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PRODUCTION OF MODIFIED PAN BREAD AND BALADY BREAD USING FORMULATED IMPROVERS.

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ABSTRACT

Formulated improvers , namely improver A containing Lactalbumin and calcium salts and improver B containing calcium caseinate and Ca^{++} salts were prepared from whey solids , partial dextrinized corn flour and soy flour were added at different levels as a component of either improver A or improver B to evaluate their effects on the dough physicochemical properties and on the quality of the produced bread . Soy lecithin and soy lecithin hydrolysate were also obtained. These preparations were used at different levels in preparation of pan and balady bread.

The obtained data revealed that improver A or improver B could be used at 4% level of the flour, dough containing 20% of both partial dextrinized corn flour and 10% of soy flour preparation to produce a dough with satisfied physicochemical properties. TLC chromatogram of soy lecithin hydrolysate exhibited three fractions. Lecithin hydrolysate was more effective than lecithin in improving of the dough physicochemical properties.

The compressibility and the amylogram of pan bread crumb, the loaf volume, specific volume and the overall acceptability revealed that the most effective level to be used from improver A or improver B was 4% and 1% of lecithin or lecithin hydrolysate which had the most improved values, for pan bread either fresh or upon storage for 72 hours. It could be concluded that the formulated improvers (A and B) and also soy lecithin and soy lecithin hydrolysate could be used for making pan and balady bread with improved quality and improved characteristics when used at the proper levels.

INTRODUCTION

Attempts have been made to substitute whey obtained from cheese manufactured for the milk solids vs. the dough (Kadhrmstan e*t al.*, 1998 and Christy *et al*., 1998). However, while such whey is rich in various minerals, it does not contain much protein and when it is used in the dough, the physical structure of the dough is weakened. The pH of the dough is not raised so that, it is too acid and there is a very limited buffering action and the dough does not have a good handling ability in mechanical equipments used in many bakeries (DeRenzo, 1975; Kulp *et al*., 1984and 1988 and Al-Eid *et al*., 1999).

The combination of corn and soy flours along with whey provides a whey product for use as a dough constituent with improved properties when compared with using the whey alone. Sorhgum flour when mixed with wheat flour can be used to produce a wide range of baked goods. Sorghum has approximate composition , amino acid contents and nutritional value similar to those of corn flour (Serna – Saldivar *et al*., 1988).

Mineral composition is an important factor determining whey functionality. Many of functional properties of whey are considerably

influenced by either demineralization or by the addition of calcium salts (Preston , 1981 and Kulp *et al*., 1988).

The natural emulsifiers. Lecithin and their hydrolysates are a complex mixture of phospholipids that provide the majority of its surface – active properties. Lecithin provides drier doughs that machine better and release well from rotary die faces (Pyler , 1988 List , 1989 ; Schunitt , 1994 , Sanchez *et al*., 1995 Suvendu *et al*., 1993 and Central Soya (1990). Soya lecithin hydrolysate retarded starch gel crystallization and bread staling as effectively as the best commercial emulsifier (Mustranta *et al*., 1994 and 1995 and Forssell *et al*., 1998).

The present work is a trial to use formulated improvers made from whey solids or/and whey powder; calcium salts; lactoalbumin and calcium caseinate, corn and soy flour. Commercial lecithin and lecithin hydrolysate were also used to produce modified pan bread. Corn and sorghum flours were mixed with wheat flour (82% extraction) at different levels and modified using the flomulated improvers or/and lecithin and lecithin hydrolysate to produce balady bread.

MATERIALS AND METHODS

Materials

Whey powder contained 25% protein, 44% lactose, 18% ash, 3% fat and 4% moisture was obtained from Meggle Wasserburg (Germany).

Liquid sweet whey was obtained from milk and milk products Research Department, Food Tech. Res. Inst. Agric. Res. Center. Cairo, Egypt.

Lactoalbumin was prepared from liquid whey.

Calcium caseinate, dicalcium phosphates, calcium chloride and calcium oxide (food grade) were obtained from Sigma Chemical Co. (USA).

Corn flour was obtained from Ministry of supply and Home trade , Cairo , Egypt.

Sorghum flour was obtained by milling of sorghum grains. (obtained from Crops Research Inst. Agric , Res. Center , Cairo , Egypt.

Soy flour was obtained from food and Tech. Res. Inst. Cairo , Egypt.

Wheat flours (72% and 82% extraction rates) were obtained from Cairo Co. for milling and backing , Cairo , Egypt.

Soy lecithin hydrolysate was prepared from soy oil obtained from Food Tech. Res. Inst. Cairo , Egypt.

Commercial lecithin was obtained from oils production . Damnhoor , Egypt.

Methods:

Preparation of the improvers.

Improver A :

The whey was concentrated by rotary evaporator to a solid content of 50%. Lactalbumin was prepared by heating the whey followed by centrifugation to separate the denatured protein from the remainder of the whey. Partial dextrinized corn flour , soy flour and lactalbumin were dispersed in water separation. Calcium chloride, dicalcium phosphate and calcium oxide

were also dispersed in water and all of these dispersions were added to the whey solids. The resultant mixture had a pH value of 8.4. It was dried in oven under vacuum, ground and passes through 125 mμ sieve. The ground improver was kept at room temperature (25 °C ± 2) until used.

Improver B :

This improver contained whey powder instead of whey solids and calcium caseinate instead of lactalbumin when compared with improver A . Improver B was prepared by mixing whey powder dextrinized corn flour and soy flour at different levels. Calcium caseinate , calcium chloride , dicalcium phosphate and calcium oxide were also mixed at 2 , 1.1 , 1.3 and 0.9% respectively.

Six different preparations of the improver differ in their dextrinized corn flour and soy flour used to replace the whey powder were tested in this study as shown in Table (1).

