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PRODUCTION OF BALADY BREAD BY USING SOME IMPROVERS
BY

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ABSTRACT

In this study using wheat flour (82% extraction) and corn flour (97% extraction) to produce balady bread with some additives such as, defatted soybean flour, whey powder, skim milk powder, calcium diphosphate and calcium chloride. The defatted soybean flour was characterized by the highest content of crude protein (51.46%), while whey powder had the highest content of ash (8.41%), also, the value of potassium and sodium in whey powder was 2210 and 811 mg/100 g, respectively. The defatted soybean flour contained higher contents of manganese, iron, cupper and zinc. The addition of corn flour increased ether extract and ash contents for the mixture (80% wheat flour + 20% corn flour), also, it had higher content of all minerals except manganese and cupper compared with wheat flour only. Water absorption decreased in most treatments except T6 (80 g wheat flour + 20 g corn flour + 0.3 g calcium diphosphate + 0.3 g calcium chloride + 5 g defatted soybean flour + 2 g whey powder + 2 g skim milk powder). Stability dough produced from 80% wheat flour + 20% corn flour was 4 min. While it decreased in treatments prepared with the addition of calcium chloride. Concerning the resistance of dough extension, treatments which contained defatted soybean flour was higher than the other treatments. The addition of 20% corn flour to wheat flour affected quality parameters.

The improvers increased the percentage of protein for all samples of produced balady bread. The data revealed that a decrease in alkaline water retention capacity (AWRC) took place with the addition of corn flour and other additives. The different additives improved water retention and retarded stability of bread.

INTRODUCTION

Balady bread is one of the most important constituents of the Egyptian diet, and with increasing population, the importance of producing safe, whole some grains for the bread paramount was required.

Wheat (*Triticum aestivum*) is the world's most important cereal crop in terms of production and consumption (Shewry and Tatham, 1994). In recent years, major advancement was taken place in baking technology and changing food habits.

Bread is a product with great nutriational value, consumed world wide. In order to extend its shelf life, either different recipe formulations or specific storage conditions can apply (Mandala and Kostaropoulos, 2007).

Wheat is one of the major cereal crops a longside maize and rice, which dominate world agriculture and is widely used in food processing as a raw material. It is the properties of the gluten protein conferring viscoelastic properties in doughs and in turn allowing a wide range of foods to be produced such as pasta, bread, noodles and others. A great deal of scientific literature has been derived over many years, on the analysis and properties of wheat gluten protein (Shewry and Lookhart, 2004).

Bread staling has been extensively studied because of its importance in determining product acceptability and shelf life. Studies on staling have mainly concerned starch modification and starch retrogardation during bread storage and more interactions occur between starch and gluten when starch granules are more swollen (Gabrietla *et al.*, 1997).

Khorshid *et al.* (1996) found that the chemical composition of corn flour was 12.63, 9.17, 4.32, 2.36, 2.27 and 70.75% for moisture content, protein, fat, ash, crude fiber and starch, respectively.

Khalil (1998) analyzed the defatted soybean protein isolate and found that it contained 4.98% moisture, 86.77% protein, 1.47% fiber, 0.17% fat, 3.24% ash and 3.37% total carbohydrate.

The chemical composition of sweet whey powder was protein content 9.76%, fat 0.80%, ash 6.47, carbohydrate 82.97% (on dry weight basis) and moisture content 4.4% Mourad (2002).

Zahran and El-Tawil (2001) mentioned that chemical composition of the skim milk powder for moisture, protein, lipids, ash and carbohydrates were 3.89, 35.08, 1.34, 8.70 and 54.81%, respectively.

Abd El-Hamid (2002) found that, minerals content of commercial wheat flour were Mg 30.2, Na 4.51, Zn 0.89, Mn 0.33, Fe 2.46, Ca 34.2, K 160.3 and Cu 0.40 mg/100 g flour.

Abd El-Moutaleb *et al.* (2002) reported that minerals content of corn flour were Mg 94, Zn 4.0, Mn 0.075, Fe 3.20, Ca 7.95 and Cu 0.352 (mg/100 g).

Saied (2002) found that minerals content of defatted soybean flour were 274 Ca, 46 Mg, 800 P, 8.07 Mn, 1.21 Zn and 0.304 Cu mg/100 g.

Ghanem (1993) found that water absorption ranged between 55 and 65%, dough development time ranged between 2.0 and 3.5 min, dough stability time ranged between 4.5 to 12.0 min and dough weakening values ranged between 40 and 90 BU.

Morad *et al.* (1980) studied the effect of supplement wheat flour with defatted soybean flour on its characteristics. They observed that increase in water absorption was more pronounced with defatted soybean flour supplementation.

Calcium salts were used at 0.05% concentration with medium protein flour and 0.25% calcium propionate or calcium phosphate to retard molding. After packaging the bread was stored at room temperature for 5 days without spoilage (Farvili *et al.*, 1995).

Souzan and El-Azab (2000) showed that, the falling number of wheat flour (82%) was 374, while falling number of corn flour was 487.

Balady bread made with 100% wheat flour (control) was compared with samples in which maize flour was added. Moisture contents of bread containing maize flour were lower than control, while, protein content decreased slightly. General appearance, chewing characteristics and taste of bread were all increased by addition of maize flour. Bread color, texture, volume and fermentation properties were similar in all cases (Ramadan, 1986).

