Experimental Baking Techniques for Evaluating Pacific Northwest Wheats in North African Breads[1]

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ABSTRACT

Experimental laboratory baking techniques and evaluation methods were developed for making four important North African breads: Tunisian "Terablesi," Moroccan, white Arabic, and Egyptian balady. Twelve wheat varieties representing two classes (hard red winter and white) including four subclasses of white wheat (soft white winter, soft white spring, club and Western white) were evaluated. An Australian standard white wheat was included for comparison. Wide differences in baking performance and rheological properties were found among varieties. Daws, Wanser, Nugaines, Western white, and Australian standard white performed satisfactorily in all breads. Performance of Stephens, Hyslop, McDermid, DPA, DPB, and DPC was less satisfactory. Supplementing with 50 ppm ascorbic acid and 0.25% malted barley enhanced bread quality of all varieties in most breads.

In North Africa, bread is still the mainstay of the people, and wheat is the staple cereal cultivated, but the production is not sufficient to satisfy the needs of the population. Therefore, large quantities of wheat are imported, and soft white wheat is preferred.

Breads produced in North African countries can be grouped in two categories. In Northwest and North Central Africa (Morocco, Tunisia, Algeria, and Libya), French-type breads are popular. In Morocco, the most popular bread is round and made of flour of high (82%) extraction rate, salt, yeast, and water. Total fermentation and proof times are about 90 min. The dough is baked at 210° C for 26 min, and the bread weighs about 600–700 g (Finney et al 1980, Patel and Johnson 1975). In Tunisia, the most popular bread, "Terablesi," is made of flour of low (70%) extraction rate, salt, yeast, and water. Total fermentation and proof times are around 75 min. The dough is baked at 210° C for 35 min, and the bread weighs about 800 g.[4] In Algeria and Libya, the most popular bread is the traditional long French bread that is also very popular in the United States. In Northeast African countries (Egypt and Sudan) pocket breads are very popular, although about 40 different breads are made in Egypt alone. Balady, the most popular bread, is made from flour of high (82%) extraction rate, salt, yeast, and water. Water absorption is very high, which has a significant impact on physical characteristics and flavor of the bread. The high absorption makes the dough very slack, and special handling techniques are required (Dalby 1963, Mousa et al 1979). Doughs of 200 g are formed into a ball and placed on a wooden tray covered with a thin layer of bran flakes and left for 30 min. The ball is then flattened to a form resembling a pancake about 20 cm in diameter and is given an additional 1 hr of fermentation. The oven temperature is 450–500° C and baking time is 60–90 sec. In the oven, a crust forms in less than 1 min, and the internal temperature reaches a point high enough to develop steam that "puffs" the bread with almost explosive rapidity. Thus, leavening is due considerably to steam (Arafah et al 1980, Tabekhia and Toma 1979).

White Arabic bread is made from flour of low (70%) extraction rate, salt, yeast, and water. The water absorption is low, resulting in a dough that is very dry. After fermenting for 1 hr, the 135-g dough pieces are sheeted to 18–20 cm in diameter and proofed for 30 min before baking at 450° C for 1 min (Abdel-Rahman and Youssef 1978, Hallab et al 1974, Maleki and Daghir 1967).

North African countries generally are net wheat importers and are present or potential customers of U.S. wheats. In 1980, Egypt imported 46 million bushels of soft white wheat from the United States alone (Oregon Wheat Commission 1981). In addition, modern baking plants are developing very rapidly in that region. Domestic wheats are usually nonuniform and vary greatly in their chemical and functional (bread-making) properties. So, until more uniform wheats are produced, these countries may depend on imported wheat for their modern bakery plants.

Although methods have been developed for evaluation of the quality of soft white wheat flour as used in the United States (Yamazaki 1969, Yamazaki and Lord 1971), in Japan (Nagao et al 1976, 1977), and in Iran (Faridi et al 1981), no method of evaluating soft wheat for production of North African-type breads has been reported.

This article describes experimental laboratory baking methods for evaluating the suitability of some U.S. wheats in the four North African breads described.

