EFFECT OF ADDING DEFATTED SOY FLOUR ON THE CHEMICAL COMPOSITION AND PHYSICAL PROPERTIES OF BREAD

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Abstract

In this study two types of wheat flour extraction72% and 82% extraction flour were used, defatted soy flour was added to wheat att levels 5.10 and 15%. The rheological properties of the two flour indicated that water absorption was lower at 72% extraction flour than 82%. Adding defatted soy flour increased stability and water absorption at 72% and 82%, but weakening, was decreased. Addition of defatted soy flour decreased extensibility and increased resistance to extension. Adding 5% or 10% defatted soy flour to wheat flour improved produced loaves quality and 5% was better, but addition of 15% defatted soy flour produced unsatisfactory bread.

INTRODUCTION

It is well known that bread is the main diet for the Egyptians and for most of the third world people. It provides most of the required calories, and contributes 80% to 90% of the total calories intake. Ibrahim (1988) mentioned that commercial wheat flour and soybean contained 12.7 and 30.3% protein, 1.8 and 28.2% ether extract, 82.9 and 30.1% total carbohydrates, 0.9 and 8.21% crude fiber and 1.4 and 3.1% ash respectively. Mizrahi et al. (1967) studied the effect of soy protein isolates in

wheat bread on baking characteristics, acceptance and nutritive value. Results showed that soy proteins increased water absorption capacity of flour. Protein isolatesat levels up to 8% did not affect taste significantly. Increasing the percentage of soybean protein showed a high nutritive value of bread samples. Onymi and Lorenz (1978) showed that addition of 5% soy concentrate or soy isolate to wheat flour did not significantly change farinograph absorption, mixing time and proofing time of bread. Soy concentrate and isolate produced good quality bread especially when they were used at levels not exceeding 5%.

On the other hand, specific loaf volume of bread was generally depressed by increasing the amount of soy protein. Viacroze (1988) found that whole husk non-defatted soy bean was subjected to a dry extrusion process to eliminate antinutritional factors and ground to a flour which was blended with cereal flour (the blends containing 10-50% soy flour). The reasulting blended flour was rich in a wide range of nutrients, especially protein, it may be used for manufacture of pasta, bread or wide range of nutrients, especially protein, it may be used for manufacture of pasta, bread or wide range of other bakery products. The study is aimed to improve the quality of bread by adding defatted soy flour at different levels to wheat flour (72% and 82% extraction flour) and organolyptic properties of bread were also measured.

MATERIALS AND METHODS

Commercial wheat flour (82% and 72% extraction flour) was obtained from the Egyptian Ministry of Supply and Home Trade. Soybean {Glycine Max (L.), Merr.}. Clark variety was obtained from food legumes Dep. Field Crops Institute, Agricultural Research Center, Giza, Egypt. The seeds were cleaned and dried at 100 ^{o}C for 30 min then milled and defatted by hexane (40/60) for 24h. The obtained meal was spreaded on a tray and dried at 60 ^{o}C for one hour to get rid of the solvent and sieved to obtain soy flour. compressed yeast was obtained from Alexandria Company of Strach and Yeast, Egypt.

1. Chemical analysis

Moisture, ash, protein, reduced and non-reduced sugars and fat of either wheat flour or defatted soy flour were determined according to the methods outlined in A.O.A.C. (1975). Total hydrolyzable carbohydrate was determined according to the method described in Dubois *et al* (1956).

2. Rheological properties of wheat flour formula

Wheat flour formulas prepared at different concentrations of added defatted soy flour (5,10 and 15%) were rheologically tested by farinograph and exensograph. Farinograph and extensograph parameters were determined according to the methods described in A.A.C.C. (1970) .

