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MALTING CHARACTERISTICS OF ACHA *(Digitaria spp)* AND FINGER MILLET *(Eleusine coracana)*

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ABSTRACT

This study was conducted to evaluate the malting characteristics of some local varieties of acha (*Digitaria exilis*) and finger millet (*Eleusine coracana*). The samples were steeped ,sprouted for 24 or 48hours and changes in the alpha amylase activities (dextrifying activity) and beta-amylase (saccharifying activity) were studied. The alpha- and beta-amylases activity of finger millet were found to be higher than those of acha ($p<0.05$). However, there were no significant differences in these enzyme levels within finger-millet or acha varieties ($p>0.05$). Nevertheless, differences ($p<0.5$) due to soaking or sprouting were observed, and the 48-hour sprouted samples had the highest alpha-amylase activity. When compared with other popular cereals, the results suggest that finger millet and its varieties could serve as alternatives for malt processing.

Keywords: malting characteristics, acha (*Digitaria exilis*), finger millet(*Eleusinecoracana*), alpha-amylase, and beta-amylase.

INTRODUCTION

Apart from its use in brewing beer, malting has general wide acceptance in the formulation of weaning foods. This technique is often preferred to the more sophisticated and expensive industrial processes like extrusion (Hickenbottom, 1996). Moreover, it could be adapted at the cottage level to produce high quality protein and high-energy foods (Almeida-Dominguez *et at,* 1993). The process also improves the nutritional quality of foods by reducing the bulkiness thus enhancing the digestibility and nutrient availability of the meal. In many parts of the world, barley and wheat are the most popular cereals used for malting. With the ban on importation of wheat and barley in Nigeria, there is an urgent need to investigate the potentials of some local lesser-known cereals. Africa has more local cereals than any other continent in the world (National Research Council, 1996). Cereals like acha *(Digitaria exilis)* and finger millet *(Eleusine coracana)* grow on poor soils and have yields comparable to those of wheat and barley. Many varieties of these lesser-known cereals are cultivated in several parts of Nigeria but little is known of their malting characteristics. The experiments reported in this paper were undertaken to examine the malting characteristics of a variety of acha and finger millet seeds. It was envisaged that the results will help in identifying those species that may be suitable for malt based foods.

MATERALS AND METHOD

Source of samples

Ten samples comprising of five varieties of finger millet (*Eleusine coracana)* namely Tamba, Balewa, Samaru, Samila, and Isakan; and five varieties of acha (*Digitaria exilis*) labeled Red Iburu, White Iburu, Khat, Cale and Patunduri were obtained from Crop Science Department , Faculty of Agriculture, Ahmadu Bello University Zaria, Nigeria.

Preparation of samples.

Prior to steeping and sprouting , the seeds were cleaned by winnowing and hand sorting. Only viable whole seeds were used for sprouting.

Malting procedure

The following parameters were considered in the malting process; soaking or steeping for 24 hours and sprouting for 24 or 48 hours. After weighing the soaked seeds they were placed on moist muslin cloth and kept in dark closet at room temperature (32 ± 5 °C)

Analyses Of Samples

Physical properties of the samples such as the weight of 10cc of the grains, water absorption capacity and malting loss were measured according to the method described by Nkama et at (2000). Alpha- and beta amylase were determined by methods described by (Bernfield, 1955). The samples were steeped for 24h and sprouted for 24h or 48h.

RESULTS AND DISCUSSION

Table 1 shows the physical characteristics of acha and finger millet.

Table 1:Some Physical Characteristics of Acha (*Digitaria exilis*) and Finger millet (*Eleusine coracana*)

Sample	Dry weight of 10cc of grains	Water absorption Capacity #
ACHA		
Red Iburu	$9.1 \pm 0.1^{*a}$	2.9 ± 0.1^{e}
White Iburu	8.7 ± 0.3^{a}	3.1 ± 0.1^{e}
Cale	7.5 ± 0.2^{b}	3.1 ± 0.1^{e}
Khat	7.4 ± 0.1^{b}	3.3 ± 0.1^{e}
Patunduri	8.9 ± 0.1^{a}	2.9 ± 0.1^{e}
FINGERMILLET		
Tamba	10.5 ± 0.1^{c}	2.4 ± 0.1^{f}
Balewa	10.2 ± 0.2^{c}	2.3 ± 0.1^{f}
Samaru	9.7 ± 0.2^{d}	2.6 ± 0.1^{f}
Samila	10.7 ± 0.2^{c}	2.3 ± 0.1^{f}
Ishaku	9.9 ± 0.1^{d}	2.4 ± 0.2^{f}

Weight of water in grams absorbed by 10cc of grains over 24h of steeping

*All values are means ± standard deviation of 3 determination. Means with different superscripts in a vertical column are statistically different ($p<0.05$) as determined by Duncan's mutiple range tests.

Generally there were differences between acha and finger millet ($p<0.05$), while there were no significant differences ($p>0.05$) within the varieties of the grains.
Acha is smaller in size than finger millet but considering that it has some desirable nutritional qualities, the smallness of the grain offers a special challenge to the cereal scientist. With the recent advances in genetic engineering, it will be possible to produce larger grain size. The water absorption capacity of acha was higher than those of finger millet. According to Sefa-Dedeh and Stanley(1979), there is an inverse correlation between water absorption capacity and seed coat thickness. Thus the results suggest that finger millet has a thicker seed coat than acha. It is also possible that the differences in physicochemical properties of starch in the grains, may have influenced their water absorption properties. The amylose content and the extent of branching in the starch of acha, is lower than that of finger millet (Jideani *et at,* 1996).

