Influence of Wheat Classes, Flour Extractions, and Baking Methods on Egyptian Balady Bread[1]

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ABSTRACT

Two commercial hard red winter and hard red spring wheat samples with 12% protein were milled in a pilot mill to 85, 90, and 95% extraction. The flour samples were baked into Balady bread by a straight-dough and a continuous mix method, with and without oxidant and barley malt supplements. Acceptable bread was made by both methods, as judged by a 10-member Egyptian taste panel. The breads made from untreated flours were preferred to those made with flours containing malt and/or oxidant.

In the Middle East, the caloric contribution of bread to the diet may be as high as 80–90% (Dalby 1969). Abbott (1969) stated that as much as 64% of the daily protein intake in the Middle East is derived from cereals.

The present food resources of Egypt do not satisfy domestic demand, and additional quantities of certain foods, principally wheat, are imported. Patwardhan and Darby (1972) mentioned that in Egypt wheat is the most widely consumed cereal and is the second most produced cereal crop. Jansen and Howe (1964) stated that two-thirds of the calories in the Egyptian diet come from grain, mostly from wheat.

Balady bread is the Egyptian type of Arabic bread, which is the main staple in the Middle Eastern diet. Balady (also spelled Baladi) means traditional, and bread production is subsidized by the Egyptian government. European style white bread in Egypt is made from flour of 60–65% extraction (Halleb et al 1974), whereas Balady bread, which is preferred in Egypt, is usually made from flour of 85–95% extraction with a protein content between 10 and 12%.

Balady bread is round and flat. The loaf measures 15–20 cm in diameter and weighs 60–65 g. Hamed et al (1973) reported a formula for Balady bread that consisted of flour (taken as 100%), 70–80% water, 0.5–1.5% salt, and 12–17% starter (fermented dough). Fermentation in the starter is initiated by the activity of wild bacteria and yeast. The dough is baked at 300–350° C for 3–4 min. The flat piece of dough raises in the oven and separates into two thin layers, from steam formation rather than from gas production (Fig. 1). When the loaf is cut in two, there is an open space between the top and bottom crusts of the loaf (Fig. 2). The bread is consumed in large amounts. Its physical shape and structure make it an edible utensil that holds food.

In today's world of food shortages and malnutrition, the flour yield obtained from wheat should be the highest possible, without reducing the quality of the finished product or consumer acceptance, regardless of flour color or ash (Watson and Shuey 1977).

The purpose of this study was to determine the effect of different flour extractions of hard red spring (HRS) and hard red winter (HRW) wheat on Balady bread produced by straight-dough and continuous methods.

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MATERIALS AND METHODS

Samples

Two commercial HRS and HRW wheat samples (12% protein) from the 1976 crop were selected for study. The samples were milled to flours of 85, 90, and 95% extraction.

Physical and Chemical Tests

Wet gluten weights were determined by AACC Method 38-11. Moisture, ash, and protein levels were determined by AACC Methods 44-15, 08-01, and 46-10, respectively. Ash and protein were expressed on a 14% moisture basis.

Farinograms were obtained by AACC Method 54-21. The 50-g small bowl, constant flour weight procedure was followed. The curve was centered at the 500 Brabender Units (BU) line. Extensigrams were obtained by AACC Method 54-10.

Baking Procedure

Straight-Dough Method. To prepare the starter, we mixed flour, 100% (14% mb); 50–55% distilled water, and 10% baker's yeast (*Saccharomyces cerevisiae*), for 2 min with a special 100-g National Mixer (National Mfg. Co., Lincoln, NE) to form homogeneous firm dough. We placed the dough in a bowl, covered it, and left it overnight in a fermentation cabinet (National Mfg. Co., Lincoln, NE) at 32° C. The starter was used at a 20% level, based on the total

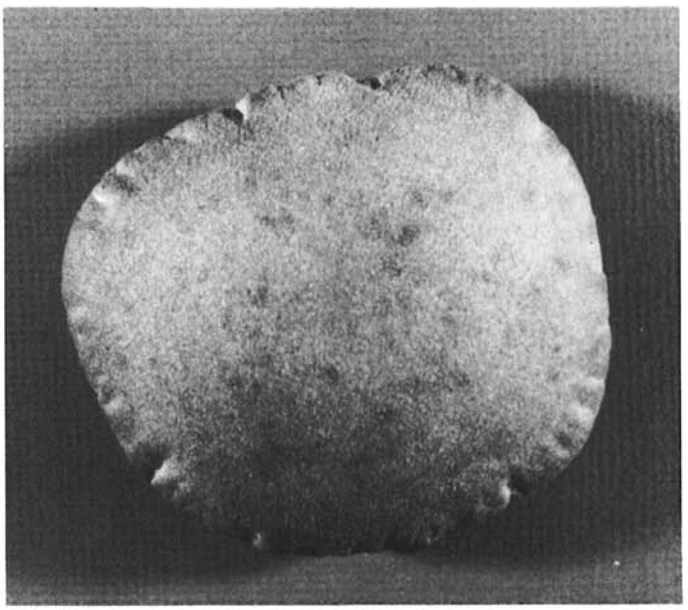

Fig. 1. A loaf of Egyptian Balady bread.

flour weight, and replaced the yeast normally used.