Abou El-Ez (2003) found that, the balady bread made from 100% wheat flour (82% ext. rate) contained 178.05 Na, 157.11 K, 175.30 P, 30.25 Ca, 150.66 Mg, 1.87 Mn, 1.75 Fe, 0.81 Zn and 0.54 Cu mg/100 g. While, balady bread made from 79% wheat flour (82% ext. rate) + 20% white corn flour + 1% fenugreek flour contained 225.73 Na, 247.90 K, 225.30 P, 45.03 Ca, 241.27 Mg, 1.47 Mn, 3.14 Fe, 2.65 Zn and 0.85 Cu mg/100 g

Bakery products have a very short shelf-life and their quality is dependant on the period of time between baking and consumption. During storage, a decrease in bread freshness parallel to an increase in crumb hardness produces a loss of consumer acceptance known as staling (Hebeda *et al.*, 1990).

The aim of this study is testing of some improvers to produce balady bread was had good quality and choose the best improver. Also to study the effects of those improvers on rheological properties for dough and on chemical composition, organoleptic evaluation, and staling of balady bread produced from their blends prepared with those improvers.

MATERIALS AND METHODS

Materials:

During the year of 2007 the foillowiung material were obtained

- Wheat flour (82% extraction rate) was obtained from Middle and West Delta Mills Company Benha Mills.
- Corn flour (97% exaction rate) was obtained from Middle and West Delta Company Benha Mills.
- Defatted soybean flour was obtained from Soy Products Factory, Food Technology Research Institute, Agricultural Research Center, Giza.
- Sweet whey powder was obtained from Arab Dairy Company, Cairo, Egypt.
- Skim milk powder was obtained from Misr for Milk Products, El-Amerya, Cairo, Egypt.
- Calcium diphosphate and calcium chloride were obtained from El-Gomhoria Chemical Company, Cairo, Egypt.
- Activated compressed yeast was obtained form the local market in Benha.
- Salt (sodium chloride) was obtained form the local market.

Pre-mix preparation:

A pre-mix from wheat flour (82% extraction) and corn flour (97% extraction) was prepared by blending 80 : 20, respectively.

Defatted soybean flour, sweet whey powder, skim milk powder, calcium diphosphate and calcium chloride were added to the blends of wheat and corn flours (80:20) as indicated in Table (A), to produce balady bread.

Table (A): The percentages of flour mixtures and different additives for making balady bread.

Treatments	Wheat flour (82% ext.)	Corn flour (97% ext.)	Chemical additives		Food additives		
			Calcium diphosphate (g)	Calcium chloride (g)	Defatted soybean flour (g)	Whey powder (g)	Skim milk powder (g)
Control 1 (C1)	100	-	-	-	-	-	-
Control 2 (C2)	80	20	-	-	-	-	-
T1	80	20	0.3	-	-	-	-
T2	80	20	-	0.3	-	-	-
T3	80	20	-	-	5	-	-
T4	80	20	-	-	-	2	-
T5	80	20	-	-	-	-	2
T6	80	20	0.3	0.3	5	2	2

Methods:

Moisture, ash, crude protein, ether extract contents were determined according to the methods in A.O.A.C. (2000). Carbohydrates content were calculated by difference.

Minerals:

Sodium (Na), magnesium (Mg), zinc (Zn), iron (Fe), copper (Cu), calcium (Ca), potassium (K) and manganese (Mn) contents were determined after ashing by using the Pevkin-Elmer 2365 Atomic Absorption Spectrophotometer (Germany) as described in A.O.A.C. (2000).

Rheological measurements of dough formula:

Rheological measurements before baking for the flour pre-mix (flour + additives) were carried out with farinograph, extensorgraph and falling number tests.

Farinograph and extensograph were used to study water hydration and mixing characteristics of dough investigation (Barabender OGH Dvisburg, Germany) the following parameters were taken from the farinograph as described in the A.A.C.C. (2002).

Falling number defined as time in seconds required to stir and allow stirrer to fall a measured distance through a hot flour gel undergoing liquefication. This method is based on the unique ability of α-amylase to liquefy a starch gel. Falling number according to A.A.C.C. (56-81B) (2002) was performed at the Egyptian Center for Bread Technology Giza, Egypt.

Falling time was calculated according to Kent-Jones and Amos (1967) and Shouk (1996).

Falling time = Falling number – 60

Liquefaction number is calculated as follow:

$$\text{Liquefaction No.} = \frac{6000}{\text{Falling No.} - 50}$$

Baking techniques:

Balady bread was prepared as formula in Table (A) by mixing each 1 kg flour with other ingredients including 1.5% compressed yeast, 1.5% sodium chloride and 700 ml water. The mixture was well mixed in mixer (250 rpm) for 20 min. The dough was left for fermentation at 30°C and 85% relative humidity for 15 min. After fermentation, the dough was divided into 160 g pieces. Each piece was moulded on a wooden board previously covered with a fine layer of bran and left to ferment 15 min at the same mentioned temperature and relative humidity. The fermented dough pieces were flattened to about 20 cm diameter. The flat loaves were proofed at 380-400°C for 1-2 min, electric oven. Bread loaves were allowed to cool at room temperature before organoleptic evaluation (Yaseen, 1985).

Staling rate:

Staling rate of the balady bread was determined during 48 h of storage at room temperature using the following method:

Moisture content for bread in two steps in the fresh and air dried portions was determined according to A.A.C.C. method (2002) daily for two days.

Alkaline water retention capacity:

Loaves freshness of each formula was tested by alkaline water retention capacity (AWRC) according to method of Yomazaki (1953), as modified by Kitterman and Rubenthaler (1971):

Organoleptic evaluation:

Balady bread samples were evaluated for the following characteristics: taste, texture, crumb distribution, odor, appearance, crust color, roundness, separation of layers and overall acceptability (Mousa *et al.*, 1979).

