Egypt. J. Agric. Res., 77 (3), 1999.

EFFECT OF ADDING GUAVA SEEDS FLOUR ON THE QUALITY OF BALADY BREAD

SANDAK R.N AND AMAL A.A. EL-HOFI

Food Technology Research Institute, Agricultural Research Center, Giza, Egypt.

(Manuscript received 29 April, 1998)

Abstract

Guava seeds were milled and a part was defatted. Defatted and undefatted guava meal portions were used as substitute for wheat flour extracts (72% and 82%) to fortify the flour. Protein contents were determined and found in undefatted, defatted guava seeds, wheat flour extracts 72% and 82% to be 8.45%, 10.19%, 9.50% and 10.24% respectively.

Fiber determination showed that undefatted and defatted guava seeds contained 48.28% and 54.02% of fiber, while values were 0.7% and 1.38% for wheat flour extracts of 72% and 82%, respectively.

Oil content in guava seeds was 10.47% while it was 0.9% and 1.37% for 72% and 82% wheat flour extracts respectively.

Wheat flour extracts were blended with undefatted and defatted guava seed portions of 5%, 10% and 20%. The results indicated gradual increase in the chemical constituents of wheat flour extracts with increaseing the addition of undefatted and defatted guava seeds.

Guava seed oil as determined by G.L.C., indicated high percentage of unsaturated fatty acids amounting to 82.4% linoleic and oleic acids.

The rheological properties of the two flour extracts indicated that water absorption was lower for the 72% extraction flour than the 82% extraction. Adding defatted and undefatted guava seeds flour increased water absorption and stability, but dough weakening decreased. Supplementing wheat flour with 5% and 10% defatted and undefatted guava flour showed non significant effect on the quality of breed loaves, while adding 15% and 20% produced unsatisfactory bread.

INTRODUCTION

Guava (Psidium guajava) fruit is one of the richest sources in vitamin C, It contains four to ten times vitamin C more than citrus fruits. Guava seeds are round and pale yellowish brown in color and resemble white mustard seeds. Seeds represent 6-12% by weight of the whole fruit depending on size and variety of the fruit (Prased and Azeemoddin, 1994).

Egypt's production of guava fruits is 218.376 tons, 25% of which is consumed as fresh fruits, while the rest is processed into juice and jam and 17.000 tons fo seeds are wasted (Ministry of Agriculture, 1995).

Opute (1978) analyzed guava seed fat using thin layer and gas liquid chromatographic methods. The lipids were exclusively of neutral lipids, mostly triglycerides and represented 9.4% of the dry weight of the seeds. Seed fatty acids were palmetic 9.7% oleic 7.8%, stearic 3.4% and 79% linoleic acid.

Habib (1986) found that chloroform-methanol extracted lipids of guava seeds (washed, air dried and Finely ground) were 9.1% oil (dry weight basis). GLC analysis of methyl esters of fatty acids were palmetic 13.3%, stearic 11.1%, oleic 14.0% and linoleic 52.1%. Protein content of guava seed was 9.73% (dry weight basis). Qualitative and quantitative analysis of guava seed proteins revealed the presence of 15 amino acids.

Ibrahem and Badawy (1990) found that guava seeds contained 12.8% oil. Its physical and chemical properties were as follow refractive index 1.785, peroxide value 1.34 m.equiv./Kg oil, iodine value 111 and acid value 2.2. Fatty acid composition showed that palmetic acid was the major saturated 15.62% and lenoleic acid was the major unsaturated fatty acid 74.88%.

Prased and Azeemoddin (1994) studied the chemical composition of guava seed and found that, oil content, total protein, crude fiber and total ash were 16.0%, 7.6%, 61.4% and 0.93% respectively. Refractive index at 40^{o}C, acid, iodine value, saponification and unsapoification matter were 1.4772, 1.7, 134.0, 196 and 0.49, respectively. Fatty acids profile of the oil indicated the presence of palmatic 6.6% stearic 4.6% oleic 10.8 and 76.4% of linoleic.

Almana and Mahmoud (1994) reported that the breads containing 10% palm date seeds were better or similar to the corresponding wheat control concerning the sensory evaluation. Increasing of these additives caused a deterioration in bread color, flavor, odor, chewing uniformity and overall acceptability.

Bhattacharya *et al.*, (1994) studied the effect of incorporation of tamarind seed powder (TSP) into bread and biscutis on the product quality. Breads were prepared from wheat flour (control) and wheat flour + TSP blends (5, 10, 15 and 20%). Bread and biscuits containing up to 15% TSP in the flour blend were acceptable to a test panel.