MATERIALS AND METHODS

Eleven Pacific Northwest wheat varieties representing hard red winter (Wanser), soft white winter (Daws, Nugaines, Stephens, Hyslop, and McDermid), white club (Moro and Jacmar), experimental selections of soft white spring (K76-00514-L-DPA, K76-00514-H-DPB, K-76514-DPC), and a composite called Western white (27% Nugaines, 27% Daws, 26% Stephens, 10% Moro, and 10% Jacmar) were studied. An Australian standard white (ASW) was also studied for comparison. Each variety was prepared by compositing two to five crop years of wheats (except the three experimental soft white spring wheats) (Table I) grown at

TABLE I
Wheat Varieties, Classes, and Composites Used for Evaluation

Variety	Class[a]	1976	1977	1978	1979	1980
Daws	SWW		X	X	X	X
Nugaines	SWW			X	X	X
Stephens	SWW				X	X
ASW[b]	SWW				X	X
Hyslop	SWW				X	X
McDermid	SWW				X	X
Wanser	HRW	X	X	X	X	X
Moro	CLUB		X	X	X	X
Jacmar	CLUB				X	X
K76-00514-L-DPA	SWS					X
K76-00514-H-DPB	SWS					X
K-76514-DPC	SWS					X

[a]SWW = soft white winter, HRW = hard red winter, and SWS = soft white spring.
[b]Australian standard white.

[1]Scientific Paper 6113, College of Agriculture Research Center, Washington State University, Pullman 99164. Presented at the AACC 66th Annual Meeting, Denver, CO, October 1981.

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[4]A. Chaar. 1980. Personal communication.

several locations in the Pacific Northwest of the United States. Equal amounts of each crop year were used to make the blend.

A Buhler mill model ML202 was used to mill each composite to two extraction levels: 71% for Tunisian and white Arabic, and 82% for Moroccan and Egyptian balady. To attain a desired 82% extraction level, shorts and bran streams were reground as needed in a Hobart coffee grinder and sieved through a 94-mesh stainless steel screen. All flours were stored in airtight containers at 1–2° C until studied. All samples were analyzed for protein, ash, and moisture contents by AACC methods (1962). Farinograph tests were performed (AACC 1962) to determine the appropriate dough consistency for each bread. Mixograms were obtained with 10-g portions of samples (Finney and Shogren 1972), and baking absorption levels were those determined by farinograph measurement. Flour color was measured by Agtron (AACC 1962).

Bread-Baking Techniques

Shogren et al (1969) described a baking procedure using 10 g of flour for evaluating white pan bread. Faridi et al (1981) described a micro-baking technique for Iranian breads. Small-scale laboratory-baking techniques similar in principle to commercial procedures were developed from questionnaires that were sent to cereal scientists and industry experts in those countries through the cooperation of U.S. Wheat Associates, Inc., Cairo, Egypt.

Tunisian bread was prepared by mixing 200 g of flour and other ingredients (Table II) to optimum. After fermenting for 30 min at 85° F and 90% rh, doughs were degassed and flattened to 2.5-cm thickness and 15-cm diameter, then proofed for 45 min on a lightly greased baking sheet at 85° F and 90% rh. Doughs were lightly sprayed with water every 15 min during proofing. A square cut (approximately 1 cm deep) was made on the top of the loaf with a sharp knife, and the loaf was then baked for 35 min at 210° C in an oven preconditioned with water (vapor). Breads were replicated at least 10 times. Weights and volumes (rapeseed displacement) of loaves were taken as bread came from the oven, and specific loaf

TABLE II
Bread Formula Used to Produce Four North African Breads

	Breads			
Ingredients[a]	**Tunisian**	**Moroccan**	**White Arabic**	**Balady**
Flour (%)	100	100	100	100
Yeast (%)[b]	2	1	1	1
Salt (%)	1.5	2	1.5	1.5
Water (%)[c]	variable	variable	variable	variable
Ascorbic acid (ppm)[d]	50	50	25–30	···
Malted barley (%)[d]	0.25	0.25	···	···

[a]On flour basis.
[b]Fresh bakers' yeast supplied by Standard Brands Inc., Sumner, WA.
[c]Water absorption levels indicated in Table IV.
[d]Not used in lean formula.

