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Full Length Research Paper

Sensory properties of pre-treated blast-chilled yam (*Dioscorea rotundata*) as a convenience food product

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Yam (*Dioscorea* sp.) is a popular staple tropical root crop in West Africa. Its postharvest loses are between 30 - 40%. Pretreated packaged convenience yam would address postharvest losses of yam. *Dioscorea rotundata* var. *fitaa* was pretreated in a factorial design with sodium metabisulphite, water blanch and steam and subsequently blast chilled at hard (-24°C) and maxi chill (-26°C) temperature regimes. A Hedonic scale of 1-9 with twenty trained judges was employed to evaluate the sensory characteristics of fried yam chips (1.0cm^2 x 7.0cm sizes) and boiled yam (4.0cm^2 x 7.0cm sizes) on appearance, colour, aroma, taste, texture, mouthfeel, overall acceptability and crispness for fried yam chips. Sodium metabisulphite treatment showed the best overall acceptability for both boiled and fried treatments for maxi chilled than hard chilled against all other treatments. Overall acceptability for sodium metabisulphite was in the range of 7.2 - 7.9 with the highest attributes from appearance, taste, aroma and colour. The sensory ranges for water blanch treatments were 6.1 - 6.8 with the highest attributes for taste and aroma. Steam treatment recorded sensory ranges of 6.1 - 7.1, however in combination with sodium metabisulphite the ranges increased to 6.4 - 7.6 with the best sensory attributes for aroma, colour and taste. The sensory attributes indicated a potential for pretreated convenience packaged *Dioscorea rotundata* var. *fitaa.*

Keywords: *Dioscorea rotundata*, sensory analysis, blast chill, sodium metabisulphite, water blanch, stream.

INTRODUCTION

Yam belongs to the genus *Dioscorea* (Family: *Dioscoreaceae*). Yam (*Dioscorea sp.*) is a popular staple tropical root crop in West Africa (Coursey, 1976; Onwueme, 1978; Passam et al., 1978; Opara, 1999). The importance of yam extends into the socio-culture lives of producing regions in West Africa in festivals ceremonies held annually to usher in newly harvested yams. Yams are cultivated often by subsistent farmers. However, their season runs from October through December when they are at their best. There are about 200 different varieties of yams with fresh colour varying from white, ivory and yellow. Their shape is long and cylindrical (often having offshoots referred to as 'toes') while their exterior texture is rough and scaly. There is a number of health benefits derived from eating yams (FAO, 1985). Yams provide a good source of vitamin B6, vitamin E, potassium and manganese. They are good sources of carbohydrate and fibres needed for health and vitality (Coursey, 1976). Yams contain a unique fat-like substance called diosgenin which is technically classified as a hormone-like molecule with probably anti-cancer effects (Bradbury and Holloway, 1988; Mishra et al., 1989; Green and Simons, 1994). Yams are available throughout the year. However, postharvest loses of yam

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are between 30 - 40% as a result of sprouting, respiration, transpiration, rot caused by mould and bacteria, insects, nemadoes, rodents and mammals (FAO, 1975; Passam et al., 1978; FAO, 1985; Ihekoronge and Ngobby, 1985; Granshaw and Oshinowo, 1985; Muck, 1994; Dumont, 1995). The high water content of yam makes storage, transportation and marketing more difficult which frequently involves high losses. This is one of the reasons for price discounting of 35-80% per unit of yams which is an obstacle for further increases in the production of yams (Bancroft, 2000). The labour productivity of yams is mostly low particularly when this includes the necessary processing of products to preserve them. In rural areas where there is a high migration rate, the low labour productivity seriously restricts production. Yams have a considerable production potential. Enhanced production, better storage through proper processing of yam would improve the livelihood of the rural and urban dwellers and simultaneously improve the nutrition and food security in producing countries. Studies describing methods for improving yam storage included the uses of different designs for conventional ambient yam-storage barns (Ezeike, 1985; Nwankiti et al., 1988, Cooke et al., 1988; Ezeike et al., 1989; Henckes et al., 1995; Bancroft, 2000). Unfortunately, few reported the successful transmission of their findings into the commercial reality of yam production and marketing. As urban population prefer convenient foods there is the need to process yam into convenient forms to meet urban demand. The objective of this study was to optimize pretreatment with sodium metabisulphite, water blanching and steam in two temperature regimes of blast freezing conditions and conduct sensory analysis consisting of appearance, colour, crispness aroma, taste, texture, mouthfeel and overall acceptability on the pretreated yam chips and boiled yam ‘‘ampesi’’.