Table (1) Percentage of constituents of formulated improvers

constituents	No. of Preparation					
	1	2	3	4	5	6
Whey solids content of improver A	94.7	84.7	74.7	64.7	54.7	44.7
Whey powder content of Improver B	94.7	84.7	74.7	64.7	54.7	44.7
Lactalbumin content of improver A	2.0	2.0	2.0	2.0	2.0	2.0
Calcium caseinate content of improver B	2.0	2.0	2.0	2.0	2.0	2.0
Calcium chloride	1.1	1.1	1.1	1.1	1.1	1.1
Dicalcium phosphate	1.3	1.3	1.3	1.3	1.3	1.3
Cacium oxide	0.9	0.9	0.9	0.9	0.9	0.9
Dextrinized corn flour	0.0	10.0	10.0	20.0	20.0	30.0
Soy flour	0.0	0.0	10.0	10.0	20.0	20.0

Preparation of soy lecithin and soy lecithin hydrolysate :

Two hundred ml of soy oil were taken in 1 L beaker and heated to 60°C with continuos stirring 5 – 10 % of warm water were added and the temperature was kept at 60°C for 30 min. The beaker was kept at room temperature for 2 hours for precipitation and then centrifuged. The precipitate was dried in oven under vacuum at 60°C until the moisture content was about 3–4%. One hundred gm of soy lecithin was mixed with 20 ml of 0.1 M sodium bicarbonate buffer solution (pH 9.0) containing 2 M $CacL_2$ and made into water in oil emulsion . Phospholipase (0.2 ml lecitasl ; 2000 T.V.) was added to the phospholipid emulsion and stirred using a stirrer for 24 hr at 60 °C in a water bath . After the reaction was complete , 180 ml of acetone was added to lecithin hydrolysate and centrifuged to separate lecithin hydrolysate (in the supernatant) from the precipitate . The phosphorus content were determined colorimetrically by molybdenum blue method (Pulliainen and Wallin, 1994) **.** The phospholipid content was calculated using a factor 30 (Forssell *et al*., 1998). Total carbohydrate content of soy lecithin was determined according to the method described by Aura *et al*., 1994. The hydrolysate and commercial lecithin (1 ml) were saponified by addition of 1 ml of 0.5 N sodium hydroxide solution in methanol , by incubation for 1.5 hr at 60 °C and by addition of 1.5 ml of 6 N HCL . Saponified fatty acids were extracted three times with (m – heptane (2 ml) and the methanol – water phase was used for

the carbohydrate analysis. The total carbohydrate content was determined according to the method described by Dubois *et al*. (1956) .

Lecithin hydrolysate was analyzed by thin layer chromatography (TLC) with precoated layers of silica gel on glass plates. The developing solvent mixture was chloroform – methanol – water in the ratio of 65 : 25 : 4 (V / V / V) and molybdenum blue was used as stain reagent.

Pan bread preparation

Bread was prepared by sponge and dough process according to the method described in AACC (1980). The total formula consisted of 100 gm flour, 4 gm sucrose, 2 gm salt, 4 gm shortening , 2 gm yeast and an optimum amount of water . The sponge dough fermented for 4 hr before the rest of the ingredients were added. The mixed dough was given 30 min rest time before molding, panning and proofing to high and then baked at 218 °C for 25 min. Dough were made with and without formulated improvers of A or B (Table 1) at 3 different levels (2, 4 and 6%). The dough was also made using hydrolysate or commercial lecithin at 3 different levels of 0.5, 13.0 and 1.5 %. The loaves allowed to cool at ambient temperature for 1 hr, loaves were weighted and their volume measured by rapeseed displacement, specific volume was reported in cm/gm. The bread was bagged and stored at 25 °C for further evaluation. Bread was scored for external characteristics volume, 10 points; symmetry, 5 points; crust color, 10 points; Break & shred, 5 points) and internal characteristics (grain, 15 points; texture, 15 points; crumb color, 10 points ; aroma , 10 points ; taste , 10 points and mouth feel , 10 points. The crumb pore size was evaluted according to Forssell *et al*., 1998 , Scaling 1 – 8 (1 , very opened and coarse structure ; 8 tight structure). In finished bread the normal pore size is between 6 and 7.

Balady bread preparation

Balady bread was prepared according to the method described by Faridi and Rubenthaler (1984) . To study the effect of the addition of corn and sorghum fours on the balady bread , the wheat flour was replaced at 10 , 20 , 30 % levels of either corn or sorghum flours and the resultant bread was compared with the control . To study the effect of both the formulated improvers , lecithin and lecithin hydrolysate on the characteristics of the balady bread made using corn and sorghum flours, the preparation No.1 of improvers A and B (shown in table 1) was added at 2 , 3 and 5 % levels. Also lecithin and lecithin hydrolysate were added at 0.25 , 0.5 and 1.0 % levels and the sensory characteristics of the resultant bread was evaluated . Scoring depended on the following desired characteristics : Color and appearance , diameter , separation , biting texture , aroma , taste , crumb texture (Williams *et al*., 1988).

Organoleptic evaluation of staleness was done using untrained 10 panelist. An 8 point rating scale was used with anchors ranging form very fresh (8 points) to very state (1 point). In the evaluation panel members were instructed to rate pan breads and balady bread for freshness by considering feel in fingers , color , flavor , mouth feel or in any manner . Used to Jude freshness . (Kulp *et al*., 1988).

Dough Rhelogy

Physiochemical properties of flour–water dough containing formulated improvers, lecithin hydrolysate and commercial lecithin at different levels as mentioned above were evaluated using the Brabender Farinograph and Extensigraph according to the method described in AACC (1990).

Pan bread freshness was determined at 0.5 , 12 , 24 , 48 and 72 hr by the Brabender struct-O-graph instrument (OHG Dfursburg, Germany) type 880303 which was used to measure the compressibility as bread staling test.

Pasting properties of bread crumb

Samples of pan bread crumb with and without formulated improvers , lecithin hydrolysate and commercial lecithin were collected at 0.5 , 12 , 24 , 48 and 72 hr after removal of bread from the oven. The crumb was dried and ground to pass the particles through a 60 mesh sieve . The Brabender Amylograph was used to examine the pasting properties of the bread crumb according to the method described by Morad and D'Appolonia (1980).

Amylogram characteristics

They included peak viscosity , viscosity at the end of the holding period , viscosity at the end of the cooling period , the bump area (measured with Planimeter) and pasting temperature . The existence or abscene of the plateau before the major peak were also considered to be amylogram characteristics . For measurment of the bump line , the base line of the bump was connected from the starting point to the ending point of the bump peak. The pasting temperature was that at the intersection point of the horizontal and vertical tangential lines of the amylograph curve during the heating period.

Statistical analysis

Statistical analysis of the data was carried according to Cochran (1960).

