6	143.06^b	365^{ab}	2.55^{ab}

Effect of alkaline water retention capacity (AWRC%) on pan bread by adding 3.0% CMC and 1.0% Arabic gum as alternative gluten.

Alkaline water retention capacity test was carried out to determine the staling rate of pan bread prepared with sesame, *Nigella sativa* and rice mill at different levels whereas, CMC and Arabic gum were added as alternative gluten. The obtained data are reported in Table (6).From the results it could be noticed that the percent of alkaline water retention capacity (AWRC) in pan bread that contained equal weight from *Nigella sativa* and sesame plus rice mill and alternative gluten were decreased as time of storage increased. Thestaling pan bread in blends 1, 2, 4 and 5 gave the best staling rates. These results were agreement with **Kim and Appolonia (1977)** whoob served that high protein content often results in a lower staling rate. Protein affects the staling process in several ways. It influence the crystallization process of starch directly, and the distribution of water. During the storage of bread, the water content of the crust increased as a result of water transport from the crumb from about 45 to 32 %. Staling of crumb occurred without any change in water but texture and a loss of aroma **Czuchajowska and Pomeranz (1989). FAO/WHO (1990)** recommends the ingestion of 25-30 g/day of proteins for children aged 5 to 19 years old, which means that the consumption of 100g of any cookie produced would provide about 44% the daily recommended value for those consumers.

Other studies on gluten-free bread made from rice flour and potato starch have noted that a combination of CMC and MC derivatives produce bread with properties similar to those of bread made from wheat flour **(Ylimaki *et al.*, 1991).**

Table (6): Effect of alkaline water retention capacity (AWRC%) on pan bread added 3.0 % CMC and 1.0% Arabic gum as alternative gluten.

Blends	Zero time	After 24 hrs.	After 48 hrs.	After 72 hrs.
Control(1)	350[a]	290[b]	230[b]	170[b]
Blend-1	390[a]	370[a]	335[a]	285[a]
Blend-2	385[a]	345[a]	290[a]	225[a]
Blend-3	370[a]	325[a]	275[ab]	190[ab]
Control (2)	350[a]	290[b]	220[b]	150[b]
Blend-4	357[a]	330[a]	270[a]	230[a]
Blend-5	353[a]	320[a]	270[a]	200[a]
Blend-6	345[a]	285[b]	235[ab]	180[ab]

Commercially prepared gluten-free products are expensive and difficult to find. Products such as *Nigella sativa* and sesame were used in this study allow patients to consume healthful and tasty products made at home and with low cost. Therefore, it could be recommended that preparation of pan bread gluten free at equal volume 10 and 20% *Nigella sativa*and sesame to 80 and 60% rice mill with added separately 3.0% CMC and 1.0% Arabic gum gave an acceptable quality and high nutritional value products.

References

1. AACC. (2002). Approved method of American Association of cereal chemists Publ. by American Association of cereal chemists in St. Publ. Minnesota .U.S.A.
2. Abdel-Akher,M., Youssef, A. M. and Ahmed, A. I. (1966). Preparation of CMC with degree of substitution. Bull Fac. Of Agric., Cairo Univ., Vol. XVII, No., 2:351-359.
3. AOAC.(2000). Association of Official Analytical Chemist Official Methods of Analysis.17th ed., Washington, USA.
4. Armitage,P. and Berry,G. (1987).Statistical method in medical research. Blackwell, Oxford, UK, pp. 93–213.
5. Bennet, M. (2011). Sesame seed: A Handbook for Farmers and Investors. 29/08/11.Available at www.agmrc.org/media/cm/sesame_38F4324EE52CB.pdf
6. Borchani C., Besbes S., Blecker C. H. and Attia H. (2010). Chemical Characteristics and Oxidative Stability of Sesame Seed, Sesame Paste, and Olive Oils.J. Agric. Sci. andTechnol., 12: 585-596.
7. Canadian Celiac Association and Dietitians of Canada (2009). Gluten-Free Eating pp:1-11.
8. Caponio, F., Summo, C., Clodoveo, M. and Pasqualone, A. (2008). Evaluation of the nutritional quality of the lipid fraction of gluten-free biscuits. Euro. Food Res. Technol., 223, 135-139.
9. Chen, H., Rubenthaler, G. L. and Schanus, E. G. (1988). Effect of apple fiber and cellulose on the physical properties of wheat flour. J. Food Sci., 52:304-309.
10. Colims, J. L., Ralantari, S. M. and Post, A. R. (1982). Peanut hull flour as dietary fiber in wheat bread. J. Food Sci., 47:1899-1907.
11. Czuchajowska, Z. and Pomeranz, D. (1989). Differential scanning calorimeter, water activity, and moisture content in crumb center and near–crust zones of bread during storage. Cereal Chem., 66:305-309.
12. FAO / WHO.(1990). Protein quality evaluation. Report of Joint FAO / WHO Expert Consultation Food and Nutrition paper 51, Roma, Italy.
13. Farag,R., Shaban, A. and Sallam, H. (1981). Biochemical studies on some chemical characteristics of sliced Egyptian onion. J. Food Sci.,46:1394-1401.
14. Gandhi, A.P. (2009). Simplified process for the production of sesame seed (*Sesamumindicum* L) butter and its nutritional profile. Asian J. Food and Agro-Industry.2(01): 24-27
15. Gilani, A. H., Jabeen, Q. A. andUllah Khan, M. (2004).A review of medicinal uses and