Statistical analysis:

The obtained results for sensory evaluation of produced balady bread were statistically analyzed by analysis of variance (ANOVA) followed by multiple comparisons applying least significant difference (LSD) according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

4.1. Chemical composition of raw materials:

Wheat flour (82% extraction rate), corn flour (97% extraction rate), blend of 80% wheat flour plus 20% corn flour, defatted soybean flour, whey powder and skim milk powder were analyzed for their chemical composition.

Data in Table (1) indicated that, the addition of corn flour to wheat flour increased ether extract and ash fiber content from 2.61

and 1.36% for wheat flour to 3.36, and 1.41% (on dry weight basis) for the mixture of 80% wheat flour + 20% corn flour, respectively. While, it was 13.89, 14.12 and 81.62% for moisture, crude protein and total available carbohydrates of wheat flour compared with 13.60, 13.68 and 81.55% for the mixture of 80% wheat flour and 20% corn flour, respectively.

Also, in the same table, the defatted soybean had the highest contents of protein (51.46%). Whey powder and skim milk contained 13.71 and 36.98% of protein, respectively (on dry weight basis).

Defatted soybean flour, whey and skim milk powders contained ash 6.74, 8.41 and 7.89%, respectively (on dry weight basis)

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These results are in agreement with finding of Ramadan (1986), Mohsen *et al.* (1997), Seleem (2000), Farag (2003) and Mohy El-Din (2004).

4.2. Minerals content in raw materials:

Data in Table (2) show the minerals content of raw materials. Whey powder contained the highest value of potassium (2210.00 mg/100 g) and sodium (811.00 mg/100 g) (on wet weight basis), while, had lower content from iron.

Also, data in the same table, showed that, the defatted soybean flour contained higher contents of manganese, iron, cupper and zinc. Skim milk powder contained higher contents of magnesium, calcium and phosphorus. Wheat flour had lower contents of these minerals compared with defatted soybean and skim milk.

Also, 80% wheat flour + 20% corn flour had higher content of all minerals except manganese (0.09 mg/100 g) and cupper (0.21 mg/100 g) compared with wheat flour without additives.

These results are in agreement with Abd El-Moutaleb (2001).

4.3. Rheological measurements of dough formula:

The rheological properties of dough have an immediate impact on functionality of dough, therefore, it may be used as reliable predictors of its behavior during the baking process as well as the quality of the final product.

4.3.1. Farinograph parameters:

Data in Table (3) and illustrated Fig. (1) showed that, the water absorption of wheat flour [control 1 (C1)] was 56.2%, while it was 54.5% for 80% wheat flour + 20% corn flour [control 2 (C2)].

The arrival time, dough development, dough stability and degree of weakening were not affected in (T6) compared with wheat flour (C1). While, in (T3), the sample contained chemical additives and food additives increased in water absorption (55.7%), arrival time (2.5 min), dough development (3.0 min) and dough stability (4.5 min) compared with 54.5 for 80% wheat flour + 20% corn flour. Also, from the same table, it could be observed that, the stability of (T2) was 2.5, 3., 3.0, 3, 1.5 and 3 min, respectively, compared with (C2) 4 min.

Water absorption decreased in most treatments except (T3) and (T6) compared with (C2).

Also, from the same table it could be noticed that, stability of dough produced from 80% wheat flour + 20% corn flour was 4 min, while it decreased in treatment prepared with additive calcium chloride. While, (T4) had also decreased in water absorption (49.5%). The water absorption of the sample (T3) was 55.7%. Arrival time of sample (T3) was 2.5 min, while it was 1.0 min for samples (T1) and (T5). Dough development time of sample (T5) was 1.5 min.

These results are in agreement with Zakharava and Kazakov (1970).

Table (1): Chemical composition of raw materials (mean±SD).

Raw materials	Moisture %	Total protein* %	Ether extract* %	Ash* %	Total carbohydrates*@ %
Wheat flour (82% ext.) (WF)	13.89±0.03	14.12±0.02	2.61±0.01	1.36±0.01	81.91±0.03
Corn flour (97% ext.) (CF)	12.41±0.06	11.99±0.02	6.31±0.02	1.58±0.01	80.12±0.02
80% WF + 20% CF	13.60±0.04	13.68±0.05	3.36±0.02	1.41±0.02	81.55±0.03
Defatted soybean flour (DSF)	6.68±0.04	51.46±0.03	4.02±0.03	6.74±0.02	37.78±0.04
Whey powder (WP)	4.49±0.05	13.71±0.03	1.16±0.01	8.41±0.03	76.72±0.02
Skim milk powder (SMP)	4.10±0.03	36.98±0.02	1.08±0.01	7.89±0.03	54.05±0.03

* On dry weight basis. @: Carbohydrate calculated by difference.

Table (2): Minerals content of raw materials (mg/100 g on wet weight basis).

Raw materials	K	Mg	Ca	Na	P	Mn	Fe	Cu	Zn
Wheat flour (82% ext.) (WF)	121.51	117.22	17.78	23.27	144.18	0.09	1.20	0.22	0.08
Corn flour (97% ext.) (CF)	205.26	174.43	18.46	38.26	280.13	0.08	3.90	0.83	3.08
80% WF + 20% CF	136.21	128.10	18.10	26.31	169.11	0.09	1.43	0.21	0.10
Defatted soybean flour (DSF)	136.89	214.46	179.56	37.26	203.66	3.86	19.34	3.71	8.33
Whey powder (WP)	2210.00	212.00	87.00	811.00	862.00	0.21	0.45	0.12	0.23
Skim milk powder (SMP)	1550.00	252.00	1290.00	557.00	1020.00	0.32	0.62	0.21	0.17

Table (3): Farinograph characteristics of dough as affected by added different additives.