MATERIALS AND METHODS

Raw materials

Dioscorea rotundata var. *fitaa* was obtained from a local yam exporter in Accra for the studies. Food graded sodium metabisulphite was obtained from Mckrite Chemicals, Accra and air-tight polyethylene bags were purchased from Polycare Group, Accra.

Pretreatment

Dioscorea rotundata var. *fitaa* was washed in tap water to remove dirt particles from the tubers. The washed tubers were peeled, washed in tap water, cut into chips (1.0cm^2 x 7.0cm sizes) and boiled “ampesi’’ (4.0cm^2 x 7.0cm sizes) and immediately pretreated in a 3 x 2 factorial design with sodium metabisulphite, water blanch and steam and subsequently blast chilled at hard (-24°C) and maxi chill (-26°C) temperature regimes. The sodium metabisulphite solution was 1g/1000ml in distilled water. Water blanching was conducted at 100°C and steam was generated from a General Electric Steam Generator No. 1366, Toronto, Canada set at 50 Pascal. The samples were exposed in the various pretreatments for 1 - 3mins. Control samples were not pretreated after cutting into chips and boiled “ampesi’’ sizes.

Sensory Analysis

A Hedonic scale of 1-9 with twenty trained judges were employed to evaluate the sensory characteristics of *Dioscorea rotundata* var. *fitaa* fried chips and boiled “ampesi’’ on appearance, colour, aroma, taste, texture, mouthfeel, overall acceptability and cripness.

The sensory evaluation was conducted at the CSIR-FRI Nutrition and Socio-economic Division’s Test Kitchen. An atmosphere of complete quietness and privacy was provided for each panelist. The sensory evaluation was conducted between 10:30am and 11:30am and samples were coded with 3-digit random numbers and a randomized complete block design was used in which the samples were randomly assigned to each panelist (Rampersad *et al*., 2003: Hood and Jood, 2005). The 9-point Hedonic scale was rated as 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely (Lawless and Heymann, 1998). The individual scores were averaged and analyzed.

RESULTS AND DISCUSSION

Figures 1-8 shows the sensory analysis of fried and boiled *D. rotundata* var. *fitaa* after pretreatment with water blanching, sodium metabisulphite and steam under

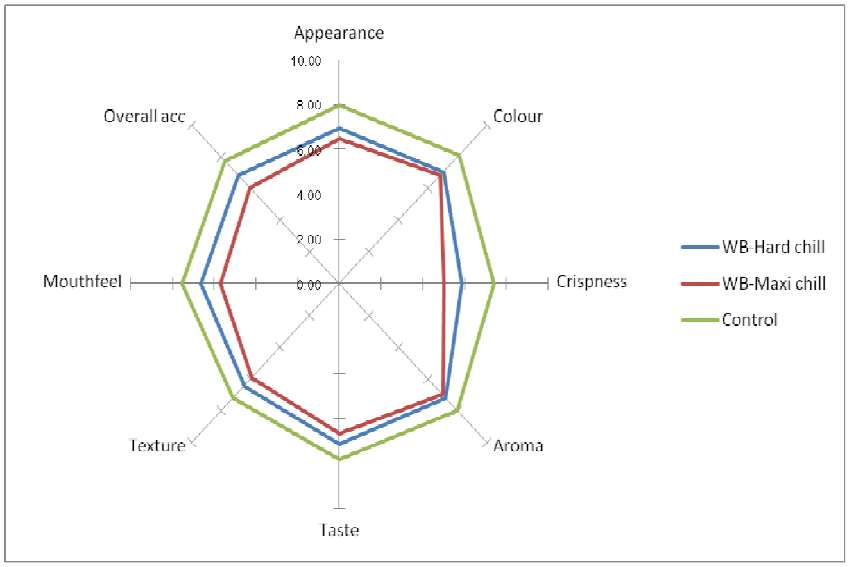

Figure 1. Sensory profile of water blanched pretreated fried *D. rotundata* var. *fitaa*