pharmacological activities of *Nigella sativa*. Pak. J. Bi. Sci., 7 (4): 441-451.
16. Goldberg, G. (2003). Plants: Diet and Health. The Report of the British Nutrition Foundation Task Force. Blackwell, Oxford.
17. Gorinstein, S., Pawelzik, E., Delgado-Licon, E., Haruenkit, R., Weisz M. and
18. Hajhashemi, V., Ghannadi A, Jafarabadi H (2004). Black cumin seed essential oil, as a potent analgesic and antiinflammatory drug.Phytother. Res. 18(3): 195-199.
19. Inglett, G. E. (1997). Development of dietary fiber gel for calorie- reduced foods. Cereal Food World, 42(5):382-384.
20. Iqbal, S., Bhanger, M. I. and Anwar, F. (2005), Antioxidant properties and components of some commercially available varieties of rice bran in Pakistan. Food Chem., 93, 265-272.
21. Kent-Jones, D. and Amos,A.(1976).Modern cereal chemistry. 6th, ed. Food Trade Press, LTD., London, England, U. K.
22. Kim, S. K. and Appolonia, B. L. (1977).Bread staling studies .II Effect of protein content and storage temperature on the role of starch. J. Cereal Sci., 16;313.
23. Kitterman,J. S. and Rubenthaler, G. L. (1971). Assessing the quality of early generation wheat selection with the micro AWRC test. Cereal Sci., (16):313-322.
24. Pal, A. (2010).Nutritional, medicinal and industrial uses of sesame (*SesamumindicumL.*) seeds - An Overview.Agriculture Conspectus Scientifics. 75(4): 159-168.
25. Qari,F. (2002).Clinical presentation of adult celiac disease in Western Saudi Arabia Saudi. 23 (12): 1514-1517
26. Randhawa, M. (2008). Black seed, *Nigella Sativa*, Deserves more attention. J Ayub Med. Coll. Abbottabad, 20(2):1-2.
27. Saturni,L.; Ferretti,G. andBacchetti,T. (2010). The Gluten-Free Diet: Safety and Nutritional Quality Nutrients, 2, 16-34.
28. Selvendran, R. R. (1984). The plant cell wall as a source of dietary fiber: Chemistry and stracture. Am. J. Clin. Nutr., 39:320-337.
29. Sirato-Yasumoto S. M. J., Katsuta Y., Okuyama Y. and Takahashi Ide T. (2001).Effect of sesame seeds rich in sesamin and sesamolin on fatty acid oxidation in rat liver. J. Agri. Food Chem., 49: 2647-2651.
30. Sivaramakrishnan, H. P., Senge, B. and Chattopadhyay, P. K. (2004). Rheological properties of rice dough for making rice bread. J. Food Eng.,62 : 37–45
31. Smith D.E., Salerno J.W. (1992).Selective growth inhibition of a human malignant melanoma cell line by sesame oil *in vitro*. Stern A., Wuthrich B. (1998). Non-IgE mediated anaphylaxis to sesame. Allergy, 53: 325-326.
32. Temple, N. J. (1996). Dietary fats and coronary heart disease. Biomed. Pharmacother., 50: 261-268.
33. Thompson, T. (1999). Thiamin, riboflavin and niacin contents of the gluten free diet: is there cause for concern. J. Am. Diet. Assoc., 99(7):858-862.
34. Tunde-Akintunde, T. Y.and Akintunde, B.O. (2004). Some physical properties of Sesame seed. Biosystems Engineering, 88 (1), 127 – 129
35. Vogel,A. I. (1975).A textbook of practical organic chemistry 4th. Ed. Longman.
36. Xu, Z., Hua, N. and Godber, J. S. (2001). Antioxidant activity of tocopherols, tocotrienols, and gamma-oryzanol components from rice bran against cholesterol oxidation accelerated by 2, 20-azo bi (2-methylpropionamidine) dihydrochloride. J Agric Food Chem., 49: 2077-2081.
37. Ylimaki, G., Hawrysh, Z. J., Hardin, R. T. and Thomson, A. B. R. (1991).Response surface methodology in thedevelopment of rice flour yeast bread: Seneory evaluation. J. Food Sci., 56:751-755.
38. Zandonadi,R., Botelho,R. and Araújo,W. (2009). Psyllium as a Substitute for Gluten in Bread. J. Am. Diet. Assoc., 109: 1781 – 1784.

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