The procedure for Balady bread described by Hamed et al (1973) was modified. The control formula used for each loaf of Balady bread was unmalted flour, 100% (14% mb); 2% salt; 20% starter; and variable water.

Baking absorption was determined for each flour by the handling properties of the dough and was 2.5 and 0.5% less than the absorptions obtained on the Brabender Farinograph for HRW and HRS flours, respectively. Ingredients were mixed until the dough was developed. The dough was feremented at 32° C and 85–100% relative humidity in the fermentation cabinet for 2 hr; it was punched down after 60 min. After fermentation, the dough was flattened by rolling to a 15-cm diameter and 7-mm thickness. The flattened dough was transferred immediately to a wooden board that had been sprinkled with a thin layer of fine dusting bran and then was placed in the fermentation cabinet for a 30-min proof at 32°C and 85–100% relative humidity. The flattened doughs were placed in the oven by means of a wooden peel and baked for 4 min at 320°C in a rotary oven with a transite hearth (Despatch Oven Co., Minneapolis, MN). Steam was injected into the oven during baking. The bread was allowed to cool on racks for 1–2 hr and then evaluated.

Continuous Method. To prepare the starter dough, we mixed 1,000 g of flour (20% of the total 5,000 g of flour), 100 g of yeast (2% of the total flour), and 750 g of water (75% of the starter's flour) for 2 min. Dough was mixed in a 5-kg bowl with a Hobart mixer, Model C-11 (Hobart Mfg. Co., Troy, OH), to form a homogeneous mixture. The starter dough was covered and left overnight in the fermentation cabinet at 32°C.

The starter dough was mixed with the remaining 4,000 g of the total flour, 100 g of salt (2%), and water in a Hobart mixer, Model A-200 FT with a 10-kg bowl, for 2 min to form a homogeneous mixture. The baking absorption was 4% more than farinograph absorption. A Wallace and Tiernan laboratory-model continuous unit (Baker Process Co., Belleville, NJ) with a developer speed of 100 rpm was used. The dough was divided into 100-g pieces and fermented at 32°C for 1 hr. The fermented dough was flattened, proofed for 30 min, and baked in the same manner as the straight-dough method.

In some baking tests, oxidizing agents and malt were added to determine their effects on dough characteristics and bread quality.

Physical Tests

Loaf volume was determined by measurement of rapeseed displacement after the bread had been dried at room temperature for one day to harden its surface.

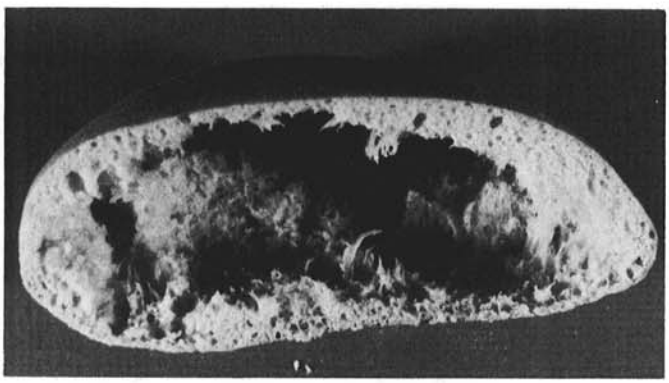

Fig. 2. Loaf of Egyptian Balady bread cut in half shows the open space between the top and bottom crusts of the loaf.

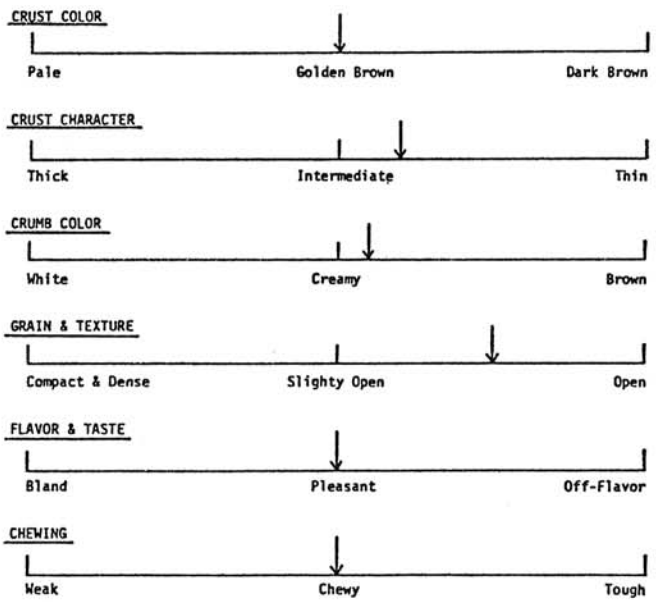

Fig. 3. Score sheet used by Egyptian taste panel. Arrows indicate average ideal score as judged by panelists.