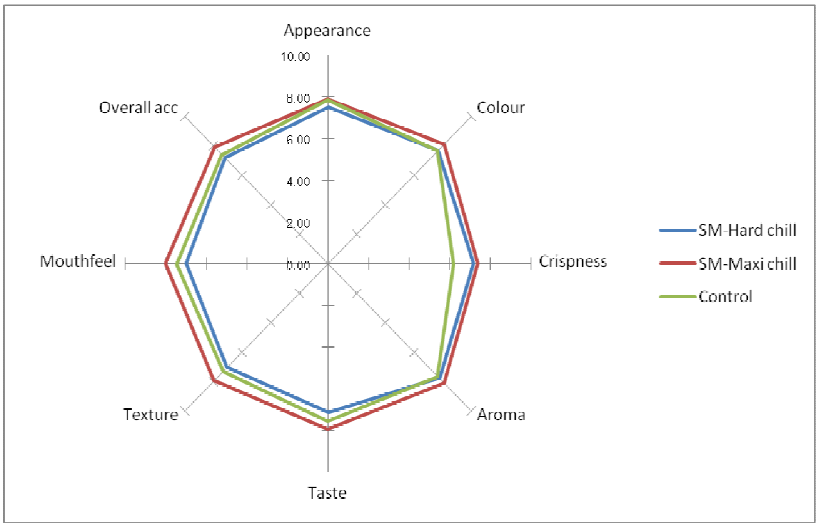

Figure 2. Sensory profile of sodium metabisulphite pretreated fried *D. rotundata* var. *fitaa*

hard and maxi chilled conditons. Sensory profile of water blanched pretreated fried *D. rotundata* var. *fitaa* shows the control samples were preferred by the judges for attributes of appearance, colour, crispness, aroma, taste, texture, mouthfeel and overall acceptance. Water blanched maxi chill was least preferred for all the sensory attributes (Figure 1). However, in sodium metabisulphite pretreated fried *D. rotundata* var. *fitaa* under maxi chill was judged best and control samples judged least for aroma, cripness and colour attributes (Figure 2).

The boiled "ampesi" *D. rotundata* var. *fitaa* pretreated in water blanching showed maxi chill and control samples as best accepted by the judges (Figure 3). Interestingly, in sodium metabisulphite pretreatment for boiled "ampesi" the hard chill treatment was the best accepted by the judges (Figure 4).

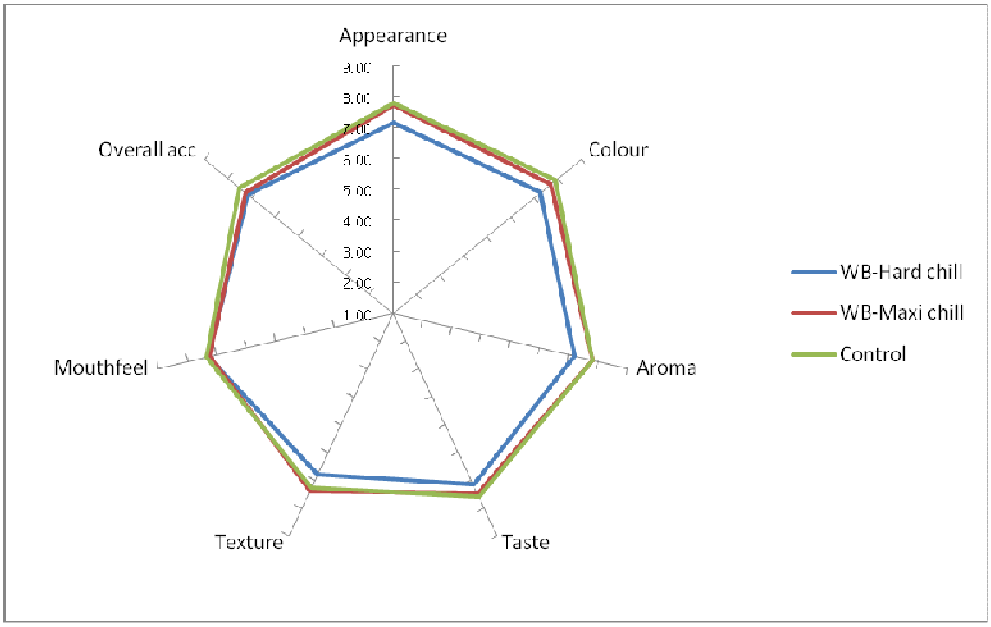

Figure 3. Sensory profile of water blanched pretreated boiled "ampesi" *D. rotundata* var. *fitaa*

