UTILIZATION OF SOME PROMISING SORGHUM TYPES IN BREAD MAKING

A.M. KHORSHID , S.M. MANSOUR AND A.M. KASSEM

Food Technology Research Institute, Agricultural Research Centre, Giza, Egypt.

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Abstract

Four types of sorghum grains flour were blended with wheat flour in the ratios of 30 : 70 and 50 : 50 for bread making. The sorghum types were Dorado, Giza 15, W65405 and P8319. Gas production during fermentation, organoletic evaluation of the produced bread and the staling rate of bread during storage were determined. The results showed that, Dorado (30%) and W65405 (30%) were the best blends for producing acceptable bread. Conditioners should be added when sorghum is used in bread production to improve the sensory evaluation and bread staling.

INTRODUCTION

Sorghum is an important basic food cereal, especially in parts of Africa and Asia, where it is widley grown due to its drought resistance (Doggett, 1981). It is the fifth important cereal in terms of world production (Mackey, 1981), and thus it deserves more attention, from the nutritional point of view.

The important factors affecting the nutritional value of sorghum and sorghum foods are the presence of free and condensed phenols, such as proanthocyanidines and tannins, (Roony and Sullins, 1976). The So-called high-tannin sorghum contain beneath the pericarp a testa layer. These kinds of sorghum are especially rich in polyphenols compared to low-tannin types in which this layer is absent. Polyphenolic complexes which affect digestibility (Eggum and Christensen, 1975) could be counteracted by eliminating the testa through decortication

or by alkaline treatment (Munck, 1982).

The purpose of the present work was to evaluate some promising sorghum grains for bread production when their blends with wheat flour reach 30 or 50%.

MATERIALS AND METHODS

Sampling

Four types of sorghum variety were obtained from Pioneer Co., Cairo, Egypt. The varieties were Dorado, Giza 15, W65405 and P8319. Wheat flour 72% extraction was obtained from the experimental bakery of the Agric. Res. Cent., Giza.

The sorghum grains were cleaned from dust, impurities and strange materials, then the grains were milled to obtain flour using a willy mill.

Blends of sorghum and wheat flour at the ratios of 30 : 70 and 50 : 50 were prepared. Fenugreek was added to each blend at the rate of 0.5%.

Chemical analysis

Protein content was determined according to the methods of A.O.A.C. (1980). Total hydrolyzable carbohydrates were estimated according to the method of Smith *et al.* (1956). Phytic acid was determined as indicated by Wheeler and Ferrel (1971). Tannins were determined according to the method described by Earp *et al.* (1981). Protein digestibility (in-vitro) was assessed by the method of Akeson and Stahman (1964).

Shami bread baking

Shami bread was made according to the method described by El-Talawy and Khorshid (1982), after calculating the percentage of water absorption (A.A.C.C. 1970).

Determination of gas production

Gas production during fermentation was calculated on a 12 channel recording gaso-graph as described by Rubenthalor *et al.* (1980).

Organoleptic evaluation of bread

Appearance, taste, crust colour, crumb colour, distribution of crumb layer separation and odour were evaluated for the produced bread. These attributes were measured subjectively by a panel of ten judges selected from the staff member of the Bread Res. Dept. according to the method described by Faridi and Rubenthaler (1984).

Determination of staling rate

After baking, the bread was cooled at room temperature and then stored at 24°C in sealed polyethylene bags to prevent moisture loss. At zero, 2, 4 and 24 h of storage, bread was cut into small pieces, dried under reduced vaccum oven at 42°C and then ground on a stein mill to pass through a 60 mesh stainless steel sieve.

Alkaline Water Retention Capacity (AWRC) of bread was measured by the method of Yamazaki (1953) and modified by Kitterman and Rubenthalor (1971).

RESULTS AND DISCUSSION

Four genotypes of sorghum grains were evaluated chemically for bread production. Data presented in Table 1 show that sorghum protein levels ranged between 12.91 and 13.57%. The highest protein content was observed in Dorado variety. Concerning the total hydrolyzable carbohydrate, it ranged from 68.4 to 74.75% in the cultivars P8319 and W65405, respectively. Phytic acid content (mg/100g) was found in amounts of 820, 708, 839 and 841 for Dorado, Giza 15, W65405 and P8319, respectively. The two types Dorado and W65405 were completly free from tannins where Giza 15 and P8319 had 0.233 and 0.263 (mg/100g) tannins as cata-

Table 1. Chemical analysis of sorghum grains.

	Moisture	Protein	Total hydrolyzable carbohy.	Phytic acid mg/100g	Tannin* mg/100g
Dorado	12.21	13.57	70.09	820	--
Giza 15	11.59	13.09	71.6	708	0.233
W65405	12.75	12.90	74.75	839	--
P8319	13.01	12.95	68.14	841	0.263

* as catachin

Table 2. Percentage of water absorption and gas production during fermentation of blends fron sorghum and wheat flour.

	Water Absorption	Fermentation Period in minutes			
		30	60	90	120
Control 100% wheat flour	42.6	190	260	290	330
Dorado 30% + W.F.* 70%	45.3	165	200	245	290
"" 50% + "" 50%	43.5	170	210	240	290
Giza15 30% + "" 70%	43.5	175	205	250	285
"" 50% + "" 50%	43.2	170	200	245	280
W65405 30% + "" 70%	41.8	190	235	275	230
"" 50% + "" 50%	40.1	185	230	275	315
P8319 30% + "" 70%	40.2	165	200	230	280
"" 50% + "" 50%	40.0	165	210	240	275

* W.F. = Wheat flour

Table 3. Protein digestibility and sensory evaluation of bread produced from blends of sorghum and wheat flour.