Hafez (1996) suplemented two types of wheat flour extracts, 72% and 82% with defatted soy bean flour at levels of 5%, 10% and 15%. The rheological properties of the two flours indicated that water absorption was lower for the 72% extraction flour than the 82%. Adding deffatted soy bean flour increased stability and water absorption for the 72% and 82% extraction flours, but dough weakening decreased. Adding 5% defatted soy bean flour to wheat flour improved produced loaves quality, but addition of 15% defatted soy bean flour produced unsatisfactory bread.

MATERIALS AND METHODS

Materials

Guava seeds were obtained from Kaha Company for preserved foods, Kalubeia, Egypt. The seeds were washed, dried in an oven at 60°C and finally ground. The oil of guava seeds was extracted with n-hexane (B.P. 40-60 °C) for 48 hours and filtered. This process was repeated for 3 times using fresh solvent. The extracts were collected and evaporated at 50°C under vacuum. The defatted guava meal was spreaded on a tray and dried at 60°C for one hour to get rid of the solvent and sieved to obtain defatted guava meal. The defatted and undefatted guava seeds flour were added to wheat flour 72% and 82% exttracts at 5%, 10%, 15% and 20 levels, respectively.

Commercial wheat flour (72% and 82% extracts) were obtained from the Egyptian Ministry of Supply and Trade.

Methods

Chemical analysis

Protein, Oil, fiber and ash contents of both wheat flour, guava seeds flour (defatted and undefatted) and supplemented wheat flour extracts were determined according to the methods described by the AOAC (1990).

Determination of the physico-chemical characteristics and identificantion of fatty acids by GLC in guava seeds oil

Refractive index, acid, iodine, saponificaton, peroxide values and unsaponifiable matter were determined in guava seeds oil according to the AOAC (1990).

Oil was saponified aand the fatty acids were methylated using diazomethan as detailed by Vogel (1975).

Fatty acid methyl esters of the oil and authentic fatty acids were identified and determined using the sigma 3B gas chromatography equipped with dual flame ionization detectors. The separation conditions were exactly as reported by Farag *et al.*, (1981).

Rheological properties

Wheat flour formulas prepared by adding different levels of defatted and undefatted guava seeds meal (5, 10, 15 and 20%) were rheologically tested by farinograph. Farinograph parameters were determined according to the methods described in AACC (1985).

Baking of bread

The Bread was prepared as follows: 100 gm of wheat flour (72% or 82% extraction) the required amount of water, one gram of sodium chloride and one gram of compressed yeast were added and mixed. These mixtures were supplemented with different amounts of defatted and undefatted guava seed powder at 5%, 10%, 15% and 20% levels respectively and mixed for 25 min. Each dough was left for fermentation at 30^{o}C and 85% relative humidity (rh) for 15 min. After fermentation, the dough was divided into 150 gm for each piece. Dough pieces were molded on wooden trays previously covered with a thin layer of bran and left to ferment for 30 min. at the same previously mentioned Fermentation conditions. The fermented dough pieces were flattened to about 20 cm. diameter. The flattened loaves were proofed at 30^{o}C and 85% rh for one hours then backed at 400-500^{o}C for 1-2 min. Bread loaves were allowed to cool on racks for about one hour before evaluation.

Organolyptic properties

Bread loaves were evaluated for general appearance, separation of layers, roundness, distribution of crumb, crust color, taste and odor by using 12 experienced panelists.

RESULTS AND DISCUSSION

Chemical analysis

Chemical composition of the two wheat flour extractions, 72 and 82%, defatted and undefatted guava seed flours are presented in table 1. The results show that wheat flours are rich sours in carbohydrate (87.37% and 85.42%) for the two extraction floure 72% and 82% respectively. The 72% extraction flour had lower

content of protein, oil, fiber and ash compored to the 82% extraction. This difference may be due to the high bran in the 82% extraction. Undefatted and defatted guava seed flours are the richest in fiber; 48.28% and 54.02%, respectively. These seeds contained good percentages of total carbohydrates (30.61% and 31.14%) and protein (8.45% and 10.19%), respectively.

Guava seeds are good source of oil 10.47%. These results are nearly in agreement with the results obtained by Prasad and Azeemoddin, (1994).

Table 1. Chemical composition of wheat flour, undefatted and defatted guava seeds flour (on dry weight basis).