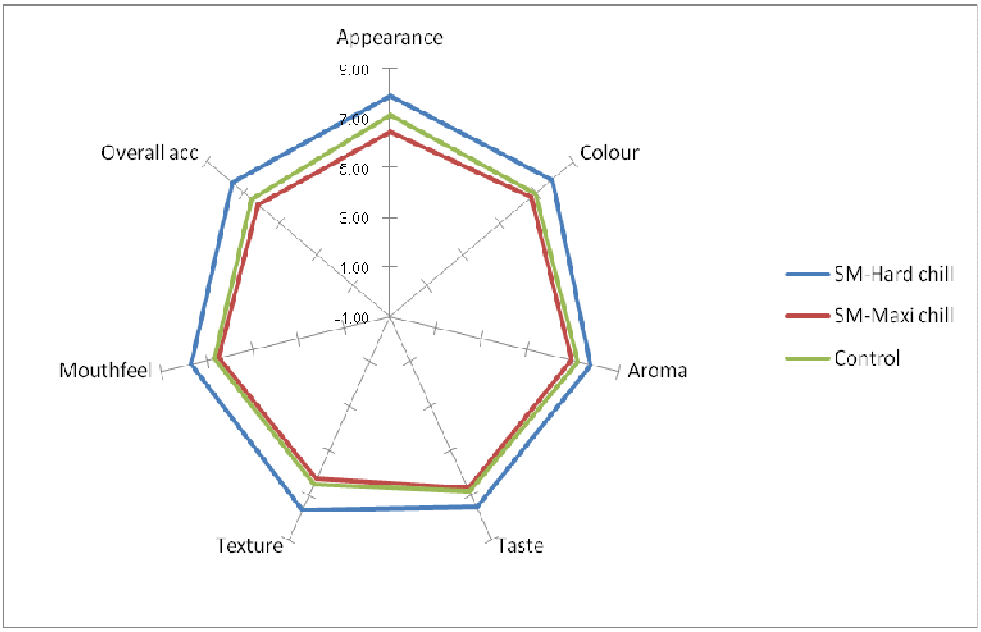

Figure 4. Sensory profile of sodium metabisulphite pretreated boiled "ampesi" D. rotundata var. fitaa