3. Baking of bread

The bread was prepared as follows. To 100 gm of wheat flour (82% or 72% extraction flour), the required amount of water, 1 gm of sodium chloride, and 1 gm of compressed yeast were added and mixed. To this mixture different amounts of defatted soy flour, i.e. 5,10 and 15% were respectively added and mixed for 25 min. Each dough was left for fermentation at 30°C and 85% relative humidity (rh) for 15 min. After fermentation, the dough was divided into 150 gm for each piece. Dough pieces were moulded on wooden trays previously covered with a thin layer of bran and left to ferment for 15 min. at the same mentioned conditions. The fermented dough pieces were flattened to about 20 cm diameter. The flattened loaves were proofed at 30-35°C and 85% rh, for one h, then baked at 400-500°C for 1-2 min. Bread loaves were allowed to cool on racks for about one hour before evaluation.

4. Organolyptic properties of bread

Bread loaves were evaluated for general appearance, separation of layers, roundness, distribution of crumb, crust, color, taste and odor by using 12 experienced penalists. Weight of loaves were directly determined after baking and volume of bread was determined after toasting .

RESULTS AND DISCUSSION

Chemical analysis of wheat and defatted soy flour

Results in table 1 show that wheat flour at different extractions had differences in their main constituents. Flour of 72% extraction had lower content of crude protein, crude oil and ash. The results showed also that wheat flour is a rich source of carbohydrates (85.56 and 84.82%) for both extraction flour. The slight increase in protein content for wheat flour at extraction (82%) may be due to the presence of bran. Results also showed that defatted soy flour contained high amounts of protein and ash being 43.7 and 7.75%, respectively. The obtained results were in agreement with the findings of Pomeranze (1978) and Kassem (1982).

Table 1. Major Chemical constituents of wheat and defatted soy flour on dry matter.

Chemical constituents %	Wheat flour extraction		Defatted soy flour
	72%	82%	
Ash	0.53	1.2	3.75
Crude protein	9.81	10.54	49.70
Crude oil	1.10	1.32	3.83
Total hydrolyzable carbohydrate	85.56	84.82	35.25
Reducing sugar	0.89	0.92	1.58
Non reducing sugar	0.45	1.04	7.50

Effect of addition of defatted soy flour to wheat flour on chemical constituents

Defatted soy flour was separately added to wheat flour at concentrations of 5, 10, 15%. The data (Table 2) indicated that the addition of defatted soy flour increase all chemical composition of the mixed flour except the total carbohydrate. the addition of 5% defatted soy flour to wheat flour (72% extraction) caused an increase in protein content by 3.2%, while 10% and 15% addition caused an increase by 4.34 and 6.13%, respectively. On the other hand, the same amount of defatted soy flour increased protein content by of 2.8, 4.0 and 5.56%, respectively when added to wheat flour (82% extraction). Total hydrolyzable carbohydrate was decreased gradually by increasing the amount of defatted soy flour. The decrease in total hydrolyzable carbohdrate was 3.45. 5.0 and 6.3%, while it was 3.50, 4.82 and 7.0% for defatted soy flour added at the levels of 5,10 and 15%, respectively to wheat flour at the two extractions of 72% and 82%, respectively.

3. The rheological properties of wheat flour dough as affected by addition of defatted soybean flour

The effect of addition of defatted soy flour at 5,10 and 15% on the rheological properties of wheat dough was evaluated by using farinograph and extensograph.

Table 2. Individual mineral contents of wheat grains (Sakha 69 variety) treated with mineral mixtures. (mg/100 g dry weight basis).

Chemical constituents	72% Extraction flour				82% extraction flour			
	control	5%	10%	15%	control	5%	10%	15%
Ash	0.53	0.91	1.30	1.69	1.20	1.40	1.86	2.10
crude protein	9.81	13.00	14.14	15.93	10.54	13.33	14.53	16.10
crude oil	1.10	2.30	2.53	2.57	1.31	2.40	2.46	2.6
Total hydrolyzable carbohydrates	85.56	82.	80.55	78.65	84.82	71.33	80.00	77.83
Reducing sugar	0.89	0.97	1.03	1.09	0.92	1.03	1.07	1.14
Non-reducing sugar	0.45	1.35	2.92	3.73	1.04	1.55	2.63	2.71