The matting characteristics of the cereals are shown in tables 2 and 3.

Table 2:Malting Characteristics of Acha (*Digitaria exilis)*

Sample	Vegetative loss%	Alpha-amylase units/g sample	Beta-amylase units/g sample
ACHA			
Red iburu			
24h steeped	N.D.	$178.3\pm10.7^{*e}$	20.5 ± 6.4^{j}
24h sprout	4.3 ± 0.2^{a}	293.3 ± 4.7^{f}	23.5 ± 1.7^{h}
48h sprout	7.1 ± 0.6^{b}	302.3 ± 23.2^{f}	25.5 ± 3.5^{h}
White Iburu			
24h steeped	N.D.	183.0 ± 3.5^{e}	16.4 ± 4.5^{j}
24h sprout	3.1 ± 0.1^{c}	236.4 ± 24.6^{g}	18.3 ± 2.8^{j}
84h sprout	7.2 ± 0.8^{b}	340.3 ± 17.3^{f}	21.2 ± 1.1^{h}
Cale			
24h steeped	N.D.	192.0 ± 8.4^{e}	19.5 ± 2.5^{j}
24h sprout	2.2 ± 0.2^{d}	265.0 ± 5.2^{g}	20.5 ± 4.9^{j}
48h sprout	8.4 ± 1.7^{b}	290.3 ± 35.3^{f}	28.0 ± 2.1^{h}
Khat			
24h steeped	N.D.	178.0 ± 5.2^{e}	19.0 ± 1.9^{j}
24h sprout	3.1 ± 0.1^{c}	273.7 ± 20.2^{f}	24.0 ± 0.6^{h}
48h sprout	7.3 ± 0.4^{b}	305.0 ± 18.7^{f}	28.0 ± 1.0^{h}
Patunduri			
24h steeped	N.D.	168.7 ± 5.5^{e}	17.0 ± 2.6^{j}
24h sprout	3.3 ± 0.3^{c}	282.7 ± 10.1^{f}	15.0 ± 2.0^{j}
48h sprout	8.2 ± 1.1^{b}	290.3 ± 20.4^{f}	22.5 ± 2.1^{h}

*All values are means ± standard deviation of 3 determination. Means with different superscripts in a vertical column are statistically different ($p<0.05$) as determined by Duncan's mutiple range tests.

Table 3: Malting characteristics of finger millet (*Eleusine coracana*)

Sample	Vegetative loss (%)	α-Amylase units/g sample	β-Amylase units sample
FINGER MILLET			
Tamba			
24 steeped	ND	$172.0\pm5.2^{c*}$	15.0 ± 2.8^{f}
24 sprout	8.3 ± 1.2^{a}	294.3 ± 22.1^{d}	13.5 ± 4.9^{f}
48 sprout	18.6 ± 1.8^{b}	428.0 ± 20.9^{e}	22.0 ± 1.4^{g}
Balewa			
24h steeped	N.D.	181.0 ± 5.0^{c}	12.3 ± 5.0^{f}
24 sprout	7.6 ± 2.1^{a}	335.0 ± 10.4^{d}	18.0 ± 4.1^{g}
48 sprout	17.8 ± 3.0^{b}	448.0 ± 18.3^{e}	26.5 ± 1.4^{g}
Samaru			
24 steeped	N.D.	161.1 ± 8.5^{c}	12.2 ± 1.4^{f}
24 sprout	10.3 ± 0.9^{a}	182.2 ± 6.7^{c}	14.3 ± 2.1^{f}
48 sprout	16.3 ± 1.0^{b}	415.1 ± 24.1^{d}	23.6 ± 1.5^{g}
Samila			
24 stepped	N.D.	160.3 ± 9.8^{c}	18.9 ± 2.8^{g}
24 sprout	9.4 ± 2.1^{a}	387.3 ± 43.8^{d}	22.3 ± 4.2^{g}
48 sprout	17.3 ± 1.4^{b}	433.0 ± 28.1^{e}	26.5 ± 4.9^{g}
Isakan			
24 steeped	N.D.	178.0 ± 5.2^{c}	17.5 ± 4.8^{f}
24 sprout	6.8 ± 0.5^{a}	384.7 ± 28.2^{d}	19.5 ± 5.7^{g}
48 sprout	18.0 ± 2.1^{b}	475.0 ± 20.1^{e}	24.0 ± 1.4^{g}

**All values are means ± standard deviation of 3 determination. Means with different superscripts in a vertical column are statistically different ($p<0.05$) as determined by Duncan's mutiple range tests.

Vegetative losses ranged between 7 and 20% and are comparable to what obtains in some popular cereals like wheat, sorghum and maize (Nkama *et al*, 2000). These results suggest that yields of malt from these cereals could be up to 90%.

After 24 or 48h of sprouting, alpha and beta amylase activities were significantly higher ($p<0.05$) in finger millet than in acha and are comparable to what obtains in sorghum (Nkama *et al*, 2000). High values of amylase activity may be due to activation of endogenous amylase within the finger millet grain; while low activities in acha, can be attributed to delayed synthesis of the enzyme. When compared with other popular cereals, the results demonstrate that finger millet and its varieties could serve as alternatives or supplements in the preparation of malted foods.

There were no significant differences ($p>0.05$) in the enzyme levels within the varieties of acha or finger millet. Therefore a more sensitive method other than alpha and beta amylase activities would be desirable in distinguishing between varieties. Methods like DNA-finger printing or electrophoresis patterns of seed proteins may be useful.

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