Sample	Water absorption %	Arrival time (min)	Dough development (min)	Dough stability (min)	Degree of weakening (B.U.)
C1	56.2	1.5	2.0	4.0	140
C2	54.5	1.0	2.0	4.0	130
T1	53.5	1.0	1.5	4.0	130
T2	53.8	1.5	2.0	3.0	160
T3	55.7	2.5	3.0	4.5	100
T4	49.5	1.5	2.0	4.0	120
T5	52.0	1.0	1.5	4.0	140
T6	56.6	1.5	2.0	3.5	40

4.3.2. Extensograph parameters:

Data in Table (4) and illustrated Fig. (2) show the effect of different additives added to wheat flour on extensograph parameters. From these results, it could be observed that, the extensibility (E) of dough produced from 80% wheat flour + 20% corn flour (C2) was decreased compared with dough produced from 100% wheat flour, also decreased in most treatments to which defatted soybean flour was added compared with (C2). These results are very close to the results reported by Hafez (1996) and Abdel-Moutaleb (2001).

Table (4): Extensograph characteristics of dough as affected by added different additives.

Sample	Resistance to extension (B.U.)	Extensibility (min)	Proportional number (R/E)	Energy (cm^2)
C1	140	125	1.2	26
C2	140	90	1.6	18
T1	130	100	1.2	17
T2	140	80	1.8	14
T3	320	55	5.8	28
T4	180	120	1.5	26
T5	230	105	2.2	29
T6	250	25	10.0	6

C1: Control (1) [100% wheat flour]
C2: Control (2) [80% wheat flour + 20% corn flour]
T1: C2 + CD **T2:** C2 + CC **T3:** C2 + DSF **T4:** C2 + WP
T5: C2 + SMP **T6:** C2+ CD + CC + DSF + WP + SMP
CD: Calcium diphosphate (0.3 g) **CC:** Calcium Chloride (0.3 g)
DSF: Defatted soybean flour (5.0 g) **WP:** Whey powder (2.0 g)
SMP: Skim milk powder (2.0 g)

Concerning the resistance to extension (R) of dough, most treatments which contained defatted soybean flour were higher (R). This may be due to the induction of more hydrogen bonds in gluten-carbohydrate complex of dough, which reinforces the dough resistance. These results are in agreement with those reported by (Hafez, 1996).

In the same time, the proportional number (R/E) of dough increased with adding different improvers except T1.

Energy values of dough prepared from different treatments were decreased compared with energy values of dough produced from 100% wheat flour except T3, T4 and T5 because no calcium salts were added to these treatments (Table, 4).

4.3.3. Falling number:

Data in Table (5) show that, the addition of corn flour to wheat flour decreased the falling number value and falling time compared with wheat flour. It was 280 sec for wheat flour, while it was 275 sec for sample of wheat + corn flour. The falling time was 220 sec for wheat flour while, it was 215 sec for the sample of 80% wheat flour + 20% corn flour.

The data of liquefication number was increased by adding corn flour to wheat flour from 26.09 to 26.66%. This means that, the addition of corn flour increased the amylolytic activity of the dough.

These results are in agreement with findings of Seleem (2000) who found that addition of corn flour lead to decrease of falling number from 285 to 280 sec. This reduction was increased by increasing the addition of corn flour from 5 to 20%. Also, Farag (2003) and Mohy El-Din (2004) found that, the addition of corn flour lead to decrease falling number.

Data in Table (5) show that the addition of defatted soybean flour slightly decreased falling number of sample (T3), while, the addition of calcium salts (diphosphate or chloride) increased falling number.

4.4. Chemical composition of balady bread:

Data in Table (6) show the chemical composition of the produced balady bread. It was observed that, of control balady bread (C1) contained 38.89±0.02% moisture, crude protein 17.08±0.02%, ether extract 1.67± 0.02%, ash 5.45±0.02% and total carbohydrate 75.80±0.02% for (C1), while, moisture content was 38.11±0.03%, crude protein 16.50±0.01%, ether extract 2.20±0.03%, ash 6.04±0.02% and total carbohydrate 75.26± 0.02% for (C2).