Chemical constituents %	Wheat flour extraction		Undefatted guava seeds flour %	Defatted guava seeds flour %
	72%	82%		
Protein	9.50	10.24	8.45	10.19
Oil	0.9	1.37	10.47	1.23
Fiber	0.7	1.38	48.28	54.02
Ash	0.65	1.04	1.19	1.42
Total carbohydrate	88.25	85.97	30.61	31.14

Chemical constituents of treated wheat flour extracts

Results in table 2 and 3 show the chemical composition of undefatted and defatted guava seeds flour added to the wheat flour 72 and 82% extractions at different levels of 5%, 10%, 15%, 20%, respectively. The results show that the addition of defatted guava seeds flour improved the nutritional value. Protein, Oil, fiber and ash contents gradually increased with incrasing the added percentage of defatted and undefatted guava seeds flour to both of the wheat flour extracts. Total carbohydrate showed opposite trend.

Physico-chemical characteristics of guava seeds oil

Table 4 show the physical and chemical properties of guava seed oil. Refractive index and iodine value are high (1.4767 and 123) which reflect high unsaturated fatty acids content of oil. Acid value is 1.95 which indictes no hydrolysis in the oil had occurred the peroxide value of the oil is 1.36 m equiv./Kg oil, which could be

Table 2. Chemical analysis of supplemented wheat flour extracts with different levels of undefatted guava seeds flour (g/100 g dry weight basis).

Chemical Component	Wheat flour, 72% extraction					Wheat flour, 82% extraction				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
Protein	9.50	9.93	10.51	11.01	11.43	10.24	10.65	11.07	11.45	11.98
Oil	0.9	1.41	1.89	2.97	2.97	1.37	1.86	2.1	2.48	3.02
Fiber	0.7	2.87	4.62	8.95	8.95	1.38	3.38	5.82	8.11	9.81
Ash	0.65	0.78	1.01	1.18	1.18	1.04	1.23	1.35	1.41	1.50
Total carbohydrate	88.25	85.01	78.37	82.95	82.95	85.97	79.47	76.56	79.47	73.69

Table 3. Chemical analysis of wheat flour containing defatted guava seeds flour (g/ 100 g dry weight basis).

Chemical Component	Wheat flour, 72% extraction					Wheat flour, 82% extraction				
	Control	5%	10%	15%	20%	Control	5%	10%	15%	20%
Protein	9.50	10.1	10.84	11.53	12.05	10.24	10.9	11.76	12.31	12.86
Oil	0.9	1.29	1.32	1.45	1.78	1.37	1.40	1.46	1.51	1.78
Fiber	0.7	3.91	5.76	8.74	10.67	1.38	4.39	6.81	9.75	12.17
Ash	0.65	0.95	1.15	1.22	1.37	1.04	1.33	1.47	1.54	1.61
Total carbohydrate	88.25	83.75	80.93	77.13	74.13	85.97	81.98	78.27	74.98	71.58

attributed to the differences in the storage conditions. The saponification value is 193 and low unsaponifiable matter 0.85 indicate that this oil is normal triglyceride. These results are in agreement with those reported by Habib (1986) and Ibrahim and Badawy (1990).

Table 4. Physico-chemical characteristics of guava seeds oil.

Characters	Results
Iodine value	123
Refractive index	1.4767
Acid value	1.95
Saponification value	193
Unsaponifible matter %	0.85
Peroxide value m.equ/Kg oil	1.36

Fatty acids of guava seeds oil

Data in table 5 represent the fatty acids content of guava oil. Palmatic and stearic acids are the dominated saturated fatty acids amounting 9.63% and 4.84%, respectively. Lenoleic acid achieved the major part of unsaturated fatty acids 71.13% which indicated that the oil is considered as a semi drying oil.

Guava seeds oil is a good source of linoleic acid. This oil may be used for nutritional advantage by blending with highly saturated edible oil to provide new oil used in modified nutritional values (Prasad and Azeemoodin, 1994).

Table 5. Fatty acid content of guava seeds oil.

Fatty acids	Fatty acids
Palmatic acid 16:0	9.63
Stearic acid 18:0	4.84
Oleic acid 18:1	11.27
Linoleic acid 18:2	71.13
Linolenic acid 18:3	---
S/Un.S.	0.1725

Rheological properties

Farinogram test

Tables 6 and 7 show the farinagram parameters of the 72 and 82% exraction

wheat flour doughs to which 5, 10, 15 and 20% of undefatted and defated Guava seed were aded.