TABLE III
Protein and Ash Content and Flour Color of 12 Wheat Varieties and a Western White Composite Used to Produce Four North African Breads

Bread	**Wheat Variety**	**Protein**[a,b] **(%)**	**Ash**[a] **(%)**	**Flour Color**[c,d]
Tunisian and	Daws	9.8	0.43	63
White Arabic	Nugaines	8.6	0.40	72
(71% extraction)	Stephens	10.6	0.42	69
	ASW[e]	9.2	0.44	61
	Western white	10.5	0.43	67
	Wanser	11.9	0.41	53
	Moro	10.0	0.46	66
	K76-00514-L-DPA	8.1	0.45	80
	K76-00514-H-DPB	10.6	0.47	70
	K-76514-DPC	12.1	0.49	66
Moroccan and	Daws	11.0	0.72	20
Egyptian balady	Nugaines	9.0	0.60	34
(82% extraction)	Stephens	11.2	0.63	32
	ASW	10.1	0.67	38
	Hyslop	10.0	0.74	32
	McDermid	8.7	0.67	46
	Western white	9.9	0.64	34
	Wanser	12.3	0.66	8
	Moro	10.7	0.67	28
	Jacmar	11.6	0.71	26
	K76-00514-H-DPB	11.3	0.76	34
	K-76514-DPC	12.6	0.80	31

[a]On 14% moisture basis.
[b]$N \times 5.7$.
[c]Agtron value.
[d]Higher values indicate lighter color.
[e]Australian standard white.

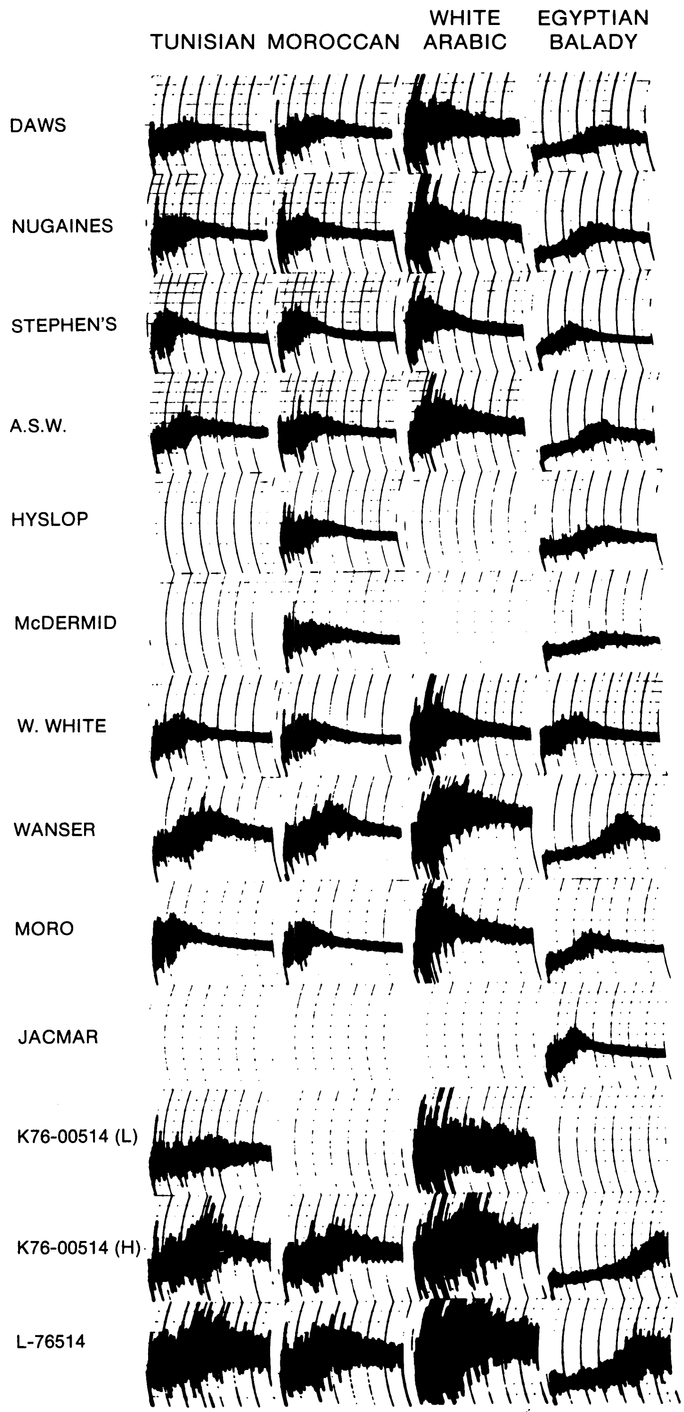

Fig. 1. Mixograms of 12 wheat varieties and a Western white composite milled to two extraction levels and hydrated to water absorption levels as described in Table IV.

volume (v/w) was calculated. Breads were allowed to cool on racks for 1–2 hr and then evaluated.