A. Farinograph test

Table 3 shows the farinogram parameters of wheat flour as affected by different levels of defatted soy flour (5-10-15%). Addition of defatted soy flour to wheat flour dough increased water absorption values, the percentages of increase were 1.12, 2.8 and 3.9% for 5,10 adn 15% levels of defatted soy flour addition, respectively in case of wheat flour (extraction 72%), while it were 1.27, 2.36 and 3.6% for 82% extraction wheat flour. Such increase in water absorption was attributed to the increase in protein due to the addition of defatted soy flour as reported by El-Farra et al (1982). Results also showed that addition of defatted soy flour at all concentrations increased mixing time and dough stability compared with the control. This may be due to its protein content that absorbed more water (Pollock and Geddes, 1960; Resubatra et al., 1974).

Table 3. Farinogram parameters of wheat flour dough as affected by addition of defatted soy flour

Sample	% DSF*	Water absorption %	Mixing time min.	Dough stability min.	Dough weakening B.U.
72% ext.	control	53.5	1.00	1.25	100
	5%	54.1	1.25	1.25	90
	10%	55.0	1.50	1.25	80
	15%	55.6	1.50	1.75	60
82% ext.	control	55.0	2.00	1.25	80
	5%	55.7	2.25	2.25	75
	10%	56.3	2.50	2.75	50
	15%	57.0	3.00	12.00	30

* DSF = Defatted Soy Flour

Addition of defatted soy flour at 5,10 and 15% decreased the weakening of wheat flour dough. This indicates that addition of defatted soy flour at the studied concentrations improved the wheat flour dough characteristics and consequently strengthened the gluten network upon mixing. These results are in agreement with those reported by El-Farra et al. (1982) and Ibrahim (1988).

B- Extensograph test

Table 4 presents the extensogram parameters of wheat dough as affected by addition of defatted soy flour at 5,10 and 15% levels . Results for 72% extraction flour showed a decrease in dough energy when 5 or 10% defatted soy flour was incorporated in wheat flour dough, dough energy had the same values for control sample at 15% defatted soy flour addition to 72% wheat flour extraction. On the contrary, the energy was increased at 5 and 10% and was decreased at 15% defatted soy flour when the wheat flour of 82% extraction was used. This means that 5% defatted soy flour could be used as an improver when the 72% extraction wheat flour was used.

Table 4. Extensogram parameters of wheat flour dough as affected by addition of defatted soy flour:

e	% DSF	Energy	E (mm)	R (B.U)	R/E
72% ext.	control	100	124	530	4
	5%	98	115	560	5
	10%	94	101	686	7
	15%	100	104	664	6
82% ext.	control	86	87	685	8
	5%	101	98	720	7
	10%	99	95	730	8
	15%	76	69	750	10

control= 0 % DSF
E = Extensibilty (mm)
R = Resistance to extension (B.U)
R/E= proportional number

Addition of defatted soy flour at all concentrations decreased the extensibility (E) while increased resistance to extension (R) for both extractions of wheat flour (72 and 82%). Concerning the proportional number (R/E), the data given in table 4

revealed that addition of defatted soy flour decreased dough extensibilty (E) and increased dough resistance to extension (R); consequently, the proportional number increased at 72% extraction of wehat flour when defatted soy flour was added at all concentrations. On the other hand, addition of defatted soy flour at 10% had the same proportional number of control when 82% extraction wheat flour was used. Addition of 5% defatted soy flour to wheat flour caused decrease in the proportional number, while addition of 15% defatted soy flour resulted in high proportional number.

In this respect, it could be pointed out that when a dough is streched, the elongation results from elastic and viscous deformation. Consequently, if the dough is released after few seconds, the recovery could be only partial, the elastic deformation would disappear, but a non recoverable deformation will remain due to flour (Kent-sones and Amos 1967).

