Available online at www.sciencedirect.com

SCIENCE DIRECT

LWT 39 (2006) 684–691

LWT

www.elsevier.com/locate/lwt

Effect of precooking time and drying temperature on the physico-chemical characteristics and in-vitro carbohydrate digestibility of taro flour

Y.N. Njintang[a,*], C.M.F. Mbofung[b]

[a]Faculty of Sciences, Department of Biological Sciences, University of Ngaoundere, P.O. Box 455, Ngaoundere, Adamaoua, Cameroon
[b]Laboratory of Nutrition, Department of Food Science and Nutrition, Higher School of Agro-industrial Sciences, Food Biophysics and Biochemistry, University of Ngaoundere, P.O. Box 454, Adamaoua, Cameroon

Received 9 July 2004; accepted 17 March 2005

Abstract

Achu is a thick porridge obtained by cooking and pounding taro (*Colocasia esculenta*) corms and cormels in a mortar. This study was undertaken with the objective of producing precooked taro flour that can be used in the preparation of achu. Taro slices were precooked to times of 0, 20, 45 and 90 min and dried in an air convection oven at varying temperatures of 50, 60, 70 or 80 °C before milling into flour which was then analysed for its water absorption capacity (WAC), water solubility index, emulsion activity and stability, bulk density, foam capacity and least gelation concentration (LGC). Achu made from the flours were equally analysed for their relative penetrometric index, bulk density and colour. The results showed that precooking induced significant ($P < 0.05$) decrease in foam capacity, penetrometric index, and increase in LGC, emulsion stability and WAC. The drying temperature also induces significant reduction in emulsion capacity and stability, penetrometric index, and increase in LGC, WAC. Long precooking time (>45 min) and drying temperature (>60 °C) induced significant reduction of the in-vitro carbohydrate digestibility of taro achu.

Keywords: Taro flour; Food processing; Physico-chemical properties; In-vitro carbohydrate digestibility

1. Introduction

Achu is a highly cherished and consumed dough-like food paste traditionally prepared by women in Cameroon by boiling taro (*Colocasia esculenta*) corms/cormels for 2–4 h followed by pounding in a wood-mortar for 1–2 h. It is commonly served and eaten with a spiced yellow-coloured soup containing palm oil, smoked fish or mushroom.

Although achu is a much cherished food, its consumption is generally limited by a number of factors: first by the fact that the processing of achu is tedious, time consuming and labour intensive and secondly by the fact that the tubers are very susceptible to postharvest rot, leading to large losses. Tubers are known to start rotting as early as 2 weeks postharvesting. Recently, studies have been conducted in our laboratory to promote the production and use of premixes or flour in the preparation of achu (Njintang, 2003; Njintang & Mbofung, 2003a, b). In an earlier study, it has been shown that browning is one of the most important problems that limit the use of raw taro flour in the preparation of achu and production of instant flour was suggested to overcome it (Njintang, Mbofung, Fombang, & Agbor Egbe, 1999). In the Pacific, precooked taro flour is prepared by boiling slices to a soft texture, followed by drying and grinding into flour (Nip, 1997). Earlier studies on taro revealed that the drying of pregelled taro chips is a slow and

*Corresponding author. Tel.: +237 987 09 79.
E-mail address: njintang@yahoo.fr (Y.N. Njintang).

0023-6438/$30.00
doi:10.1016/j.lwt.2005.03.022

energy-intensive process (Njintang & Mbofung, 2003b). On the other hand, while drying at high temperatures is more efficient, the process adversely affects product quality in terms of colour, functionality and performance of the flour during reconstitution (Njintang, Mbofung, & Waldron, 2001). In order to ensure good product quality, there is a need to determine the drying temperature beyond which quality is not significantly affected.

As part of a wider project aimed at producing taro flour for achu preparation, the present study was carried out to determine the effect of the precooking time and drying temperature on the physico-chemical of taro flour.

2. Materials and methods

2.1. Samples and treatments

A white variety of taro locally called 'Country coco' used in this study was freshly harvested from a farm in Wakwa, Adamaoua, Cameroon. The samples were washed in tap water, peeled using a stainless steel knife, washed in clean water and cut into 0.5 cm thick slices using a slicing machine. The slices were then divided into 4 subgroups, which were cooked in boiling water for varying periods of 0, 20, 45 or 90 min. Preliminary gelatinization kinetics studies had shown that cooking 0.5 cm thick taro slices in boiling water for these various times produces slices with 0%, 25%, 50% and 75% degree of gelatinization (Njintang & Mbofung, 2003a). Following the cooking at the chosen time periods, subsamples of the cooked taro slices were dried at 50, 60, 70 and 80 °C in an air convection oven and dried to a brittle touch. In this respect, drying times as well as the water content of the resulting flour samples are resumed in Table 1. Dried sliced were fine-milled into flour of particle size 0.5 mm using a hammer mill.

2.2. Proximate analysis

Flours obtained were analysed in triplicate for crude fibre, total fat, ash and moisture contents using standard methods of the Association of Official Analytical Chemists (AOAC, 1990). Crude proteins were evaluated by the spectrophotometric method using formaldehyde and acetylacetone after acid digestion of subsamples in Kjeldhal tubes (Devani, Shishoo sha, & Suhagia, 1989). Available carbohydrate was determined after digestion in sulphuric acid followed by analysis of reducing sugars using the 3,5-dinitrosalicylic acid (DNS) method as previously described (Njintang et al., 2001).

2.3. Functional properties of taro flour

The apparent water absorption capacity (WAC) (Phillips, Chinnan, Branch, Miller, & Mcwatters, 1988), water solubility index (Anderson, Conway, Pfeifer, & Griffin, 1969), emulsifying activity and emulsion stability (ES) (Yatsumatsu, Sawada, & Morita, 1972), foam capacity (Coffman & Garcia, 1977) and bulk density (Okezie & Bello, 1988) and least gelation concentration (LGC) (Coffman & Garcia, 1977) were evaluated following standard procedures. The LGC was determined on flour suspensions of 4–14 g/100 ml.

The Blue value index was evaluated by the method of Birch and Prietly (1973) as previously modified by Njintang and Mbofung (2003b). Precisely 0.1 g of flour was suspended in 10 ml distilled water and incubated with mixing for 1 h in a shaking water-bath (Kottermann, Germany) set at varying temperatures (60, 70, 80, 90 and 100°C) and centrifuged at 5000 rpm for 30 min. The supernatant was recuperated and 1 ml of it mixed with 2 ml of I_2/KI (0.075%; 0.75%) reagent and the absorbance read at 620 nm on a Spectronic Genesys 2PC spectrophotometer. The relative blue value index (RBVI, dimensionless) was calculated as the ratio of absorbance at a given soaking temperature and that at 60 °C.

2.4. Preparation of reconstituted achu

Flour suspensions (30 g/100 ml water) were poured into polyethylene bags (100 ml container), sealed and then mixed by shaking. The mixture was then cooked for 20 min in a pressure cooker. The latter was a casserole (SEB, France) with the following

Table 1
Drying time of precooked taro slices and moisture content of the resulting taro flours

Properties	Precooking time (min)	Drying temperature (°C)			
		50	60	70	80
Moisture content (g/100 g)	0	4.55	3.50	4.73	9.92
	20	9.92	2.89	6.11	6.26
	45	6.16	3.20	4.10	3.77
	90	3.65	4.00	5.01	4.23
Drying time (min)	Any	4310	2100	1305	1365