RESULTS AND DISCUSSION

Physicochemical properties of flour doughs were affected by the flormulated improvers (A and B) as shown in Table (2). The addition of improver (A) to the flour dough at 2 , 4 and 6 % levels caused a decrease in arrival time and an increase in stability (min) up to preparation No. 3 (10% of both partial dextrinized corn and soy flours). The addition of improver A at either 4% or 6% level exhibited the same values of stability up to preparation No. 3 and the same values of arrival time for preparations No. 1 and No. 2 to the flours doughs . The addition of improver (B) decreased arrival time and increased stability up to preparation No. 3 (10% of both partial dextrinized corn and soy flours) at 2 and 4% levels of the improver . At 6% level , the improver decreased both arrival time and stability . Extensibility values (Table 2) indicated an increase in extensibility and resistance to extension by

adding either improver A or improver B up to the level of 4% to the flour dough (preparation No. 3 , 10% of both dextrinized corn flour and soy flour) .

From the above mentioned data , it could be concluded that either improver A or improver B could be used at 4% level of the flour dough containing 10% of partial dextrinized corn flour and 10% of soy flour to produce a dough with satsified physicochemical properties.

Fig.1 showed the TLC chromatogram of soy lecithin hydrolysate . It contained 3 fractions , phosphatidylcholine (PC) , phosphatidy ehanolamine (PE) and lysophosphatidylcholine (LPC).

Table (3): Phosphorus ; carbohydrates and phospholipids content of soy lecithin and soy lecithin hydrolysate .

	Phosphorus content	Carbohydrate content	Phospholipids content
Soy lecithin hydrolysate	3.22	10.82	96.6
Soy lecithin	2.05	12.55	61.5

The total content of phosphorus and carbohydrate indicate that soy lecithin hydrolysate contains more phospholipids than soy lecithin (Table 3).

The effects of soy lecithin and soy lecithin hydrolysate on the physicochemical properties of dough are illustrated in Table (4) . The Farinograph resultes showed an increase in stability and a decrease in arrival time by adding soy lecithin hydrolysate to the flour dough up to 1.5% level. Lecithin hydrolysate was more effective than lecithin in improvement of the physicochemical properties of doughs . The use of lecithin hydrolysate resulted in a slight decrease in extensibility and an increase in the resistance to extension as compared with control sample. The results are in agreement with those reported by (Pomeranz , 1980 and b ; Aura , 1994 and Forssell *et al*., 1998). They have reported that soy lecithin hydrolysate reduced the protein solubility and resulted in improved dough properties .

Fig 1: Thin layer chromatogram of 1-pure 2- commercial 3-hydrlysat lecithin

Table (5) showed the effects of formulated improvers (A and B) on the proof time , weight , volume and specific volume , various quality scores and pore size of crumb. It could be seen that the addition of improvers A and B at 2 , 4 and 6% levels decreased the proof time. The weight of loaves increased due to the addition of improvers at all levels . Both loaf volume and specific volume increased with the addition of improvers (A or B) up to 20% partial dextrinized corn flour and 10% soy flour (preparation No. 4) at 4% level of improver A and 6% level of improver B) . Behind preparation No. 4 . Both volume and specific volume were decreased with the addition of the improvers.

The crumb pore size was improved with the addition of the improvers (A or B) up to preparation No. 4 which resulted improved higher crumb pore size value of 8.0 at 2 , 4 and 6% levels of the improvers (A or B). Volpe and Zabik , 1975 ; Kulp *et al*., 1988 ; Erdogdu – Arnoczky *et al*., 1996 ; Huffman , 1996 and Jacobson , 1997 reported and improvement of physical and organolyptic properties of bread by using different improvers.

Table (6) showed the effects of soy lecithin and soy lecithin hydrolysate on proof time (min) , weight (gm) , volume (cm^3) , specific volume (cm^3/ gm) , crumb grain , crumb texture , total quality and spore size. It could be seen that proof time was nearly the same when compared with control sample at the used levels of lecithin . Weight , volume and specific volume increased by increasing the levels of soy lecithin and soy lecithin hydrolysate up to 1%.

Soy lecithin hydrolysate was more effective in improvement (increasing) of weight , volume and specific volume when compared with soy lecithin . Crumb pore size , crumb grain, crumb texture and total quality were higher when 1% of soy lecithin hydrolysate was added when compared with the addition of soy lecithin . These results are in agreement with those

reported by Pomeranz *et al*., 1984 , Mettler and Seibel , 1993 and Forssell *et al*., 1998.

Table (7) showed the effect of formulated improvers (A or B) containing 20% partial dextrinized corn flour and 10% soy flour (preparation No. 4) and soy lecithin hydrolysate on staling of pan bread. Since preparation No. 4 had given satisfied results as reported before , it was selected to carry out the organolyptic and firmness study.

It could be seen that the addition of improvers (A or B) at 2, 4 and 6% levels improved the acceptability (compressibility) and the firmness of pan bread when compared with the control sample either fresh or even after 72 hours of storage at room temperature (25°C±2). Table (7) also revealed that improver A was fairly better than improver B in the respect of improving the acceptability and firmness (compressibility) of the produced bread either fresh or stored for 72 hours.

So from resulted in Table (7), it could be concluded that the most effective level to be used from either improvers A or improver B was 4% which had the most improved values of acceptability and firmness (compressibility) of pan bread either fresh or up to storage for 72 hours.

Data of amylogram of bread crumbs made with formulated improvers A (preparation No. 4) , B (preparation No. 4) , soy lecithin or soy lecithin hydrolysate are summarized in Tables (8 & 9) and Fig. (2, 3, 4 & 5) . From presented data , it could be observed that formulated improvers and lecithin affected all the crumb amylogram readings . Bread crumb with improvers and lecithin gave higher viscosity (BU) , much higher bump area (cm^2) and higher pasting temperature as compared to the control sample . In the absence of improvers and lecithin (control) , minor peak appeared before the major peak.

In case of crumb with 6% of improver A and 4 and 6% of improver B and also 0.5% and 1.0% of soy lecithin hydrolysate , the minor peak appear , In the case of soy lecithin , the minor peak did not appear at 0.5 and 1.0% during storage except after 72 hours of storage .

The amylogram bump area and viscosity readings are presented in Table (9) . The statistical analysis showed that , there were no significant differences between the all amylograph readings at different storage periods . The storage period up to 72 hours was not correlated with bump area.

The amylogram of the heating of the first cycle of bread gave a plateau for some crumb before the raise in viscosity upon gelatinization . The existence of the plateau depended on the type of additive used in the bread formulation . In case of control sample , improver A (2 and 6% level , 6% of improver B , 1.5% of lecithin hydrolysate and commercial lecithin , the plateau increased with storage time.