TABLE I
Physical and Chemical Analyses of the 85, 90, and 95% Extraction Flours and Doughs

	HRS Wheat Flour			HRW Wheat Flour		
	85%	90%	95%	85%	90%	95%
Moisture, %	13.0	12.9	12.7	13.0	12.7	12.6
Protein, %[a]	12.3	12.3	12.3	12.1	12.3	12.3
Ash, %[a]	0.929	1.097	1.267	0.926	1.121	1.311
Wet gluten, %[a]	30.0	30.0	29.5	33.1	32.4	31.7
Color value	92.8	77.3	63.8	91.8	74.0	60.0
Farinograph						
Absorption, %	64.4	67.3	71.0	62.2	63.6	65.3
Dough development time, min	4.5	5.0	5.5	4.5	4.5	4.0
Stability, min	10.0	10.0	6.0	8.0	7.5	6.0
Extensigraph						
Extensibility at 45 min, cm	23.0	22.4	23.3	17.2	20.0	19.4
Resistance at 45 min, cm	5.4	4.5	4.7	3.5	3.7	3.6
Extensibility at 180 min, cm	20.5	21.1	19.4	21.0	19.7	19.7
Resistance at 180 min, cm	10.2	8.4	7.4	6.5	7.4	6.7

[a] 14% mb

TABLE II
Baking Characteristics of Balady Bread Produced from 85, 90, and 95% Extraction Flours by Straight-Dough and Continuous Methods

Baking Characteristics	Straight-Dough Method												Continuous Method							
	HRS Wheat Flour						HRW Wheat Flour						HRS Wheat Flour				HRW Wheat Flour			
	85%		90%		95%		85%		90%		95%		85%	90%		95%	85%	90%		95%
	U[a]	T[b]	U	T	U	T	U	T	U	T	U	T	U	U	T	U	U	U	T	U
Absorption, %	63.9	63.9	66.8	66.8	70.5	70.5	59.7	59.7	61.1	61.1	62.8	62.8	68.4	71.3	71.3	75.0	66.2	67.6	67.6	69.3
Loaf weight, g	52.7	51.9	48.7	50.0	52.0	49.0	50.1	48.9	50.0	48.3	47.7	50.3	49.7	48.3	48.3	47.4	48.9	49.4	48.9	48.1
Loaf volume, cc	580	500	585	475	500	550	610	425	530	540	540	530	440	460	360	450	440	525	450	540
Specific volume, cc/g	11.0	9.6	12.0	9.5	9.6	11.2	12.2	8.7	10.6	11.2	11.3	10.5	8.9	9.5	7.5	9.5	9.0	8.6	9.2	11.2

[a]U = Bread made from untreated flour.
[b]T = Bread made from flour treated with 7.5 ppm $KBrO_3$ and 0.1% malted barley flour for straight-dough method and with 60 ppm $KBrO_3$ and 15 ppm KIO_3 for continuous method.

TABLE III
Organoleptic Evaluation of Balady Bread[a]