Adedtion of guava seed flours to wheat flour increased the water absorption in both wheat flour extracts. This increase was due to high protein and fiber (Pomeranz 1988).

Arrival time and dough stability were higher with the increase of the portions of guava seeds flour added to wheat flour 72% and 82% extraction. This increase in dough stability was attributed to the increase in protein level which lead the dough to be more stable (El Farra *et al.*, 1982).

Weakening of the dough was improved by the increase of guava seeds flour supplemetion.

Baking of bread with undefatted guava seeds flour

With respect to Balady bread characteristic of organoliphic scores, data are given in Table 8. It may be seen that there was significant and considerable increase in all these characters for bread made of 72% extraction of flour. The 72% extraction flour exhibited the highest scores from all bread characteristics compared to 82% extraction. The bread made from 72% extraction of flour gave bread of good quality than bread made from 82% extraction flour.

Data presented in Table 9 and 10 show that adding guava seed meal with various levels caused significant effect on all bread characteristics when supplemented with 15% and 20% of guava seed powder.

Results indicated that adding 5% and 10% of guava seed powder being the most effective supplementation when added to wheat flour for baking bread.

Adding guava seed powder with high levels (15% and 20%) gave bread of low characteristics.

Baking of bread with defatted guava seeds flour

Concerning the effect of wheat flour extraction on balady bread properties, data indicate significant differences in all properties except roundness in Table 11.

The 72% extraction is significantly exhibiting the highest values of these properties compared to the other extraction, except roundness which had an insignificant difference.

Results in table 12 show that all balady bread backing characteristics were higher in bread backed from flour with no additives. Bread prepared with 5% guava seed flour was closely similar to the 100% wheat flour bread in most sensory evaluations i.e. appearance, separation of layers, crust color, taste and odor. Bread prepared with 5% and 10% of guava seed flour closely resembled the 100% wheat flour bread with respect to roundness of the bread. Differences in texture were significant in all guava seed flour additive levels.

Results of sensory quality evaluation show also that most organolyptic attributes of bread containing guava seed meal were not adversely affected by the addition of 10, 15 and /or 20% guava seed flour. However, panelists commented that bread containing 10%, 15% and 20% of guava seed powder received lower scores in all respects.

From the aforementioned result, it may be concluded that Balady bread with 5% of guava seed flour will produce bread with the same properties and acceptability as the control.

Regarding the effect of interaction between the wheat flour extraction with different guava seed flour levels, data presented in Table 13 indicate that appearance, separation of layers, texture, crust color and order showed significant differences for all treatments.

All baking characteristics of bread containing 5% guava seed flour have similar characteristics of bread prepared from 100% wheat flour.

Table 6. Farirogram parameters of wheat flour doughs as affected by the addition of undefatted guava seed flour.

Wheat flour extraction	addition level	Water absorption%	Arrival time (min.)	Dough stability (min)	Dough weakening (B.u.)
72%	Control	56.5	1.25	2.25	100
	5%	57.0	1.50	2.75	95
	10%	57.6	1.50	4.00	90
	15%	58.2	1.75	5.25	80
	20%	59.4	2.00	6.50	60
82%	Control	58.4	2.00	3.2	110
	5%	59.0	2.00	4.00	105
	10%	59.6	2.50	5.00	95
	15%	60.2	2.75	6.75	85
	20%	61.00	2.75	11.50	65

Table 7. Farirogram parameters of wheat flour doughs as affected by the addition of defatted guava seed flour.

Wheat flour extraction	addition level	Water absorption %	Arrival time (min.)	Dough stability (min)	Dough weakening (B.u.)
72%	Control	56.5	1.25	2.25	100
	5%	57.2	1.650	3.00	90
	10%	58.0	1.75	4.5	80
	15%	58.8	1.75	5.75	60
	20%	60.2	2.00	7.25	50
82%	Control	58.4	2.00	3.25	110
	5%	59.2	2.25	4.25	100
	10%	60.0	2.75	5.50	85
	15%	60.6	3.00	7.00	55
	20%	61.8	3.00	12.00	40

Table 8. Effect of flour extraction rate on the baking properties of balady bread.

flour Extraction rate %	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Taste (10)	Odor (10)
72	16.80	18.00	14.13	13.00	8.60	8.13
82	15.13	16.53	13.60	11.73	7.87	7.67
L.S.D. at 5%	0.62	0.41	0.33	0.42	0.40	0.35

Table 9. Effect of adding undefatted guava seed flour on the baking properties of balady bread.