An increase in the height of plateau was observed in control sample . In the case of improver A , the plateau appeared after 72 hours of storage at 2% level while it appeared slightly after 48 and 72 hours of storage .In the

Fig 2:5

Fig -----8

case of improver B , the plateau appeared after 24 hours at 2 and 6 % levels . In case of soy lecithin hydrolysate , the plateau slightly appeared after 48 hours at 1.5% level while in the case of soy lecithin , it appeared after 72 hours at 0.5% level and appeared slightly at 1% level after 72 hours . It also appeared slightly at 1.5% level after 72 hours. These data suggested that the plateau was a result of the dissociation of retrograded amylopectin . The lack of plateau indicated that improver B and soy lecithin hydrolysate may have a greater inhibitory effect on amylopectin retrogradation then control sample , improver A and soy lecithin .

All amylogram readings were significantly effected by crumb firmness of samples. The decrease of solubilized amylose during baking and the retarding of amylopectin retrogradation during storage as a result of the use of improvers , soy lecithin and soy lecithin hydrolysate contributed to the softer bread crumb and slower firming rate . These results are in agreement with those reported by D'Appolonia and MacARThure , 1974 ; Morad and D'Appolonia 1980 ; Eliassojn and Ljunger , 1988 ; Krog *et al*., 1989 ; and Kweon *et al*., 1994 ; and Park and Hyun , 1989 .

The starch in bread crumb had been swollen an pasted to different degrees due to its interaction with formulated improvers (soy lecithin and soy lecithin hydrolysate) . No significant differances were found between bump area and crumb firmness . These results are in a good agreement with White *et al*., 1989 and Slade and Levine , 1991 .

Balady bread

Quality evaluation scores of balady bread made with 10 , 20 and 30 % of corn or sorghum flours without improvers or lecithin and with improvers (preparation No. 1) at 2 , 3 , 5 % levels and also with soy lecithin and soy lecithin hydrolysate at 0.25 , 0.5 and 1% levels are illustrated in Tables 10 and 11 .

From the Tables it could be seen that balady bread with corn or sorghum flours at 20 % level were acceptable and had higher overall scores when compared with control or bread with 10% corn or sorghum flours . The bread contained 20% corn or sorghum flours and improved with 3% of formulated improver A or B (preparation No. 1) , 0.5% of soy lecithin or 0.5% of soy lecithin hydrolysate had higher score values as compared to the control samples.

The organolyptic evaluation of staleness of balady bread during storage periods are shown in Table (12) .It could be seen that during storage periods of 4 , 8 , 12 , 16 , 16 , 20 , 24 , 28 , 32 and 36 hrs., the total overall scores of bread decreased by increasing storage periods . The addition of improver A or improver B at 3% level or the addition of 0.5% of soy lecithin and soy lecithin hydrolysate to the bread containing 20% corn or sorghum flours improve the balady bread quality in the respect of staleness .

From the above data it could be concluded that the formulated improvers A and B and also soy lecithin and soy lecithin hydrolysate could be used for making pan and balady bread with improved quality and improved characteristics when used at the proper levels.

Table (2) : Farinograph and Extensograph properties of wheat flour modified by formulated improvers (A and B) at different levels.

Physiochemical Properties / Improver levels (%)	Preparations of formulated improvers						
	Control	1	2	3	4	5	6
Farinograph properties				**Improver A**			
Arrival time (min)							
2	4.9	4.8	4.85	4.70	4.65	4.50	4.45
4	4.9	4.75	4.70	4.65	4.65	4.40	4.40
6	4.9	4.75	4.70	4.60	4.60	4.45	4.35
Stability (min)							
2	7.7	7.75	7.80	7.80	7.80	7.65	7.65
4	7.7	7.85	7.85	7.85	7.85	7.80	7.60
6	7.7	7.85	7.85	7.85	7.75	7.70	7.50
				Improver B			
Arrival time (min)							
2	4.9	4.70	4.70	4.65	4.60	4.50	4.40
4	4.9	4.75	4.65	4.60	4.60	4.45	4.35
6	4.9	4.70	4.60	4.55	4.55	4.45	4.25
Stability (min)							
2	7.70	7.80	7.75	7.75	7.70	7.55	7.50
4	7.70	7.75	7.75	7.75	7.70	7.50	7.40
6	7.70	7.70	7.60	7.60	7.60	7.50	7.30
					Improver A		
Extensograph properties							
Extensibility (mm) after 90 min rest							
2	135	140	145	145	140	130	125
4	135	145	150	155	140	130	120
6	135	145	145	155	130	120	110
Resistance to Extension (BU)							
2	860	875	880	885	870	860	855
4	860	870	880	880	860	855	850
6	860	880	880	880	860	850	840
Extensibility (mm)							
2	135	135	140	140	130	125	115
4	135	140	145	145	120	120	110
6	135	145	150	135	125	120	110
					Improver B		
Resistance to Extensibility (BU)							
2	860	865	875	880	870	855	850
4	860	865	875	875	860	850	840
6	860	865	860	860	850	845	830

Table (4) : Farinograph and Extensograph properties of wheat flour modified by soy lecithin and soy lecithin hydrolysate.

Physicochemical properties	Control	Lecithin concentrations		
		0.5%	1.0 %	1.5 %
Farinograph Properties		**Soy lecithin hydrolysate**		
Arrival time (min)	4.90	4.80	4.80	4.90
Stability (min)	7.70	7.70	7.72	7.60
		Soy lecithin		
Arrival time (min)	4.90	4.85	4.85	4.95
Stability (min)	7.70	7.70	7.50	7.45
Extensograph properties		Soy lecithin hydrrolysate		
Extensograph (mm)	135	135	134	130
Resistance to extension (BU)	860	900	950	955
		Soy lecithin		
Extensibility (mm)	135	130	127	121
Resistance to extension (BU)	860	870	885	850

Table (5) : Prof time ; Physical ; organolyptic evaluation and pore size of crumb of pan bread modified by formulated improvers (A or / and B).