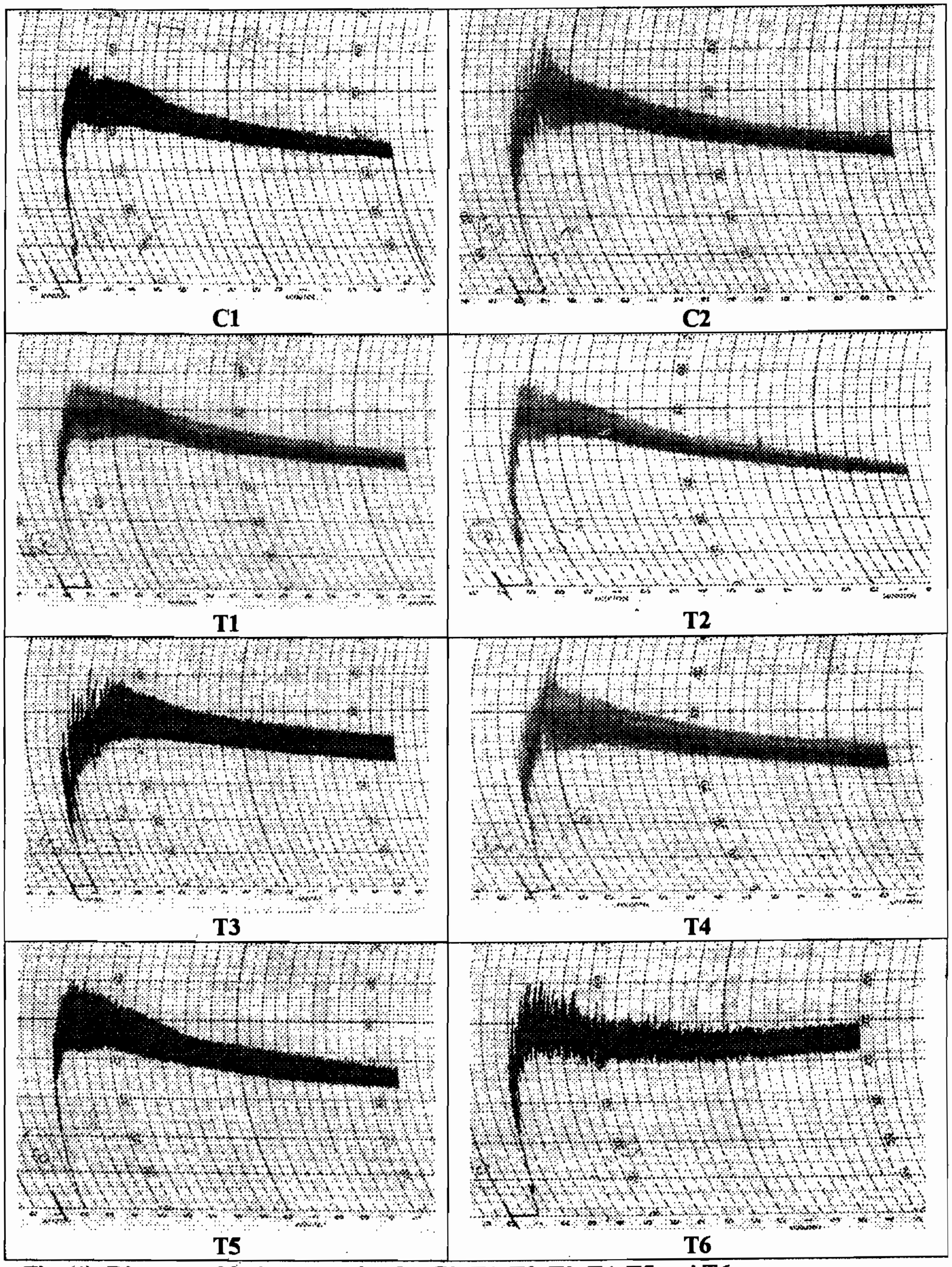

Fig. (1): Diagram of farinograph for C1, C2, T1, T2, T3, T4, T5 and T6

C1: Control (1) (100% wheat flour) **C2:** Control (2) (80% wheat flour + 20% corn flour)
T1: C2 + CD **T2:** C2 + CC **T3:** C2 + DSF **T4:** C2+ WP **T5:** C2 + SMP
T6: C2 + CD + CC + DSF + WP + SMP **CD:** Calcium diphosphate (0.3 g)
CC: Calcium Chloride (0.3 g) **DSF:** Defatted soybean flour (5.0 g)
WP: Whey powder (2.0 g) **SMP:** Skim milk powder (2.0 g)