Moroccan bread was prepared by mixing 200 g of flour and other ingredients (Table II) to optimum. After fermenting for 45 min at 85° F and 90% rh, doughs were degassed and flattened to 2-cm thickness and 15-cm diameter. The doughs were proofed for 45 min on a lightly greased baking sheet at 85° F and 90% rh and then cut across the middle (approximately 1 cm deep) with a sharp knife, and the loaf was baked for 26 min at 210° C in an oven preconditioned with water. Breads were replicated at least 10 times. Weights and volumes (rapeseed displacement) of loaves were taken as bread came from the oven, and specific loaf volume (v/w) was calculated. Breads were allowed to cool on racks for 1–2 hr and then evaluated.

Egyptian balady bread was prepared by mixing to optimum 65 g of flour and other ingredients (Table II). The dough is slack, and must be handled carefully. Fermentation time was 60 min at 85° F and 90% rh. On a heavily floured board, doughs are degassed and then transferred to a special molder (Rubenthaler and Faridi 1982) and flattened to a thickness of 6 mm and a diameter of 15 cm. Molded doughs were transferred onto a canvas that had been dusted with a thin layer of flour and then were placed in the fermentation cabinet for a 30-min proof at 85° F and 90% rh. The proofed dough was transferred by sliding onto a lightly floured stainless steel sheet that was used to slide the dough onto a baking stone in a specially designed oven[5] to bake at 450° C for 105 sec. Treatments were replicated at least 10 times. Breads were allowed to cool on racks for 1–2 hr and then evaluated.

White Arabic bread was prepared by mixing 50 g of flour and other ingredients (Table II) to optimum. After fermenting for 30 min at 85° F and 90% rh, doughs were degassed and flattened to a thickness of 4 mm and a diameter of 15 cm with a special, lightly floured molder. Flattened doughs were transferred immediately to a canvas that had been dusted with a thin layer of flour and then were placed in the fermentation cabinet for a 45-min proof at 85° F and 90% rh. The proofed dough was transferred by sliding onto a lightly floured stainless steel sheet that was used to slide the dough onto a baking stone in a specially designed oven to bake at 450° C for 1 min. Treatments were replicated at least 10 times. Breads were allowed to cool on racks for 1–2 hr and then were evaluated.

Bread Evaluation Techniques

Visual scoring of all breads was done on a numerical basis of 1 to 10, where 10 is excellent. The average score for each factor of 10 replicated bakes was converted to a descriptive category of excellent, satisfactory, questionable, and unsatisfactory for scores of 9–10, 7–8, 5–6, and lower than 5, respectively.

Rheological value (RV) of the Tunisian and Moroccan breads was evaluated using a Fudoh Rheometer[6] model J fitted with a 2.5-cm diameter disk and an automatic-stop accessory adjusted to penetrate the bread crumb 3 mm. For balady and white Arabic breads, the instrument was fitted with a 0.29-mm diameter wire that cut through a 1-cm slice of bread. Readings obtained are in grams per square centimeter and grams of pressure needed, respectively. The Fudoh Rheometer is a Japanese instrument designed to measure the rheological properties of gels, pastas, baked goods, and other foods.

Factors scored for each bread depended upon the following traditional desired characteristics: The most desirable characteristics of Tunisian and Moroccan breads are a glossy gold-brown crust, a white and shiny crumb with a small and uniform cell texture, a high specific volume, and a low RV; desirable factors for white Arabic and balady pocket breads are a complete separation of upper and lower layers that are equal in thickness, a soft, white, and moist crumb, low RV, and a white shiny crust with brown spots. Due to higher extraction flour in balady bread, the crust is darker than that of white Arabic bread.

[5]G. L. Rubenthaler and H. A. Faridi. 1982. Unpublished data.

RESULTS AND DISCUSSION

Flour Characteristics

DPC and Wanser had the highest protein content, followed by Jacmar, DPB, and Stephens. DPC also had the highest ash content. Wanser was significantly darker than the other wheat varieties shown by the flour color test (Table III). Several North African breads are made from high-extraction flours; therefore, the dark color imparted from the hard red wheat bran could make them less desirable. Their ash content followed a typical flour ash at the respective extraction rates.

The effect of various water absorption levels on bread quality was determined by experimental baking. The optimum dough consistencies for Tunisian, Moroccan, white Arabic, and balady were 450, 500, 800, and 200 Brabender units (BU), respectively (Table IV). The 800-BU value for white Arabic bread was also suggested by Hallab et al (1974).