		Proof Time (min)	Weight (gm)	Volume (Cm^3)	Specific volume cm^3 /gm	Scores			Crumb Pore Size
						Crumb grain	Crumb texture	Crumb quality	
Control		55	160.45	450	2.80	8.20	12.10	83.10	7.0
Improver (A)									
Prep. No.	Level %								
(1)	**2**	50	163.0	462	2.85	8.70	12.50	83.5	7.3
	4	50	164.2	470	2.86	8.75	12.50	83.5	7.3
	6	47	164.9	475	2.89	8.70	12.40	83.4	7.3
(2)	**2**	45	164.8	486	2.95	8.70	12.60	83.4	7.5
	4	45	165.2	490	2.97	8.80	12.60	83.6	7.5
	6	45	165.3	495	2.99	8.85	12.65	83.60	7.5
(3)	**2**	40	165.0	520	3.15	8.90	12.80	83.90	7.8
	4	40	165.0	542	3.28	8.95	12.90	84.4	7.85
	6	37	167.0	542	3.24	8.90	12.90	84.0	8.00
(4)	**2**	40	167.1	555	3.32	9.50	14.60	94.0	8.0
	4	35	167.1	565	3.38	9.70	14.70	95.0	8.0
	6	35	169.0	557	3.30	9.50	14.70	95.0	8.0
(5)	**2**	35	174.5	455	2.61	9.30	13.5	89.0	7.0
	4	35	176.0	455	2.58	9.20	13.5	90.0	7.0
	6	35	177.1	450	2.54	9.35	13.6	88.0	7.0
(6)	**2**	35	178.0	450	2.52	8.5	12.5	82.0	6.5
	4	35	179.0	450	2.51	8.0	12.5	82.0	6.0
	6	30	179.2	455	2.54	8.0	12.0	80.0	5.5
No.	**%**								
(1)	**2**	55	163.14	457	2.80	8.40	12.30	83.0	7.0
	4	50	164.34	460	2.80	8.45	12.35	83.2	7.2
	6	50	164.04	460	2.80	8.40	12.35	83.1	7.2
(2)	**2**	50	163.31	460	2.82	8.45	12.50	84.0	7.3
	4	47	163.90	468	2.85	8.60	12.60	84.5	7.3
	6	46	164.50	472	2.87	8.65	12.60	84.5	7.3
(3)	**2**	50	167.13	490	2.93	8.70	13.20	85.0	7.5
	4	45	167.20	510	3.05	8.80	13.50	86.5	7.5
	6	45	167.50	512	3.06	8.75	13.50	86.0	7.5
(4)	**2**	45	169.50	526	3.10	9.30	14.50	92.0	8.0
	4	45	169.30	540	3.20	9.55	14.80	93.0	8.0
	6	40	169.90	548	3.22	9.50	14.80	92.5	8.0
(5)	**2**	40	171.28	470	2.76	9.10	14.00	90.1	7.5
	4	40	171.79	484	2.81	8.70	13.50	88.5	7.0
	6	40	172.48	482	2.79	8.90	14.00	88.0	6.5
(6)	**2**	40	178.19	481	2.70	8.00	12.00	82.0	6.0
	4	40	178.85	480	2.68	8.10	12.00	80.0	5.5
	6	40	178.70	480	2.69	8.00	11.80	79.0	5.5

Table (6) : Proff time ; Physical and organolyptic evaluation and pore size of crumb of pan bread modified by soy lecithin and soy lecithin hydrolysate.

	Proof Time (min)	Weight (gm)	Volume (Cm^3)	Specific volume cm^3/gm	Scores			Crumb Pore Size
					Crumb grain	Crumb texture	Crumb quality	
Control	55	160.45	450	2.80	8.20	12.10	83.10	7.0
Soy lecithin								
0.5	54	161.30	470	2.91	8.00	12.30	84.00	7.00
1.0	54	164.00	485	2.95	8.50	12.70	86.00	7.00
1.5	53	161.70	470	2.90	8.00	12.00	80.00	6.00
Soy lecithin hydrolysate %								
0.5	53	166.94	510	3.05	8.50	12.50	85.00	7.50
1.0	54	166.90	530	3.18	9.00	13.50	89.00	8.00
1.5	54	166.0	490	2.95	8.70	13.00	86.00	7.00

Table (7) : Effect of formulated improvers (A and B)* and soy lecithin and soy lecithin hydrolysate on staling of pan bread.

	Organolyptic evaluation** (Acceptability)	Firmness (compressibility) after storage				
		0.5 hr.	12 hr.	24 hr.	48 hr.	72 hr.
Control	80.00	110	110	100	90	78
Improver (A) Preparation No(4) Level %						
2	86.40	145	140	138	135	130
4	86.90	146	145	145	140	135
6	86.10	144	140	135	130	120
Improver (B)						
(4) 2	85.0	140	135	130	125	120
4	84.5	140	140	140	135	130
6	84.0	130	120	120	115	100
Soy lecithin hydrolysate						
0.5	82.20	140	140	140	130	125
1.0	86.70	160	155	155	145	140
1.5	82.40	150	150	140	135	130
Soy lecithin						
0.5	80.90	125	120	120	110	105
1.0	82.20	130	130	125	120	110
1.5	76.90	130	120	110	110	100

*** Containing 20% of both partial dextrinized corn flour and 10% of soy flour (Preparation No. 4) .**

**** 10 Panelists were used and each value is an average of the obtained for fresh and the value obtained during storage for 72 hours .**

Table (8) : Appearances of plateau ; minor peak and pasting temperatures of pan bread at different storage times.

	Storage times (hrs)	Appearance						Pasting		
		Plateau			Minor peak			Temperature		
		2%	4%	6%	2%	4%	6%	2%	4%	6%
Control	0.5	1	1	1	1	1	1	83.1	83.1	83.1
	12	1	1	1	1	1	1	83.7	83.7	83.1
	24	1	1	1	1	1	1	83.2	83.2	83.2
	48	1	1	1	1	1	1	83.0	83.0	83.0
	72	1	1	1	1	1	1	82.7	82.7	82.7
Improver (A) **Preparation No(4)**	0.5	0	0	0	0	1	0	90.8	91.6	90.9
	12	0	0	0	0	1	0	90.7	90.8	91.2
	24	0	0	0	2	1	0	90.6	90.7	90.8
	48	0	0	2	2	1	0	90.9	91.2	89.5
	72	1	0	2	2	1	0	90.6	91.0	89.2
Improver (B) **Preparation No. (4)**	0.5	0	0	0	2	0	0	84.9	90.1	90.0
	12	0	0	0	2	0	0	85.1	90.0	89.8
	24	1	0	1	2	0	0	85.1	90.4	89.3
	48	1	0	2	2	0	0	85.0	90.5	89.6
	72	1	0	1	2	0	0	84.7	90.6	89.9
	hrs.	**0.5%**	**1.0%**	**1.5%**	**0.5%**	**1.0%**	**1.5%**	**0.5%**	**1.0%**	**1.5%**
Soy lecithin	0.5	0	0	0	0	0	1	90.1	92.4	92.0
	12	0	0	0	0	0	1	90.0	92.2	92.0
	24	0	0	2	0	0	1	90.7	92.0	91.7
	48	0	0	2	0	0	1	90.3	92.0	91.2
	72	1	2	2	2	2	1	90.3	92.6	91.0
Soy lecithin hydrolysate	0	0	0	0	0	0	0	92.1	93.9	92.3
	12	0	0	0	0	0	0	92.0	93.7	92.0
	24	0	0	0	0	0	2	92.3	93.1	92.8
	48	0	0	2	0	0	2	92.4	93.8	92.4
	72	0	0	2	0	0	2	92.0	93.2	92.0