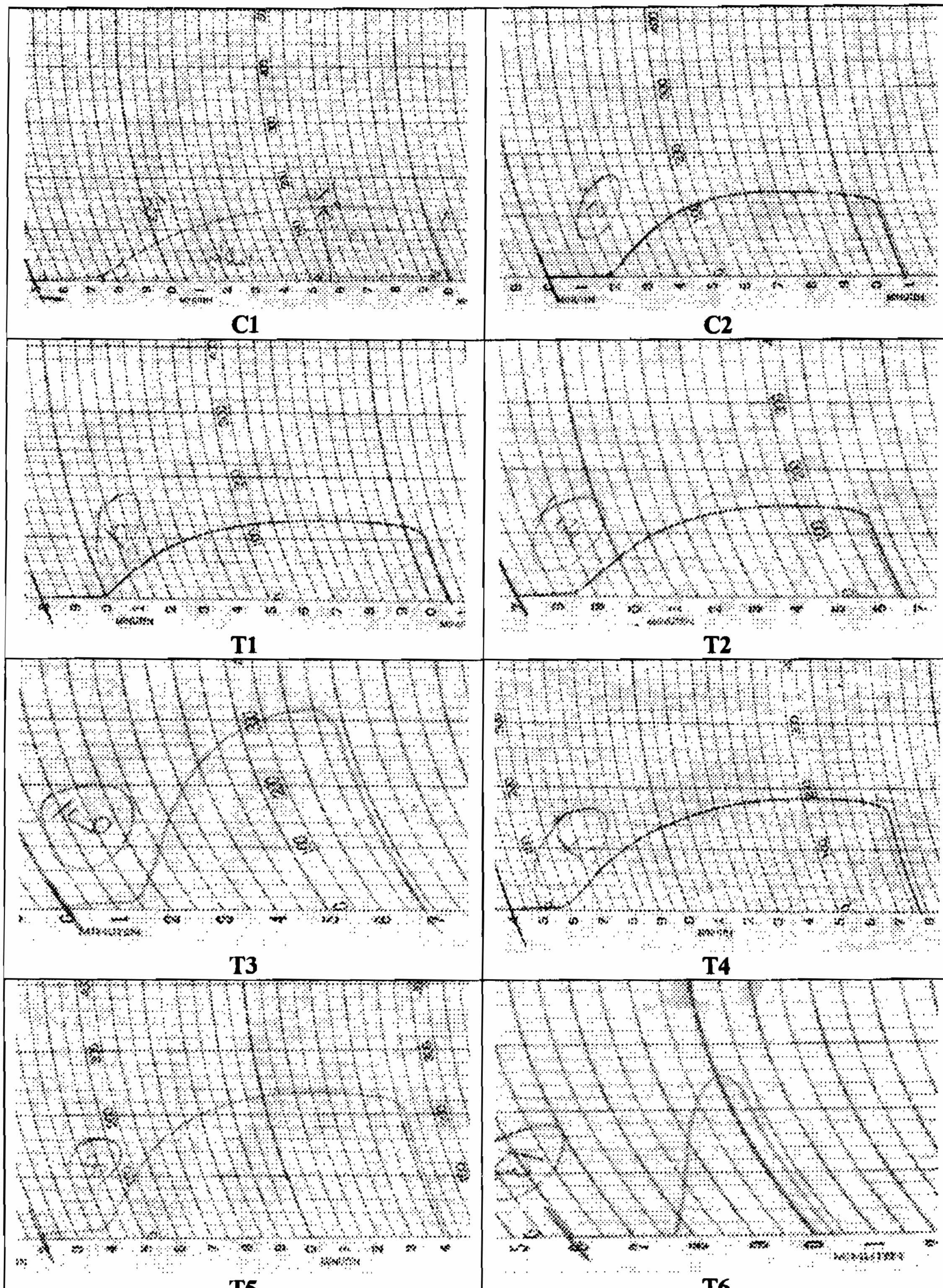

Fig. (2): Diagram of extensograph for C1, C2, T1, T2, T3, T4, T5 and T6

C1: Control (1) (100% wheat flour) **C2:** Control (2) (80% wheat flour + 20% corn flour)

T1: C2 + CD **T2:** C2 + CC **T3**: C2 + DSF **T4:** C2+ WP **T5:** C2 + SMP

T6: C2 + CD + CC + DSF + WP + SMP **CD:** Calcium diphosphate (0.3 g)

CC: Calcium Chloride (0.3 g) **DSF:** Defatted soybean flour (5.0 g)

WP: Whey powder (2.0 g) **SMP:** Skim milk powder (2.0 g)

Table (5): Falling number, falling time and liquefaction number of wheat flour 82% extraction rate with different additives.

Samples	Falling number (F.N.)	Falling Time (F.T.)	Liquefaction number (L.N.)
C1	280	220	26.09
C2	275	215	26.66
T1	301	241	23.90
T2	306	246	23.44
T3	273	213	26.90
T4	273	213	26.90
T5	251	191	29.85
T6	246	186	30.61

Table (6): Chemical composition of producing balady bread from wheat flour and different additives (mean±SD).

Treatments	Moisture %	Total protein* %	Ether extract* %	Ash* %	Total carbohydrate*@ %
C1	38.89±0.02	17.08±0.02	1.67±0.02	5.45±0.02	75.80±0.02
C2	38.11±0.03	16.50±0.01	2.20±0.03	6.04±0.00	75.26±0.02
T1	38.13±0.02	16.50±0.01	2.20±0.03	6.26±0.02	75.04±0.02
T2	38.13±0.03	16.50±0.03	2.20±0.01	6.37±0.03	74.93±0.02
T3	38.16±0.02	17.92±0.01	2.23±0.03	6.65±0.03	73.21±0.03
T4	38.38±0.37	16.68±0.03	2.20±0.02	6.26±0.03	74.86±0.03
T5	38.18±0.03	17.24±0.02	2.20±0.01	6.20±0.00	74.36±0.03
T6	38.24±0.02	18.83±0.03	2.27±0.02	6.85±0.02	72.05±0.04
LSD at 5%	**0.16**	**0.50**	**0.05**	**0.03**	**0.04**

* On dry weight basis. @: Carbohydrate calculated by difference.
C1: Control (1) [100% wheat flour]
C2: Control (2) [80% wheat flour + 20% corn flour]
T1: C2 + CD **T2:** C2 + CC **T3:** C2 + DSF **T4:** C2 + WP
T5: C2 + SMP **T6:** C2+ CD + CC + DSF + WP + SMP
CD: Calcium diphosphate (0.3 g) **CC:** Calcium Chloride (0.3 g)
DSF: Defatted soybean flour (5.0 g) **WP:** Whey powder (2.0 g)
SMP: Skim milk powder (2.0 g)

The addition of 20% of corn flour increased ether extract, ash and crude fiber of bread, while, it decreased the moisture and crude protein contents.

These results are in agreement with that mentioned by Ramadan (1986), Mohsen *et al.* (1997) and Seleem (2000).

Also, data in the same table show the addition of different improvers to have affected moisture content of balady bread.

Data in the same table showed, significant difference in moisture content in all treatments compared with (C1). It had also significant difference compared with (C2) except sample (T2) which had significant difference with (C2).

The improvers increased the percentage of protein for all samples. Crude protein content of bread produced from (C2) was decreased compared with that produced from (C1).

Ether extract content of all bread treatments had no significant difference compared with C2, while ash content and crude fiber had significant difference in all treatments compared with (C1) or (C2). Finally, total carbohydrate decreased with the additions of different additives.

4.5. Minerals content of the produced balady bread:

Data in Table (7) show that the addition of 20% corn flour to 80% wheat flour caused an increase in all minerals content except Mn which was decreased. The sample of bread produced from wheat flour (C1) had 0.07 mg/100 g of Zn, while, it was 2.59 mg/100 g for bread produced from 80% wheat flour + 20% corn flour (C2).

Bread of (T6) had the highest content of K, Mg, Ca, P, Mn, Fe, Cu and Zn compared with (C2) and other treatments. This may be due to the content of defatted soybean flour, whey powder and skim milk additives.

Most treatments of bread showed higher content of minerals. This may be due to the addition of different additives.

4.6. Organoleptic evaluation of balady bread produced from wheat flour and different additives:

Data in Table (8) show that, the addition of 20% corn flour had an effect on the quality parameters of bread than that produced by using wheat flour without additives (C1).