Organoleptic Evaluation	Ideal Score (Avg)	Straight-Dough Method												Continuous Method							
		HRS Wheat Flour						HRW Wheat Flour						HRS Wheat Flour				HRW Wheat Flour			
		85%		90%		95%		85%		90%		95%		85%	90%		95%	85%	90%		95%
		U[b]	T[c]	U	T	U	T	U	T	U	T	U	T	U	U	T	U	U	U	T	U
Crust color	5.0	4.4	4.5	6.4	7.3	5.3	5.7	5.3	5.0	6.5	4.7	4.7	9.1	4.5	6.1	5.0	7.6	4.4	5.5	5.2	4.7
		(0.6)	(0.5)	(1.4)	(2.3)	(0.3)	(0.7)	(0.3)	(0.0)	(1.5)	(0.3)	(0.3)	(4.1)	(0.5)	(1.1)	(0.0)	(2.6)	(0.6)	(0.5)	(0.2)	(0.3)
Crust characteristics	6.0	4.9	5.4	5.1	5.7	5.5	5.8	6.7	5.0	5.8	5.7	6.6	3.7	4.3	4.8	2.3	5.6	5.0	5.5	3.9	5.3
		(1.1)	(0.6)	(0.9)	(0.3)	(0.5)	(0.2)	(0.7)	(1.0)	(0.2)	(0.3)	(0.6)	(2.3)	(1.7)	(1.2)	(3.7)	(0.4)	(1.0)	(0.5)	(2.1)	(0.7)
Crumb color	5.5	4.5	4.4	6.3	6.2	6.8	6.3	5.1	4.0	6.1	5.2	6.2	8.3	4.9	7.3	6.0	7.0	4.8	5.5	5.6	5.3
		(1.0)	(1.1)	(0.8)	(0.7)	(1.3)	(0.8)	(0.4)	(1.5)	(0.6)	(0.3)	(0.7)	(2.8)	(0.6)	(1.8)	(0.5)	(1.5)	(0.7)	(0.0)	(0.1)	(0.2)
Crumb grain and texture	7.5	7.1	7.4	7.0	7.1	6.1	5.7	7.5	6.2	7.1	6.4	5.9	6.7	6.1	6.4	5.2	6.0	6.9	4.1	5.6	7.0
		(0.4)	(0.1)	(0.5)	(0.4)	(1.4)	(1.8)	(0.0)	(1.3)	(0.4)	(1.1)	(1.6)	(0.8)	(1.4)	(1.1)	(2.3)	(1.5)	(0.6)	(3.4)	(1.9)	(0.5)
Flavor and taste	5.0	5.4	4.7	4.7	4.0	5.9	5.7	4.6	4.7	5.3	5.1	5.6	5.0	5.0	5.9	5.1	5.4	5.1	5.0	5.6	5.1
		(0.4)	(0.3)	(0.3)	(1.0)	(0.9)	(0.7)	(0.4)	(0.3)	(0.3)	(0.1)	(0.6)	(0.0)	(0.0)	(0.9)	(0.1)	(0.4)	(0.1)	(0.0)	(0.6)	(0.1)
Chewing	5.0	6.0	5.3	5.2	6.9	4.7	5.0	5.7	4.6	6.9	5.0	4.7	5.4	5.7	5.6	5.2	6.2	6.2	5.9	5.2	5.9
		(1.0)	(0.3)	(0.2)	(1.9)	(0.3)	(0.0)	(0.7)	(0.4)	(1.9)	(0.0)	(0.3)	(0.4)	(0.7)	(0.6)	(0.2)	(1.2)	(1.2)	(0.9)	(0.2)	(0.9)
Sum of absolute deviations	···	4.5	2.9	4.1	6.6	4.7	4.2	2.5	4.5	4.9	2.1	4.1	10.4	4.9	6.7	6.8	7.6	4.2	5.3	5.1	2.7

[a]Average scores of 10 Egyptian panelists. Absolute deviations from ideal scores are given in parantheses.
[b]U = Bread made with untreated flour.
[c]T = Bread made from flour treated with 7.5 ppm $KBrO_3$ and 0.1% malted barley for the straight-dough method and with 60 ppm $KBrO_3$ and 15 ppm KIO_3 for the continuous method.

Organoleptic Tests

A 10-member Egyptian taste panel judged external and internal loaf characteristics. The fresh samples were delivered to the panelists within 2 hr after baking. Crust color and characteristics; crumb color, grain, and texture; flavor and taste; and chewiness were scored on a scale of 1–10. A sample of the score sheet used by the panel is shown in Fig. 3.

RESULTS AND DISCUSSION

Selected physical and chemical analyses on the 85, 90, and 95% extraction flours from the two commercial wheats are given in Table I.

Table II shows the adjusted baking characteristics of the bread. Baking absorption increased with increasing flour extraction, and the continuous method required higher baking absorption than did the straight-dough method.

High loaf volume is the most important criterion for acceptance of Balady bread by Egyptian consumers. Because the Egyptian Food Administration requires a constant weight for Balady bread, high specific volume is desirable. For both baking methods, bread baked from untreated flours generally showed higher specific volumes than did bread baked from treated flours.

The organoleptic evaluation data of the Balady bread produced by both methods are presented in Table III. Summation of the absolute deviations from ideal score for each bake gave a relative rating of the quality of the breads. Those from the untreated flours (average 4.7) were preferred to the treated samples (average 5.3), and results were better with the straight-dough method than with the continuous method; average scores were 4.6 and 5.4, respectively.

Although acceptable Balady bread was made by the continuous method, the quality might be improved with additional studies. Improved Balady bread produced by the continuous method could increase the production of Balady bread, a mainstay of the Egyptian diet.

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