0 : No **1 : yes** **2 : slight**

Table (9) : Pan bread crumb amylogram characteristics at different storage times.

	Storage time (hrs)	Bump area (Cm ^{2})			Viscosity (BU)								
					Peak			Holding end		Cooling end			
		2%	4%	**6%**	2%	4%	**6%**	2%	4%	**6%**	2%	4%	**6%**
	0.5	8.70	8.70	8.70	321	321	321	210	210	210	560	560	560
Control	12	8.70	8.70	8.70	320	320	320	208	208	208	549	549	549
	24	8.60	8.60	8.60	315	315	315	204	204	204	547	547	547
	48	8.55	8.55	8.55	311	311	311	197	197	197	550	550	550
	72	8.45	8.45	8.45	299	299	299	190	190	190	550	550	580
	0.5	22.30	24.00	23.80	4.10	418	416	248	253	250	775	760	765
Improver (A)	12	22.25	23.90	23.80	4.10	418	410	242	250	248	770	755	765
preparation No. (4)	24	22.25	23.80	23.80	4.02	412	408	240	246	241	750	740	755
	48	22.00	23.80	23.6	4.02	410	413	235	240	238	760	741	750
	72	21.90	23.40	23.10	4.06	413	415	221	236	230	760	740	755
Improver (B)													
preparation No. (4)	0.5	21.4	23.2	23.0	397	412	415	235	250	250	750	735	740
	12	21.4	23.2	22.9	396	412	415	230	246	246	740	730	736
	24	21.3	23.1	22.9	396	412	415	221	240	246	740	721	732
	48	21.2	23.0	22.7	399	406	409	215	230	235	735	722	726
	72	20.9	22.8	22.5	395	408	412	200	215	225	736	720	729
	Hrs	**0.5%**	**1.0%**	**1.5%**	**0.5%**	**1.0%**	**1.5%**	**0.5%**	**1.0%**	**1.5%**	**0.5%**	**1.0%**	**1.5%**
Soy	0.5	24.1	25.9	25.0	405	410	415	260	265	262	760	745	765
Lecithin	12	23.9	25.9	25.0	405	410	415	260	260	260	750	740	761
	24	23.8	25.8	24.8	403	405	410	260	255	250	750	730	755
	48	23.4	25.6	24.6	398	401	405	250	250	241	734	721	750
	72	23.0	25.1	24.4	399	401	406	240	244	238	740	733	740
Soy lecithin	0.5	24.8	26.1	25.8	445	454	450	260	270	270	783	760	767
hydrolysate	12	24.7	26.0	25.6	440	450	445	260	270	268	780	755	760
	24	24.7	25.8	25.5	441	448	440	250	265	260	775	750	760
	48	24.3	25.4	25.4	438	449	440	241	258	256	765	740	750
	72	24.0	25.1	25.0	435	447	441	240	251	251	760	730	740

10.1

10.2

11.1

Table (12) : Organolyptic evaluation of balady bread made with corn or/and sorghum flours at different levels , and improved by formulated improvers or/and soy lecithin and soy lecithin hydrolysate during storage.

	Organoleptic evaluation during storage								
	4 hr	**8 hr**	**12 hr**	**16 hr**	**20 hr**	**24 hr**	**28 hr**	**32 hr**	**36 hr**
Control (82% extraction rate)	30.0 b	27.5 c	25.5 d	23.0 e	20.0 e	17.0 de	17.0 d	16.0 d	14.0 d
Control + 20% corn flour	33.0 a	30.0 b	28.0 bc	25.0 d	20.0 e	18.0 d	17.0d	15.0 d	13.0 d
Control + 20% sorghum flour	30.0 b	28.0 c	25.0 d	25.0 d	20.0 e	17.0 de	15.0e	13.0 de	12.0de
Balady bread with 20% Corn flour +									
3% improver (A)	34.0 a	34.0 a	33.0 a	30.0 a	28.0 b	27.0 b	27.0a	25.0 a	22.0 b
3% improver (B)	33.5 a	33.0 a	31.0 b	29.0 b	27.0 bc	25.0 c	24.0 b	22.0 bc	20.0 b
0.5% soy lecithin	33.5 a	33.0 a	31.0 b	29.0 b	27.0 bc	25.5 c	24.0 b	23.0 ab	21.0 b
0.5% soy lecithin hydrolysat									
Balady bread with 20% sorghum flour + **3% improver A**	34.0 a	33.5 a	33.0 a	31.0 a	30.0 a	29.0 a	28.0 a	27.0 a	25.0 b
3% improver B	32.5 a	32.5 a	30.0 b	29.0 b	27.0 bc	25.0 c	24.0 b	22.5 bc	20.0 bc
0.5% soy lecithin	32.0 a	31.0 b	29.0 bc	27.5 bc	25.0 d	24.0 c	22.5 c	21.0 bc	20.0 bc
0.5% soy lecithin hydrolysate	31.5 b	30.5 b	29. bc	28.0 bc	26.0 d	24.0 c	22.5 c	21.5 bc	20.5 bc
	33.5 a	33.0 a	32.0 a	30.0 a	29.0 a	28.0 a	26.5 a	25.5 a	24.0 a
L.S.D	1.62	1.45	1.12	1.76	1.21	1.63	1.82	2.99	2.89

L.S.D. of crumb firmness (compressibility) and other values.