Baking water absorption was found to play a very important role in the overall performance of the breads. Every wheat variety has its own flour physical characteristics and water absorption for the four breads tested. The hard red winter variety Wanser had a characteristically higher water absorption requirement.

Relative dough strength among varieties as measured by mixograms showed that as water absorption is adjusted to a certain Farinograph consistency line, all soft white and club wheats tested performed equally. DPA, DPB, DPC, and Wanser were stronger and showed more strength (Fig. 1).

[6]Manufactured by Fudoh Kogyo Co., Ltd., 16-6, 4-Chome Nishigotanda, Shinagawa-ku, Tokyo 141, Japan.

TABLE IV
Water Absorption of 12 Wheat Varieties and a Western White Composite Flour Used to Produce Four North African Breads

	Percent Absorption			
Wheat Variety	**Tunisian[a] (71% extraction)**	**Moroccan[a] (82% extraction)**	**White Arabic[a] (71% extraction)**	**Egyptian Balady[a] (82% extraction)**
Daws	60.0	61.5	51.0	78.0
Nugaines	58.5	61.0	51.0	77.0
Stephens	59.3	60.0	51.0	75.5
ASW[b]	63.0	64.0	54.0	79.0
Hyslop	···	58.0	···	71.0
McDermid	···	56.5	···	71.0
Western white	58.5	60.5	51.0	76.0
Wanser	67.0	68.5	56.0	83.0
Moro	57.0	58.5	48.0	73.5
Jacmar	···	···	···	73.0
K76-00514-L-DPA	54.5	···	48.0	···
K76-00514-H-DPB	57.0	58.5	48.5	72.5
K-76514-DPC	58.0	59.0	51.0	73.0

[a]Adjusted to 450-, 500-, 800-, and 200-Brabender unit line, respectively.
[b]Australian standard white.

Baking Results

Tunisian Bread. When the control formula was employed, the best varieties for Tunisian bread production were Daws and Wanser followed by ASW and Nugaines (Table V). Stephens and DPA failed to produce acceptable bread. Addition of 50 ppm of ascorbic acid and 0.25% of malted barley significantly improved

TABLE V
Quality Evaluation of Nine Wheat Varieties and a Western White Composite Flour Used to Produce Tunisian Bread With or Without Ascorbic Acid and Malted Barley

	Control				Control + Ascorbic Acid (50 ppm)				Control + Ascorbic Acid (50 ppm) + Malted Barley (0.25%)				
Wheat Variety	Specific Volume[a]	Crust Color	Texture	Crumb Color	Specific Volume[a]	Crust Color	Texture	Crumb Color	Specific Volume[a]	Crust Color	Texture	Crumb Color	RV[b]
Daws	3.24	S[c]	S	S	3.37	E	S	S	4.33	E	E	E	57
Nugaines	2.92	Q-S	S	Q-S	3.26	S	S	S	3.81	E	S	E	56
Stephens	2.56	U	U	U	2.64	Q-S	U	U	3.09	Q-S	U	Q-S	169
ASW[d]	3.28	S	S	Q-S	3.37	S	S	S	3.76	E	S	E	57
Western white	3.02	Q-S	Q-S	S	3.16	S	S	S	4.00	E	E	E	59
Wanser	3.36	S	S	S	3.45	E-S	S	S	3.88	E	E	E	70
Moro	2.99	Q-S	Q-S	Q-S	3.18	Q-S	S	S	3.81	S	S	E	57
K76-00514-L-DPA	2.46	U	U	U	2.51	Q-U	Q-U	Q	2.88	Q	Q	Q	147
K76-00514-H-DPB	2.97	Q-U	Q-U	Q-U	3.02	Q	Q	Q	3.42	Q-S	Q-S	Q-S	122
K-76514-DPC	2.95	Q	U	U	3.00	Q-S	Q	Q	3.44	S	Q-S	S	98

[a] Specific loaf volume = loaf volume (cc)/loaf weight (g). Average of 10 values; overall standard deviation = 0.07.
[b] Rheological value on g/cm^2 basis. Average of 10 values; overall standard deviation = 5.06.
[c] E = excellent, S = satisfactory, Q = questionable, U = unsatisfactory.
[d] Australian standard white.