Flour Composite	Protein Digestibility	appearance	Taste	Crust Colour	Crumb Colour	distribution of Crumb	Layer Separation	Odour	Total Score
Control : 100% W.F.*	77.5	18	18	14	14	9	9	9	90
Dorado 30% + W.F. 70%	76.7	16	15	12	12	9	9	9	81
"" 50% + "" 50%	75.3	15	12	10	11	7	8	7	70
Giza15 30% +"" 70%	68.2	14	8	9	8	8	8	5	60
"" 50% + "" 50%	62.7	13	8	8	7	6	7	5	54
W65405 30% +"" 70%	74.9	16	13	12	12	9	9	8	79
"" 50% + "" 50%	74.0	13	9	9	10	8	9	6	64
P8319 30% + "" 70%	64.3	14	8	8	7	7	7	5	57
"" 50% + "" 50%	60.2	13	8	8	7	6	7	5	54

* W.F. = Wheat Flour

Table 4. AWRC** values of bread during storage.

Flour composite	Staling Period in hours			
	Zero time	2	4	24
Control 100% wheat flour*	265	245	230	190
Dorado 30% + W.F. 70%	255	214	187	171
"" 50% + "" 50%	232	205	165	158
Giza 15 30% + "" 70%	245	220	180	166
"" 50% + "" 50%	240	210	168	155
W65405 30% + "" 70%	251	237	220	185
"" 50% + "" 50%	248	213	208	179
P8319 30% + "" 70%	236	213	190	173
"" 50% + "" 50%	230	200	180	160

* W.F. = Wheat flour.
** (AWRC) : alkaline Water Retention Capacity.

chin, respectively.

Blends of wheat flour with 30% and 50% sorghum flour were prepared to produce bread during dough making. The percentage of water absorption was found in high amount in Dorado and Giza types than in W65405 and P8319 types. The percentage of water absorption ranged from 43.2 to 45.3 in the first two types, while it ranged 40.0 to 41.8 in the other types. This could be attributed to the high content of protein in Dorado and Giza 15 than in W65405 and P8319 types (Table 2). The gas production during fermentation of blends from sorghum and wheat flour is presented in Table 2. The results show that after 20 minutes of fermentation, no differences were noticed in gas production when each type of sorghum was blended with 30% or 50%/ After 20 minutes, the percentages of gas production in comparison with the control were 87.8%, 86.3%, 96.9% and 84.8% for Dorado, Giza 15 W65405 and P8319, respectively.

Results of protein digestibilty and sensory evaluation of bread produced from composite flour of wheat and sorghum are shown in Table 3. The obtained results revealed that the nutritional quality of the produced bread differs between varieties depending on chemical composition. Bread from wheat and Dorado or W65405 (free from tannins) gave high protein digestibility than with bread from wheat and Giza 15 or P8319. The digestable protein ranged from 74.0 to 76.7 when sorghum free from tannins was used, while it reached 60.2 to 68.2 when the other types of sorghum were used. These results were in good agreement with those of Elias *et al.* (1984) who mentioned that tannins play an important role in the reduction of protein digestibility because they were from complexes with food protein.

Concerning the results of sensory evaluation of the produced bread, the control sample (100% wheat flour) gave 91%. When wheat flour was blended with the different types of sorghum flour, the total score reached in a descending order 81%, 79%, 70%, 64%, 60%, 57%, 54% and 54% for Dorado 30%, W65405 30%, Dorado 50%, W65405 50%, Giza 15 30%, P8319 30%, Giza 50% and P8319 50%, respectively. These results indicate that up to 30% sorghum flour from Dorado and W65405 types, an acceptable bread could be produced compared with the other types of sorghum.

The freshness value of the produced bread was estimated after baking and during storage for 24h. Results in Table 4 show that the highest values were ob-

served when W65405 type was blended with 30% and 50% of wheat flour (185 and 179, respectively) compared with 190 in the control. Dorado 30% and P8319 gave the value of 171-173 followed by Giza 15 30% (166). P8319 50%, Dorado 50% and Giza 15 50% showed lower values ranging from 155-160. In conclusion, and from the nutritional point of view, Dorado (30%) and W65405 (30%) could be blended with wheat flour for producing acceptable bread. Decorticated sorghum with tannin content is very important for preparing sorghum to become an acceptable food. Conditioners should be added when sorghum is used in bread production to improve sensory evaluation and bread staling.

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إستخدام بعض أصناف السورجم فى صناعة الخبز

أحمد محمود خورشيد ، سعيد محمد منصور ، أحمد مراد قاسم

معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة .

في تجربة لمحاولة إستخدام بعض أصناف السورجم في صناعة الخبز عن طريق خلطها مع دقيق القمح بنسبة ٣٠ : ٧٠ ، ٥٠ : ٥٠ إستخدمت أربعة أصناف الواردة من شركة بيونير وهي Dorado ، Giza 15 ، W65405 ، P8318 وتم تقدير كمية الغازات المتولدة أثناء التخمر وتقييم الخبز الناتج حسياً ، وكذلك درجة الطزاجة أثناء فترات التخزين المختلفة لمعرفة مدي صلاحيتة للحفظ .

ولقد أوضحت النتائج أن أحسن الخلطات التي أعطت خبزاً مقبولاً كانت لصنفي Dorado و W6504 عند إستخدامهما بنسبة ٣٠٪ ، هذا وقد ثبت أهمية إستخدام بعض المحسنات مثل برومات البوتاسيوم عند إستخدام خليط دقيق السورجم مع دقيق القمح لإنتاج خبز مقبول .