	Values of firmness of formulated improvers A & B			
	2 %	**4 %**	**6 %**	**Between any two**
Storage period	0.579	0.899	0.789	0.314
Organolyptic evaluation	0.345	0.362	0.311	0.299
Amylogram reading				
Pasting temperature	0.562	0.214	0.321	0.202
Viscosity	0.589	0.225	0.318	0.198
Peak	0.462	0.173	0.107	0.112
Holding-end	0.411	0.209	0.391	0.323
Cooling-end	0.603	0.232	0.198	0.176
Bump area	0.210	0.029	0.179	0.091
	Soy lecithin and soy lecithin hydrolysate			
	0.5%	**1.0%**	**1.5%**	**Between any two**
Storage period	0.602	0.711	0.628	0.219
Organolyptic evaluation	0.214	0.258	0.212	0.198
Amylogram reading				
Pasting temperature	0.484	0.312	0.311	0.201
Viscosity	0.598	0.229	0.304	0.189
Peak	0.485	0.200	0.113	0.104
Holding-end	0.585	0.218	0.341	0.300
Cooling-end	0.721	0.241	0.189	0.167
Bump area	0.189	0.100	0.035	0.021

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إنتاج خبز إفرنجي و بلدي باستخدام محسنات جديدة

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تم تصميم نوعين من المحسنات و هما محسن (A) و يتكون من اللاكتوالبيومين و أملاح الكالسيوم ، و محسن (B) و يتكون من كازينات الكالسيوم و أملاح كالسيوم ، و قد تم إضافة جوامد الشرش و دقيق الذرة المجلتن و دقيق فول الصويا لكلا النوعين من المحسنات . و أضيف كل من محسن (A) و محسن (B) بنسب مختلفة إلى دقيق القمح و ذلك لاختبار تأثيرهما على الخواص الفيزوكيميائية للعجين . كما تم أيضا إنتاج ليثيثين فول الصويا و تحويلة إلى hydrolysate ، و قد تم استخدامه بنسب مختلفة لإنتاج خبز إفرنجي و خبز بلدي ، و قد أظهرت النتائج إمكانية استخدام كل من محسن A و محسن B حتى نسب 4 % (يحتوي على 20% دقيق ذرة مجلتن و 10% دقيق صويا) لإنتاج خبز إفرنجي و خبز بلدي ذو مواصفات جودة محسنة ، كما أظهرت النتائج أفضل قيم لصفات اللبابة و حجم الرغيف و الحجم النوعي و درجات القبول الكلية و التي قد تحققت باستخدام أي من محسن A أو محسن B بنسبة 4% و كذلك باستخدام الليثيثين و الليثيثين hydrolysate بنسبة 1% و ذلك عند تخزين الخبز لمدة 72 ساعة على درجات حرارة مختلفة .

Table (10): Sensory characteristics of balady bread made with corn or sorghum flours at different levels and improved with soy lecithin and soy lecithin hydrolysate .

		Color & Appearance		Diameter		Separation		Biting textures		Aroma		Taste		Crumb texture		Overall score	
		1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*
Balady bread with : corn flour + %	**improver %**																
	2	4.0 a	4.0 a	5.0 a	5.0 a	4.5	4.5	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	33.0a	33.0 a
10	3	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0	34.0 a	34.0 a
	5	4.0 a	4.0 a	5.0 a	5.0 a	4.5	4.5	4.5 b	4.5 a	4.0 b	4.0 a	5.0 a	5.0 a	5.0 a	5.0 a	32.0 a	32.0 b
	2	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	33.5 a	33.5 a
	3	5.0 a	5.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	34.5 a	34.5 a
	5	4.0 a	3.5 b	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.0 b	4.0 b	4.5 a	4.5 a	4.0 b	4.0 b	31.5 b	31.0 b
	2	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	4.5 a	31.0 b	31.5 b
30	3	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.5 a	4.5 a	4.0 b	4.0 b	4.0 b	4.5 a	31.5 b	32.0 b
	4	4.0 a	3.5 b	4.5 b	4.5 b	5.0	5.0	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	3.5bc	4.0 b	29.0 c	30.0 c
L.S.D.		0.55	1.25	0.52	0.58	n.s	n.s	1.31	0.90	0.80	0.90	1.20	1.00	1.30	1.01	1.78	172

Continue No. (1) of Table (10).

	Color & Appearance (5)		Diameter (5)		Separation (5)		Biting textures (5)		Aroma (5)		Taste (5)		Crumb texture (5)		Overall score (35)	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Balady bread with : corn flour + improver																
% **%**																
2	4.0 a	4.0 a	5.0 a	5.0 a	4.5	4.5	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	33.0a	33.0 a
10 3	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	34.0 a	34.0 a
5	4.0 a	4.0 a	5.0 a	5.0 a	4.5	4.5	4.5 b	4.5 a	4.0 b	4.0 a	5.0 a	5.0 a	5.0 a		32.0 a	32.0 b
2	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	33.5 a	33.5 a
3	5.0 a	5.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.0 b	34.5 a	34.5 a
5	4.0 a	3.5 b	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.0 b	4.0 b	4.5 a	4.5 a	4.0 b		31.5 b	31.0 b
2	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	4.5 a	31.0 b	31.5 b
30 3	4.0 a	4.0 a	5.0 a	5.0 a	5.0	5.0	5.0 a	5.0 a	4.5 a	4.5 a	4.0 b	4.0 b	4.0 b	4.5 a	31.5 b	32.0 b
4	4.0 a	3.5 b	4.5 b	4.5 b	5.0	5.0	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	4.0 b	3.5bc	4.0 b	29.0 c	30.0 c
L.S.D.	0.55	1.25	0.52	0.58	n.s	n.s	1.31	0.90	0.80	0.90	1.20	1.00	1.30	1.01	1.78	1.72

A : Improver A prep. No. (1) **B : improver (B) prep. No. (2)**

Continue No. (2) of Table (10).