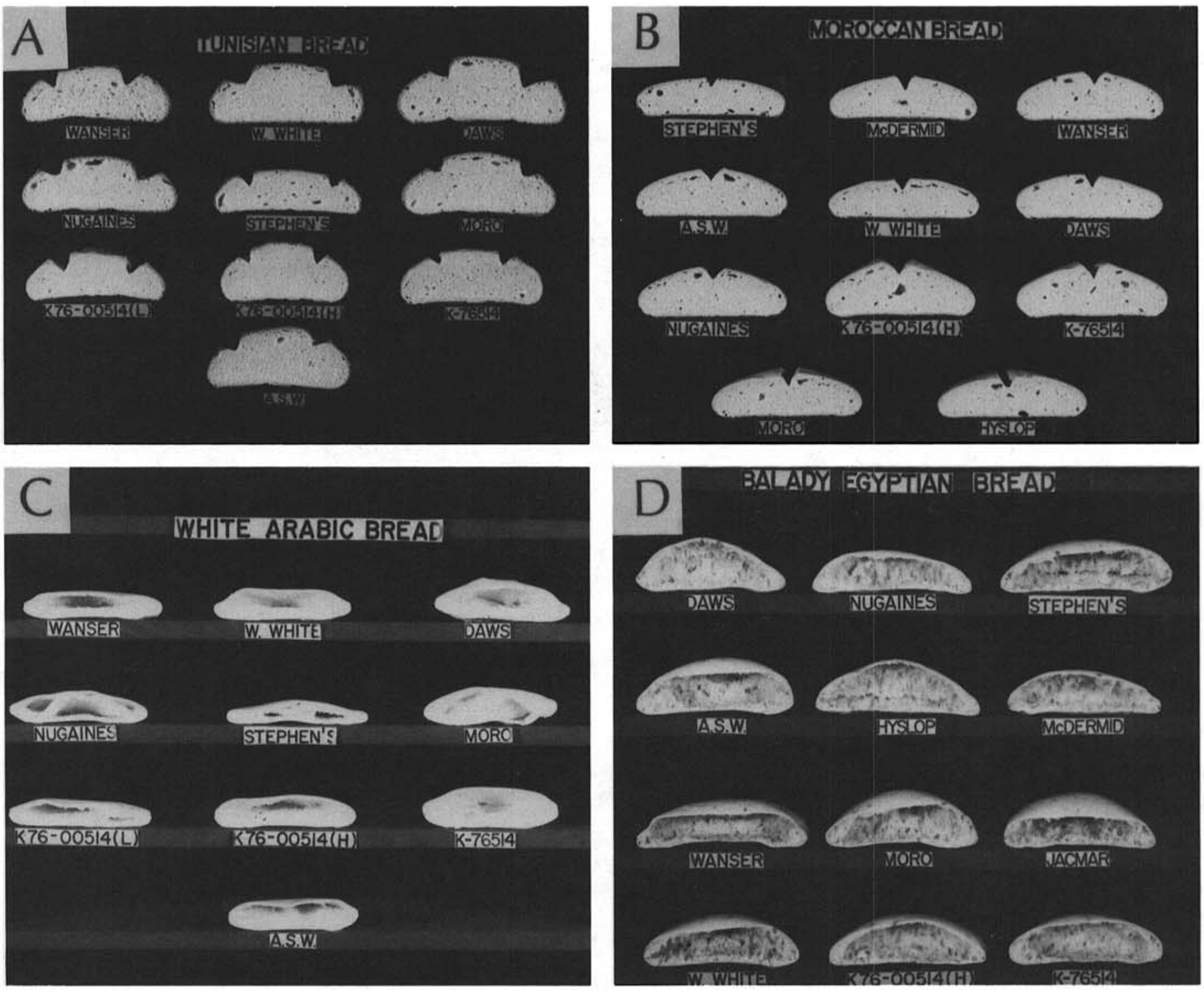

Fig. 2. Cross-sections of Tunisian **(A)**, Moroccan **(B)**, white Arabic **(C)**, and Egyptian balady **(D)** breads produced from 9–11 varieties and a Western white composite.

the performance of all varieties tested (Table V, Fig. 2a). Daws had the highest specific volume and best physical properties followed by Western white and Wanser. The poor performance of Stephens and DPA, DPB, and DPC appear not to be related to their dough consistencies as measured by the mixograph and/or protein content. Although Stephens dough consistency was very similar to the other SWW varieties included in the study, the three SWS experimental selections were similar to the strength of Wanser.