Organoleptic evaluation of balady bread produced from wheat flour and different additives (Table, 8) showed significant differences between bread of C1 and C2. It was 7.76% and 7.31%, respectively.

On the other hand, taste, texture, crumb distribution, odor, appearance, crust color, roundness, separation of players and overall acceptability were 15.7, 12.4, 12.4, 7.6, 7.8, 7.5, 4.5, 3.8 and 7.8, respectively, for bread produced from wheat flour. While, bread produced from 80% wheat flour plus 20% corn flour improved texture (12.5) and odor (7.7) compared with bread produced from 100% wheat flour (C1).

Crust color of bread of T4 had higher score than that of bread (C2). It was 6.69 for bread (C2), while it was 7.50 for bread of (T4). This may be due to the lactose of whey powder and milk powder, which interacts with amino acid of defatted soybean flour.

Data in Table (8) indicated that (C1) was significantly better than (C2) in taste and overall acceptability. No significant difference in the other characteristics was noted between (C1) and (C2).

These results are in agreement with Hegazy (2002).

4.7. Staling of balady bread produced from wheat flour with different additives:

4.7.1. Alkaline water retention capacity (AWRC):

Data in Table (9) show the alkaline water retention capacity (AWRC) of balady bread produced from wheat flour with different additives at zero, 24, 48 and 72 hr after baking. The data revealed that a decrease in AWRC took with different additives added to the flour. This decrease in AWRC retarded staling compared to control.

From the same Table, it could be observed that, the rate of AWRC of bread produced from 80% wheat flour + 20% corn flour after 8 hrs was lower comparing with the rate of AWRC of balady wheat bread (C1). The rate of decrease for bread produced by using T2 was 11.02%, while, the rate of decrease for balady wheat bread (C1) was 4.01%. After 24 hr, the rate of AWRC of bread of (T2) was 21.30% compared with 15.09% of bread (C1).

Alkaline water retention capacity (AWRC) is a simple and quick test to follow staling of bread. From the alkaline water retention capacity which reflect the swelling power of the starch granules and in other words staling or retrogradation. It could be concluded that, the presence of slight amounts of oil delayed the staling and improved somewhat the freshness of the produced baked products.

Table (7): Minerals content of produced balady bread from wheat flour and different additives (mg/100 g) (mean±SD) (on wet weight basis).

Treatments	K	Mg	Ca	Na	P	Mn	Fe	Cu	Zn
C1	151.33	144.77	27.86	169.17	171.23	1.63	1.63	0.46	0.07
C2	238.45	234.65	41.37	217.42	222.56	1.38	2.98	0.82	2.59
T1	238.45	234.65	56.37	217.42	237.56	1.38	2.98	0.82	2.59
T2	238.45	234.65	71.37	217.42	222.56	1.38	2.98	0.82	2.59
T3	245.30	245.37	50.35	219.28	232.74	1.57	3.95	1.01	3.00
T4	282.65	238.89	43.11	233.64	239.80	1.42	3.07	0.84	2.64
T5	269.45	239.69	67.17	228.56	242.96	1.42	3.04	0.86	2.62
T6	320.50	254.65	122.89	246.22	285.38	1.65	4.10	1.07	3.08

Table (8): Sensory evaluation of produced balady bread from wheat flour and different additives (mean±SD).

Treat-ments	Taste (20)	Texture (15)	Crumb distribu-tion (15)	Odor (10)	Appea-rance (10)	Crust color (9)	Round-ness (6)	Separation of layers (5)	Overall accepta-bility (10)
C1	15.7±1.07	12.4±1.06	12.4±0.73	7.6±0.66	7.8±1.39	7.5±0.59	4.5±0.46	3.8±0.51	7.8±0.45
C2	13.7±1.72	12.5±1.09	11.7±0.67	7.7±0.56	7.3±0.89	6.7±0.56	4.4±0.59	3.4±0.41	6.4±0.39
T1	16.6±0.67	12.8±0.62	12.5±0.52	7.8±1.06	7.8±0.75	7.1±1.00	4.3±0.65	3.5±0.52	7.3±0.33
T2	18.0±0.43	13.7±0.49	13.3±0.45	8.2±0.72	8.2±0.58	7.8±0.45	4.5±0.67	4.1±0.51	7.6±0.17
T3	16.0±1.48	12.4±0.51	12.6±0.90	7.6±1.24	7.2±0.39	6.8±0.83	3.9±0.90	3.5±0.52	7.0±0.57
T4	17.3±1.60	12.5±1.31	12.2±1.85	8.4±0.79	8.1±0.67	7.5±1.17	4.7±0.89	4.2±0.58	7.5±0.65
T5	17.0±0.95	13.0±0.74	13.3±0.45	7.9±0.67	7.7±0.65	7.2±0.83	4.5±0.67	3.9±0.67	7.4±0.33
T6	15.3±2.34	12.4±1.51	12.3±1.36	7.7±1.44	7.8±1.19	7.0±1.13	4.5±1.09	3.8±0.62	7.7±0.81
LSD 5%	1.38	1.07	1.16	0.85	0.93	0.92	0.75	0.52	0.51

C1: Control (1) [100% wheat flour]
C2: Control (2) [80% wheat flour + 20% corn flour]
T1: C2 + CD **T2:** C2 + CC **T3:** C2 + DSF **T4:** C2 + WP
T5: C2 + SMP **T6:** C2+ CD + CC + DSF + WP + SMP
CD: Calcium diphosphate (0.3 g) **CC:** Calcium Chloride (0.3 g)
DSF: Defatted soybean flour (5.0 g) **WP:** Whey powder (2.0 g)
SMP: Skim milk powder (2.0 g)

From the same table, the alkaline water retention capacity as swelling power (S.P.) of balady bread stored at zero, 8, 24, 48 and 72 hrs after baking are also shown. The data revealed that a decrease in AWRC took place with the addition of corn flour and other additives.