Addition	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Crust color (10)	Taste (10)	Odor (10)
Zero (control)	19.67	20.00	15.00	15.00	9.33	10.0	10.0
5	19.00	20.00	15.00	14.67	10.00	10.00	10.00
10	17.50	18.83	14.17	13.33	9.17	90.00	8.50
15	13.00	15.17	12.83	10.67	7.17	6.67	6.17
20	10.67	12.33	12.33	8.17	5.50	4.50	4.83
L.S.D. at 5%	0.97	0.64	0.53	0.66	0.63	0.76	0.56

Table 10. Effect of interaction of undefatted guava seed flour and wheat flour extraction rates on the baking properties of Balady bread.

Wheat flour extraction rate	% of Addition of undefatted guava seed flour	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Crust color (10)	Taste (10)	Odor (10)
72% Extraction	Zero (control)	20.00	20.00	15.00	15.00	8.67	10.0	10.0
	5	19.67	20.00	15.00	15.00	10.00	10.00	10.00
	10	18.67	19.33	14.33	14.00	10.00	9.33	8.67
	15	14.00	16.67	13.33	12.00	8.00	7.33	6.67
	20	11.67	14.00	13.00	9.00	6.33	5.00	5.33
82% Extraction	Zero (control)	19.33	20.00	15.00	15.00	10.00	10.00	10.00
	5	18.33	20.00	15.00	14.33	10.00	10.00	10.00
	10	16.33	18.33	14.00	12.67	8.33	8.67	8.33
	15	12.00	13.67	12.33	9.33	6.33	6.00	6.67
	20	9.67	10.67	11.67	7.33	4.67	4.00	4.33
	L.S.D. at 5%	1.37	0.91	0.75	0.94	0.89	0.97	0.97

Table 11. Effect of wheat flour extration rate on baking properties of balady bread.

Extraction %	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Crust color (10)	Taste (10)	Odor (10)
72	17.0	17.27	14.33	12.53	8.33	8.33	8.87
82	16.07	16.07	14.27	11.67	7.87	7.87	8.40
L.S.D. at 5%	0.51	0.49	n.s	0.46	0.44	0.38	0.33

Table 12. Effect of adding deffated guava seed flour on baking properties of Balady bread.

Bread properties Guava seed flour	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Crust color (10)	Taste (10)	Odor (10)
Zero (control)	20.00	20.00	15.00	15.00	9.33	10.00	10.0
5	19.67	19.83	14.83	13.83	9.83	9.50	10.00
10	17.33	17.13	14.50	12.67	8.83	8.33	9.00
15	14.67	14.83	13.67	10.67	6.83	7.17	7.33
20	11.00	11.90	13.50	8.33	5.67	5.50	6.83
L.S.D. at 5%	0.81	0.77	0.59	0.73	0.78	0.60	0.50

Table 13. Effect of interaction between defatted guava seed flour and the flour extraction rate on baking properties of Balady bread.

	Addition	Appearance (20)	Separation of layer (20)	Rounndness (15)	Texture (15)	Crust color (10)	Taste (10)	Odor (10)
Extraction 72%	Zero (control)	20.00	20.00	15.00	15.00	8.67	10.00	10.0
	5	20.00	20.00	14.67	14.33	9.67	9.67	10.0
	10	18.00	18.00	14.67	13.00	10.00	8.67	9.33
	15	15.33	1367	13.67	11.33	7.33	7.67	7.67
	20	11.67	12.67	13.67	9.00	6.00	5.67	7.33
Extraction 82%	Zero (control)	20.00	20.00	15.00	15.00	10.00	10.00	10.0
	5	19.33	19.67	15.00	13.33	10.00	9.33	10.0
	10	16.67	16.33	14.33	12.33	7.67	8.00	8.67
	15	14.00	14.00	13.67	10.00	6.33	6.67	7.00
	20	10.33	10.33	13.33	7.67	5.33	5.33	6.33
	L.S.D. at 5%	1.11	1.09	n.s	1.03	0.95	n.s	0.64

REFERENCES

1. A.A.C.C. 1985. American Association of Cereal Chemists. Approved Methods, 11th Ed. st. Paul; Minn., U.S.A.

2 . Almana, H.A. and R.M. Mahmoud. 1994. Palm date seeds as an alternative source of dietary fiber in Saudi bread. Ecology of Food and Nutrition 32 (314) 261.

3 . A.O.A.C. 1990. Association of Official Analysis Chemists, Official Methods. 15th Ed. Washington, D.C, U.S.A.