Rheometer readings measured for Western white showed that ascorbic acid and malted barley made bread both lighter and less chewy than either the control or the control plus ascorbic acid, 125, 64, and 59, respectively. Among the varieties, Nugaines, ASW, Daws, and Moro had the best texture (RV 56–59); and Stephens, DPA, and DPB (RV 122–169) had the heaviest. A high correlation ($r = .89$) between specific loaf volume and RV confirms the texture and other loaf characteristics observed.

Moroccan Bread. When the control formula was employed, only Wanser, Daws, and ASW produced satisfactory breads (Table VI). McDermid, Stephens, and Hyslop showed very poor performance. Supplementing 50 ppm of ascorbic acid, with or without 0.25% malted barley, significantly improved the baking performance of all varieties tested. Although DPB and DPC gave the highest specific loaf volume, their overall performance were not as high as that of Daws (Fig. 2b). Rheological tests showed that although breads produced from lean formulas were heavy and chewy, supplementing them with ascorbic acid and malted barley improved the bread quality.

Rheological differences between varieties did not change when ascorbic acid and malted barley were supplemented. ASW, Daws, Wanser, and Hyslop were lighter and less chewy, and Stephens was heavier than other varieties. No correlation between specific loaf volume and RV exists in the Moroccan breads.

White Arabic Bread. When the control formula was employed, Wanser, Daws, Western white, ASW, DPB, and DPC performed satisfactorily (Table VII). Good pocket formation and white crust with brown spots are the most important factors of acceptance of white Arabic bread. DPA and Stephens failed to produce acceptable bread. Supplementing the formulas with small quantities of ascorbic acid (30 ppm) improved bread-making qualities of less desirable varieties (Fig. 2c), but adding malted barley had an adverse effect by darkening the crust.

Rheological tests showed that ASW, Western white, and Wanser were lightest in texture and least resistant to Rheometer wire-cut pressure, and Moro, DPB, and DPC were the toughest.[7] Supplementing ascorbic acid, although improving the overall performance of all varieties, made most of them heavier and more chewy as measured by the Rheometer.

Balady Bread. Variety differences were less significant in regard to pocket formation, the most important factor in acceptability of

[7]Organoleptic tests by laboratory personnel confirmed differences in bread textures as measured by Rheometer. Data not included.

TABLE VI
Quality Evaluation of 10 Wheat Varieties and a Western White Composite Flour Used to Produce Moroccan Bread With or Without Ascorbic Acid and Malted Barley

	Control					Control + Ascorbic Acid (50 ppm)					Control + Ascorbic Acid (50 ppm) + Malted Barley (0.25%)				
Wheat Variety	Specific Volume[a]	Crust Color	Texture	Crumb Color	RV[b]	Specific Volume[a]	Crust color	Texture	Crumb Color	RV[b]	Specific Volume[a]	Crust Color	Texture	Crumb Color	RV[b]
Daws	2.67	S[c]	S	S	170	2.80	E-S	E	E	143	2.93	E	E	E	99
Nugaines	2.72	Q-S	S	S	146	2.84	S	E	S	129	3.03	E	E	S	111
Stephens	2.67	U	U	Q	231	2.72	Q	Q	Q	164	2.92	Q-S	Q-S	E	149
ASW[d]	2.75	S	S	S	129	2.80	S	E-S	E	106	3.00	E	E	E	94
Hyslop	2.58	U	U	U	199	2.92	Q	Q	S	189	3.03	S	Q-S	E	99
McDermid	2.52	U	U	U	210	2.77	Q-S	Q-S	Q-S	182	2.86	Q-S	S	S	135
Western white	2.68	Q	Q	Q	162	2.88	Q-S	S	Q-S	140	3.00	S	S	S	119
Wanser	2.68	S	S	E-S	139	2.95	E	E	E	116	3.09	E	E	E	100
Moro	2.72	Q	Q-S	Q	155	2.95	Q-S	S	S	139	2.96	S	S	S	117
K-76-00514-H-DPB	2.63	S	S	Q-S	247	3.00	E-S	E	S	197	3.16	E	E	S	136
K-76514-DPC	2.63	Q	S	S	205	2.89	S	E-S	S	191	3.18	E	E	S	135

[a]Specific loaf volume = loaf volume (cc)/loaf weight (g). Average of 10 values; overall standard deviation = 0.04.
[b]Rheological value on g/cm^2 basis. Average of 10 values; overall standard deviation = 10.09.
[c]E = excellent, S = satisfactory, Q = questionable, U = unsatisfactory.
[d]Australian standard white.