		Color & Appearance (5)		Diameter (5)		Separation (5)		Biting Textures		Aroma (5)		Taste (5)		Crumb texture		Overall score	
		A	B	A	B	A	B	A		A	B	A	B	A	B	A	B
Balady bread with : sorghum flour + improver																	
%	**%**																
	2	4.0 a	4.0 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.0 b	4.0 a	4.5 a	4.5 a	32.0 a	32.0 a
10	3	4.0 a	4.0 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.0 b	4.0 b	4.5 a	4.5 a	32.0 a	32.0 a
	5	4.0 a	4.0 a	4.5 a	4.5 a	4.0 b	4.0 a	4.5 a	4.5 a	4.5 a	4.5 a	4.0 b	4.0 b	4.0 a	4.0 b	29.5 b	29.5 b
	2	4.0 a	4.0 a	4.5 a	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	3.5 b	3.5 c	5.0 a	5.0 a	32.5 a	31.5 a
20	3	4.5 a	4.0 a	4.5 a	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	4.0 b	4.0 b	5.0 a	5.0 a	32.5 a	32.0 a
	5	4.5 a	4.5 a	4.0 a	4.0 a	4.5 a	4.5 a	4.0 b	4.0 b	4.0 a	4.0 b	3.0 c	3.0 a	4.0 b	4.0 b	28.0 a	28.0 b
	2	3.5 b	3.5 b	4.0 a	4.0 a	3.5 b	3.5 b	4.0 b	4.0 b	5.0 a	5.0 a	4.0 b	4.0 b	4.0 b	4.0 b	27.0 b	28.0 b
30	3	3.0 b	3.5 b	3.5 b	4.0 a	3.5 b	3.5 b	3.5 b	4.0 b	4.0 a	4.0 b	3.5 b	3.5 c	3.0 c	3.0 c	24.0 c	25.0 c
	4	3.0 b	3.5 b	4.0 a	4.0 a	3.0 b	3.0 b	4.0 b	4.0 b	3.0 b	3.0 c	3.5 b	3.5 c	3.5cb	3.5 c	24.0 c	24.5 c
L.S.D.		1.35	1.25	1.10	1.10	1.10	0.98	1.10	1.10	1.6	0.9	0.6	0.32	0.51	0.62	1.45	1.33

A : improver A prep. No. (1)
B : improver B prep. No. (2)

Continue of Table (11).

	Color & Appearance (5)		Diameter (5)		Separation (5)		Biting textures (5)		Aroma (5)		Taste (5)		Crumb texture (5)		Overall score (35)	
	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*
Balady bread with : sorghum flour + lecithin																
% **%**																
0.25	4.0 b	4.0 b	4.0 a	4.0 a	5.0 a	5.0 a	4.5 a	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	32.0 a	32.0 a
10 0.5	4.5 a	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	4.5 a	4.5 a	5.0 a	5.0 a	4.5 a	4.5 a	5.0 a	5.0 a	32.0 a	33.0 a
1.0	5.0 a	5.0 a	4.5 a	4.5 a	5.0 a	5.0 a	4.5 a	4.5 a	4.5 a	4.5 a	4.5 a	4.5 a	4.5 a	4.5 a	32.5 a	32.5 a
0.25	3.5 b	4.6 b	4.5 a	4.5 a	5.0 a	5.0 a	4.0 b	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	4.0 b	4.0 b	30.5 b	31.5 b
0.5	4.5 b	4.0 b	4.5 a	5.0 a	4.5 a	4.5a	4.0 b	5.0 a	4.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	31.5 a	33.5 a
1.0	3.0 c	3.5 b	3.5 b	3.5 b	4.0 b	4.0 b	4.0 b	4.0 b	4.5a	4.0 a	4.0 b	4.0 b	4.0 b	4.0 b	27.0 c	27.0 c
0.25	3.5 b	3.5 b	3.5 a	3.5 b	3.5 b	4.0 b	3.0 c	3.5 b	3.0 a	3.5 b	4.0 b	4.0 b	4.0 b	4.0 b	24.5 d	26.0 c
30 0.5	3.5 b	4.0 b	3.5 a	3.5 b	3.5 b	3.5 b	3.5 c	3.5 b	3.0 b	3.0 b	4.0 b	4.0 b	3.0 c	3.5 b	24.0 d	25.0 d
1.0	3.5 b	3.5 b	3.0 b	3.0 b	3.0 c	3.0 b	3.0 c	3.0bc	3.5 b	3.5 b	3.0 c	3.0 c	3.0 c	3.0 c	18.5 e	22.0 e
L.S.D.	0.91	0.82	1.10	1.23	0.67	0.86	0.99	0.81	1.02	1.40	0.55	1.00	0.91	1.00	1.78	1.50

1* : Soy lecithin
2* : soy lecithin hydrolysate

Table (11): Sensory characteristics of balady bread made with corn or sorghum flours at different levels and improved with soy lecithin and soy lecithin hydrolysate .

		Color & Appearance (5)		Diameter (5)		Separation (5)		Biting textures (5)		Aroma (5)		Taste (5)		Crumb texture (5)		Overall score (35)	
		1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*
Balady bread with : corn flour + lecithin																	
%	**%**																
	0.25	4.0 a	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	4.0 b	4.0 b	32.0 a	32.5 b
10	0.5	4.0 a	5.0 a	4.5 a	4.5 a	5.0 a	5.0 a	4.0 b	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	32.5 a	34.0 a
	1.0	4.0 a	4.5 a	4.0 b	4.5 a	5.0 a	5.0 a	4.0 b	4.5 a	4.0 c	4.0 b	4.0 b	4.0 c	4.0 b	4.0 b	29.0 b	30.5 c
	0.25	4.0 a	4.5 a	4.0 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.0 b	4.0 b	32.0 a	33.0 a
	0.5	4.5 a	4.5 a	4.5 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	4.5 a	4.5 a	33.5 a	34.0 a
	1.0	4.0 a	4.0 b	4.0 b	4.0 a	4.0 b	4.0 b	4.0 b	4.0 b	4.5 a	4.5 a	4.0 c	4.0 b	4.0 b	4.0 b	28.5 b	28.5 d
	0.25	4.0 a	4.0 b	4.0 b	4.0 a	4.0 b	4.0 b	4.0 b	4.0 b	3.5 b	3.5 b	4.5 b	4.5 a	4.0 b	4.0 b	28.0 b	28.0 d
30	0.5	3.0 b	3.5 b	4.0 b	4.0 b	4.5 b	4.0 b	3.5 b	3.5 b	4.0 b	4.0 b	4.0 c	4.0 b	4.0 b	4.0 b	27.0 d	27.0
	1.0	2.5 b	3.0 c	3.5 b	3.5 b	3.5 c	3.5 b	3.5 b	3.5 b	3.5 b	3.5 b	4.0 c	4.0 b	3.0 c	3.0 c	23.5 d	24.0 e
L.S.D.		1.20	1.00	0.98	1.11	0.90	0.96	0.69	0.66	1.0	0.81	0.31	0.71	0.68	0.52	1.98	1.61

1* soy lecithin **2* soy lecithin hydrolysate**