Organolypitc properties of bread

Results in table 5 showed that the loaves had almost the same weight (120 gm) for the two different extractions of wheat flour (72% and 82%) without defatted soy flour. The supplementation with defatted soy flour caused an increase in loaf weight compared to the control. This may be due to the defatted soy flour protein which caused an increase in water absorption. The addition of defatted soy flour caused a decrease in loaf volume at 10 and 15% while it caused an increase at 5% level in 72% extraction flour. In 82% extraction flour, the highest loaf volume was found at 10% defatted soy flour which was 903.33 Cm^3. The lowest loaf volume was found at 5% defatted soy flour (693.33 Cm^3), specific loaf volume (cm/g) had the similar trend of either loaf weight or loaf volume. The best was noticed at 5% supplementation of defatted soy flour at 72% and 82% extraction. The unsatisfactory odor was found at 15% supplementation for 72% and 82% extraction flour. These findings were in good agreement with the findings of Abdel-Naeim (1975) who mentioned that during baking process, the temperature of crust was increased to 150 ^oC and its moisture was decreased. Those conditions permit condensation reaction between the free amino groups and free reducing sugars forming aldhydes and ketons during the Strecker degradation and successive non-enzymatic reaction. The excellent taste was found at 5% supplementation with defatted soy flour, while the unsatisfactory taste was found at 15% defatted soy flour in both the bread baked from wheat flour at extraction 82% and 72%.

The texture of crumb was excellent for the bread baked from 72% and 82%.

The satisfactory texture of crumb was found at 5% adn 10% supplementation with defatted soy flour. Supplementation with defatted soy flour at all amounts caused. an excellent color of the bread. This may be due to the protein compounds and free amino acids which combine with the free sugars to produce the bread color.

Table 5. Baking characteristics and organoleptic properties of bread made from two extraction wheat flours and different levels of defatted soy flour.

Ext. of flours	72% Ext.				82% Ext.			
Concentration Characters (DSF)	control 0%	5%	10%	15%	control 0%	5%	10%	15%
Weight gm	121.00	132.00	130.0	131.00	120.0	128.33	128.33	131.66
Volume cm	740.00	1120.0	640.0	750.00	733.33	693.33	903.33	726.66
Specific volume (cm/gm)	6.12	8.48	4.92	4.35	6.11	5.40	7.04	5.52
Odor 40	35.66	39.66	34.66	21.33	34.33	39.66	34.00	24.00
Taste 40	38.33	40.00	35.66	34.00	35.33	40.00	35.00	29.66
Crust color 10	6.66	9.33	9.33	8.00	8.66	9.66	10.00	7.66

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تأثير تدعيم دقيق القمح بدقيق الصويا على التركيب الكيماوى والخواص الطبيعيه للخبز

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استخدم فى هذه الدراسه نوعين من الاستخلاص لدقيق القمح ٧٢٪ ، ٨٢٪ وتم اضافة دقيق الصويا منزوع الدهن الى الدقيق السابق بنسب (٥ ، ١٠ ، ١٥٪) وتم تقدير التركيب الكيماوى ومدى قابلية المنتج النهائى (الخبز) للمستهلك والخواص الطبيعيه.

دلت الاختبارات الريولوجيه لنوعى الدقيق استخلاص ٨٢٪ وكذلك مطاطيه الدقيق فى الاكستنوجراف للدقيق استخلاص ٧٢٪ اكبر منها فى الدقيق استخلاص ٧٢٪ ، ٨٢٪ وكذلك زادت نسبه الامتصاص وبالتالى قل الضعف، اما فى حاله الاكستنسوجراف فقد ادت اضافة دقيق الصويا منزوع الدهن بالنسب (٥ ، ١٠ ، ١٥٪) الى انخفاض المطاطيه وزيادة المرونه وكان لتدعيم دقيق القمح بدقيق الصويا منزوع الدهن تأثير على الصفات الحسيه للخبز حيث ان اضافة نسب ٥ ، ١٠ ٪ ادى الى تحسين جودة الخبز وكانت احسن النتائج عند اضافة ٥٪ دقيق صويا منزوع الدهن اما عند اضافة ١٥٪ حدث انخفاض فى جودة الخبز الناتج.