The addition of defatted soybean and dried skim milk increased the staling period compared with control bread (C2) and the other bread treatments. This may be due to crystallization of amylose after baking processing during bread storage. These results are in agreement with those of Khorshid *et al.* (1996) and Salah (2005).

The same table show that (C1) is the best when compared to (C2). This may be due to the higher percentage of adding corn flour. After zero time all samples increased in AWRC than that of (C2). This is due to the effect of defatted soybean flour, whey powder and skim milk powder.

The loss of freshness of control was 31.82 and for control 2 was 43.49. The results of freshness of all samples are better than that of C2 (Table, 9). The best sample in freshness was T6. This is may be due to the addition of defatted soybean flour, skim milk powder and whey powder.

The rate of decrease in moisture content was lower in all bread treatments compared with bread C2. The different additives increased moisture retention of bread samples and retarded staling.

These results are in agreement with Seleem (2000), Hegazy (2002) and Mohy El-Din (2004).

Table (9): Alkaline water retention capacity (AWRC) of producing balady bread from wheat flour (82% ext. rate) with different additives.

Treatments	Storage period (hr)								
	AWRC after zero time	After 8 hr		After 24 hr		After 48 hr		After 72 hr	
		AWRC (%)	Rate of decrease (%)	AWRC (%)	Rate of decrease (%)	AWRC (%)	Rate of decrease (%)	AWRC (%)	Rate of decrease (%)
C1	418.71	401.90	-4.01	355.49	-15.09	302.13	-27.84	285.48	-31.82
C2	386.54	332.17	-14.07	284.59	-26.38	237.92	-38.45	217.60	-43.71
T1	368.73	330.01	-10.50	293.39	-20.43	268.65	-27.14	256.37	-30.47
T2	357.18	317.81	-11.02	281.10	-21.30	261.17	-26.88	244.34	-31.59
T3	387.00	355.49	-8.14	309.67	-19.98	285.18	-26.31	277.78	-28.22
T4	395.12	353.03	-10.65	308.32	-21.97	294.48	-25.47	272.00	-31.16
T5	387.10	352.26	-9.00	315.37	-18.53	301.24	-22.18	285.83	-26.16
T6	411.37	390.40	-5.10	364.30	-11.44	313.09	-23.89	307.37	-25.28

C1: Control (1) [100% wheat flour]
C2: Control (2) [80% wheat flour + 20% corn flour]
T1: C2 + CD **T2:** C2 + CC **T3:** C2 + DSF **T4:** C2 + WP
T5: C2 + SMP **T6:** C2+ CD + CC + DSF + WP + SMP
CD: Calcium diphosphate (0.3 g) **CC:** Calcium Chloride (0.3 g)
DSF: Defatted soybean flour (5.0 g) **WP:** Whey powder (2.0 g)
SMP: Skim milk powder (2.0 g

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إنتاج خبز بلدى باستخدام بعض المحسنات

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في هذه الدراسة تم استخدام دقيق القمح (استخراج ٨٢ ٪) ودقيق الذرة (استخراج ٩٧٪) لانتاج الخبز البلدى مع بعض الإضافات مثل: دقيق فول الصويا منزوع الدهن، ومسحوق الشرش، ومسحوق لبن الفرز، ثنائى فوسفات الكالسيوم وكلوريد الكالسيوم. تميز دقيق فول الصويا منزوع الدهن بأعلى محتوى من البروتين الخام (٥١,٤٦ ٪) ، في حين أن مسحوق الشرش كان أعلى فى محتوى الرماد (٨,٤١ ٪) ، وأيضا مسحوق اللبن الفرز احتوى على قيم من البوتاسيوم والصوديوم ٢٢١٠ و ٨١١ مجم/١٠٠ جم، على التوالي. دقيق فول الصويا منزوع الدهن كان أعلى فى محتواه من المنجنيز والحديد والزنك والنحاس. أدت إضافة دقيق الذرة إلى زيادة نسبة المستخلص الأثيرى والرماد لمخلوط الدقيق (٨٠٪ من دقيق القمح + ٢٠٪ دقيق ذرة)، وأيضا كان أعلى فى محتواه من المعادن عدا المنجنيز والنحاس مقارنة بدقيق القمح فقط. انخفضت نسبة امتصاص الماء في معظم المعاملات عدا المعاملة رقم (٦) (٨٠ جم دقيق قمح + ٢٠ جم دقيق ذرة + ٠,٣ جم ثنائى فوسفات الكالسيوم + ٠,٣ جم كلوريد الكالسيوم + ٥ جم دقيق فول صويا منزوع الدهن + ٢ جم مسحوق شرش + ٢ جم مسحوق لبن فرز). كان ثبات العجينة الناتجة من دقيق القمح بنسبة ٨٠٪ + ٢٠٪ والذرة والدقيق (كنترول ٢) ٤ دقائق، في حين انخفض في جميع المعاملات ماعدا المعاملة المضاف لها كلوريد الكالسيوم. وكانت المعاملة التى احتوت على دقيق فول صويا منزوع الدهن أعلى فى المطاطية. وكان لإضافة ٢٠٪ من دقيق الذرة إلى دقيق القمح تأثير واضح على معايير (مقاييس) الجودة.

أدت إضافة المحسنات إلى زيادة نسبة البروتين لجميع عينات الخبز البلدى المنتجة. كما أدت إضافة المواد المحسنة المختلفة إلى تحسين القدرة على الاحتفاظ بالماء وتأخير البيات للخبز الناتج.