TABLE VII
Quality Evaluation of Nine Wheat Varieties and a Western White Composite Flour Used to Produce White Arabic Bread With or Without Ascorbic Acid

	Control				Control + Ascorbic Acid			
Wheat Variety	Crust Color	Pocket Formation	Crumb Texture	RV[a]	Crust Color	Pocket Formation	Crumb Texture	RV[a]
Daws[b]	E[c]	E	E	1,100	E	E	E	1,100
Nugaines	E	Q	S-Q	990	E	Q-S	E	1,000
Stephens	S	U	Q	1,060	S	Q	Q-S	1,010
ASW[d]	E	S	E	850	E	E	E	980
Western white	E	S	S	860	E	E	E	1,090
Wanser[b]	E	E	E	920	...	...	...	...
Moro	S-Q	Q	S	1,070	S	Q-S	S	1,170
K76-00514-L-DPA	U	U	U	930	Q	Q-S	Q	1,000
K76-00514-H-DPB	Q-S	S	Q-S	1,070	E-S	E	E-S	1,140
K-76514-DPC	Q-S	S	Q-S	1,110	E	E	E-S	1,160

[a]Rheological value = grams of pressure needed to cut through a 1-cm slice of bread with a 0.29-mm diameter wire. Average of 10 values; overall standard deviation = 40.82.
[b]Ascorbic acid was not added to the formula.
[c]E = excellent, S = satisfactory, Q = questionable, U = unsatisfactory.
[d]Australian standard white.

TABLE VIII
Quality Evaluation of 11 Wheat Varieties and a Western White Composite Flour Used to Produce Egyptian Balady Bread

	Bread				
Wheat Variety	Upper Crust To Lower Crust Ratio	Pocket Formation	Crumb Texture	Crust Color	RV[a]
Daws	E[b]	E	E	E	1,320
Nugaines	E	E	E	E	1,510
Stephens	E	E	E	E	1,445
ASW[c]	E	E	E	E-S	1,510
Hyslop	E	E	E	E	1,490
McDermid	E	E	E	E	1,515
Western white	E	E	E	E	1,450
Wanser	E	E	S	Q-S	1,260
Moro	E	E	E	E	1,430
Jacmar	E	E	E	E	1,650
K76-00514-H-DPB	E	E	Q-S	Q-S	1,740
K-76514-DPC	E	E	Q-S	Q-S	1,695

[a] Rheological value = grams of pressure needed to cut through a 1-cm slice of bread with a 0.25-mm diameter wire. Average of 10 values; overall standard deviation = 32.40.
[b] E = excellent, S = satisfactory, Q = questionable, U = unsatisfactory.
[c] Australian standard white.

balady bread (Table VIII, Fig. 2d). This is probably due to high water content of the dough, high baking temperature, and high dough thickness, which contribute to excessive steam formation during baking. Some differences were noted in crumb texture and crust color among the varieties. Rheological tests showed that Wanser and Daws were less chewy, and DPB and DPC were toughest in texture among varieties. Preliminary bakes gave poor pocket formation and other physical characteristics with the varieties Wanser, DPB, and DPC. Overmixing improved the bread quality significantly, possibly due to mechanical degradation of the gluten structure. This has been reported to be a common practice necessary to produce good-quality balady breads from strong gluten flour in Egypt.[8] The DPB and DPC that had the poorest crumb texture (rubbery) also had the highest RV for toughness.

CONCLUSION

Among wheat classes evaluated in this study, the hard red winter we used (Wanser) was very suitable at lower extraction (71%). At the higher extraction level (82%), added flour color made the bread less desirable. Also, overmixing is required to make optimum balady bread.

Soft white and club wheats performance varied among different varieties, even though mixograms, when run at constant dough consistencies, showed similar strength. The baking quality variations observed were not a function of protein. The poor performance of Hyslop, and McDermid in Moroccan bread; Stephens in three of the breads; and the SWSs in all breads are not explainable. Further rheological and biochemical studies are required to identify the factors inhibiting optimum performance of such wheats. Australian standard white performed well in all breads tested.

[8] A. M. Khorshed. Dept. of Cereal and Bread Technology, Ministry of Agriculture, Cairo, Egypt. 1980. Personal communication.

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