4 . Bhattacharaya, S., S. Bal, R.K. Mukherjeeand S.Bhattacharaya. 1994. Studies on the characteristics of some products from tamarind (tamarindus indicaa) Kernel. J. Food Sic and Techn. 31 (5) 371.

5. El Farra, A.A., A. M. Khorshid, S.M.Mansour, A.N. Elisa and A.M. Galal, 1982. Studies on the possibility of supplementation of balady bread with various commercial soy products. 1st Egypt conf. on Bread Res., 9-23, Egypt.

6. Farag, R.S., A.H. Shaban and H.A. Sallam. 1981. Biochemical Studies on some chemical characteristics of sliced Egyptian onion. J. Food Sic., 46, 1394.

7. Habib, M.A. 1986. Studies on the lipid and protein composition of guava seeds (Psidium guajava). Food Chem., 22 (1), 7-16.

8. Hafez, S.A. 1996. Effect of adding defatted soy on the chemical composition and physical properties of bread. Egypt. J. Agric. Res. 74 (2), 409.

9. Ibrahim, A.A.M. and H.A.A. Badawy. 1990. Study on the evaluation of guava seed oil. Egypt. J. Appl. Sci., 5 (6), 332.

10. Ministry of Agriculture. 1995. The annual report of central department of agricultural economics, Cairo, Egypt.

11. Opute, F.I. 1978. The component fatty acids of psidium guajava seed fats. J. Sci. Food Agric. 29, 737.

12. Pomeranz, Y. 1988. Wheat chemistry and technology volume 2. Pub by American Association of Cereal Chemists, Inc., St. Paul, Minn. USA.

13. Prased, N.B.L. and G. Azeemoddin. 1994. Characteristics and composition of guava (Psidium guajava) seed and oil J.A.O.C.S. 71 (4), 454.

14. Vogel, A.I. 1975. A text book of practical organic chemistry 4th Ed. Longman.

تأثير إضافة بذور الجوافة على جودة الخبز البلدى

رأفت نجيب سندق ، أمال عبد الله الحوفى

قسم بحوث تكنولوجيا المحاصيل - معهد بحوث تكنولوجيا الأغذية -
مركز البحوث الزراعية - جيزة - مصر.

تم التعرف على التركيب الكيميائى لبذور الجوافة الكاملة والبذور منزوعة الزيت ونوعين من الاستخلاصى لدقيق القمح ٧٢٪ ، ٨٢٪ فكانت النتائج كالاتى :-

- تقارب نسب البروتين فى كل من بذور الجوافة الكاملة والبذور منزوعة الزيت واستخلاصي الدقيق (٨,٤٥ ٪ ، ١٠,١٩٪ ، ٩,٥٪ ، ١٠,٢٤٪) ارتفاع نسبة الألياف فى بذور الجوافة والبذور منزوعة الزيت (٤٨,٢٨٪ ، ٥٤,٠٢٪) مقارنة باستخلاصى الدقيق ووجد أن نسبة الزيت فى الجوافة هى ١٠,٤٧٪.

استخلاصات دقيق القمح عوملت ببذور الجوافة والبذور المنزوعة الزيت بنسب (٥٪ ، ١٠٪ ، ١٥٪، ٢٠٪) و تشير النتائج إلى ارتفاع تدريجى فى نسب المكونات بزيادة إضافة بذور الجوافة الكاملة والبذور منزوعة الزيت.

التركيب الكيميائى والطبيعى وتفريد الأحماض الدهنية لزيت بذور الجوافة يدل على انه مصدر جيد للزيت حيث انه مرتفع فى نسبة حامض اللينوليك والاوليبك.

الصفات الرريولوجية لاستخلاص القمح تشير إلى انخفاض امتصاص الماء فى الدقيق استخلاص ٧٢٪ مقارنة باستخلاص ٨٢٪ . و بإضافة دقيق بذور الجوافة ودقيق البذور منزوعة الزيت حدثت زيادة فى الامتصاص والثبات لاستخلاصات دقيق ٧٢٪، ٨٢٪ وقل ضعف العجين. بإضافة دقيق بذور الجوافة والبذور منزوعة الزيت بنسبة ٥٪، ١٠٪ لإستخلاص القمح كانت النتائج مقارنة لعينة (الكونترول) فى جودة المقارنة فى جودة الخبز ولكن إضافات ١٥٪ ، ٢٠٪ ، أحدثت انخفاضا ملوحظا فى جودة الخبز الناتج.