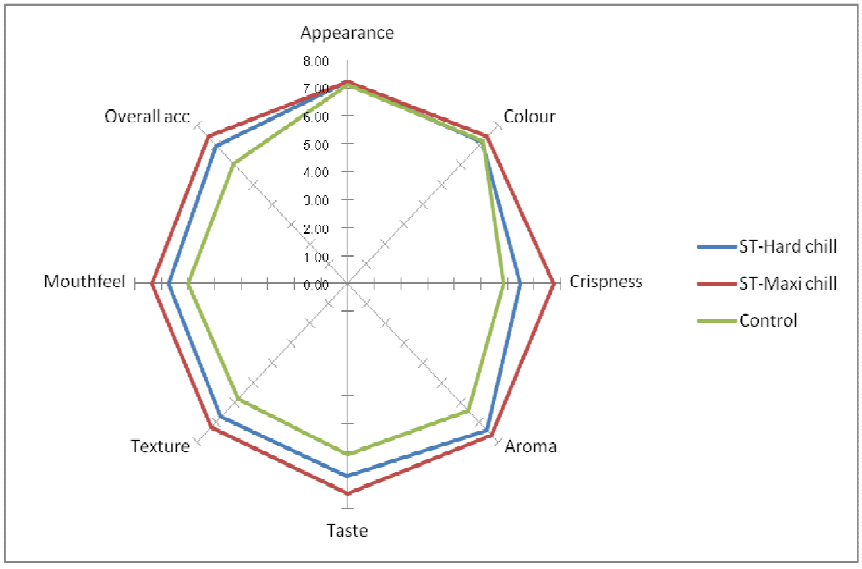

Figure 5. Sensory profile of steam pretreated fried *D. rotundata* var. *fitaa*

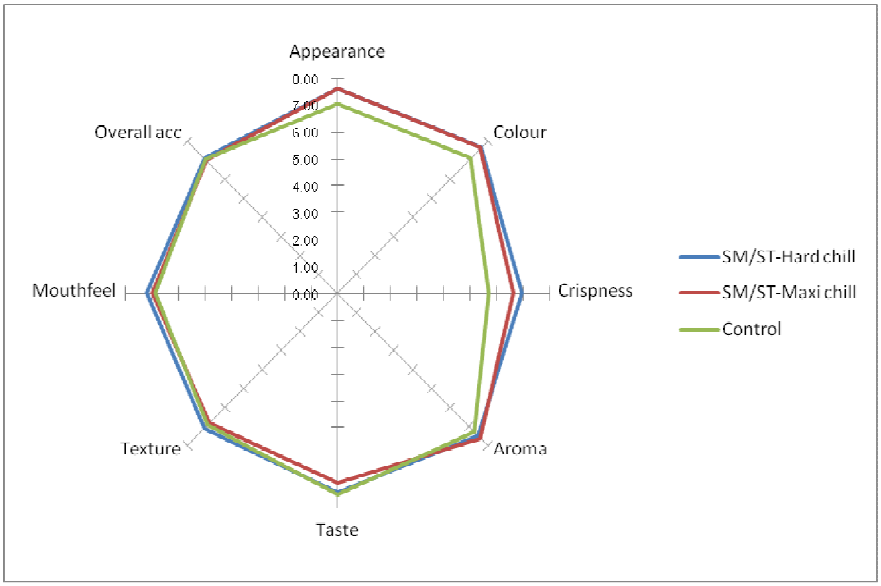

Figure 6. Sensory profile of sodium metabisulphite plus steam pretreated fried D. rotundata var. fitaa

Figure 5 shows that steam pretreated fried *D. rotundata* var. *fitaa* attribute for appearance was judged similar for hard-chill, maxi-chill and control samples. Additionally, introduction of sodium metabisulphite before stream samples was judged best (Figure 7), similar to sodium metabisulphite plus stream treatment (Figure 8).

pretreatment showed attributes of texture, mouthfeel and overall acceptance was similar for hard chill, maxi chill and control samples (Figure 6). In steam pretreatment on boiled "ampesi" *D. rotundata* var. *fitaa,* the control

Yams are eaten mainly a source of energy since they contain carbohydrate, fat, fibre and protein (Ihekeronye

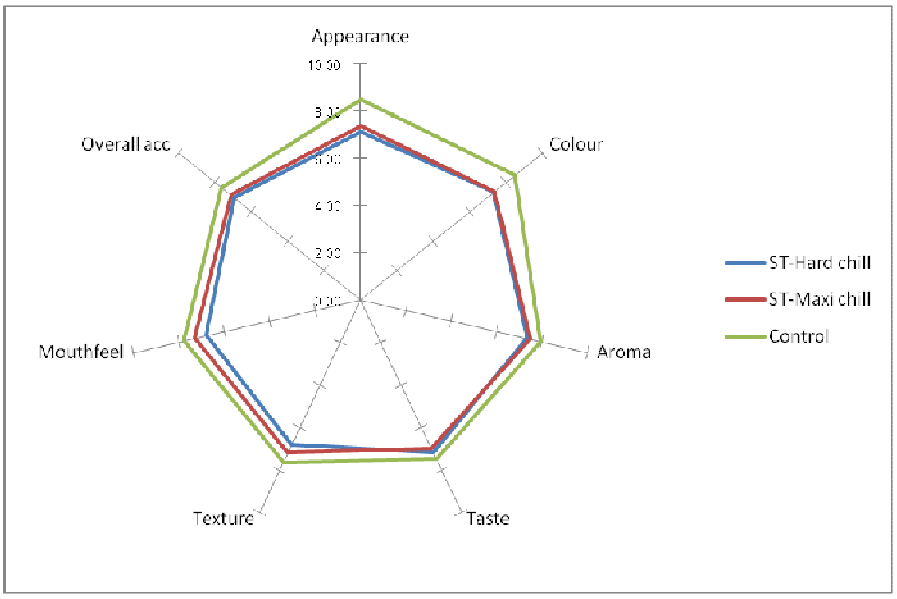

Figure 7. Sensory profile of steam pretreated boiled "ampesi" *D. rotundata* var. *fitaa*

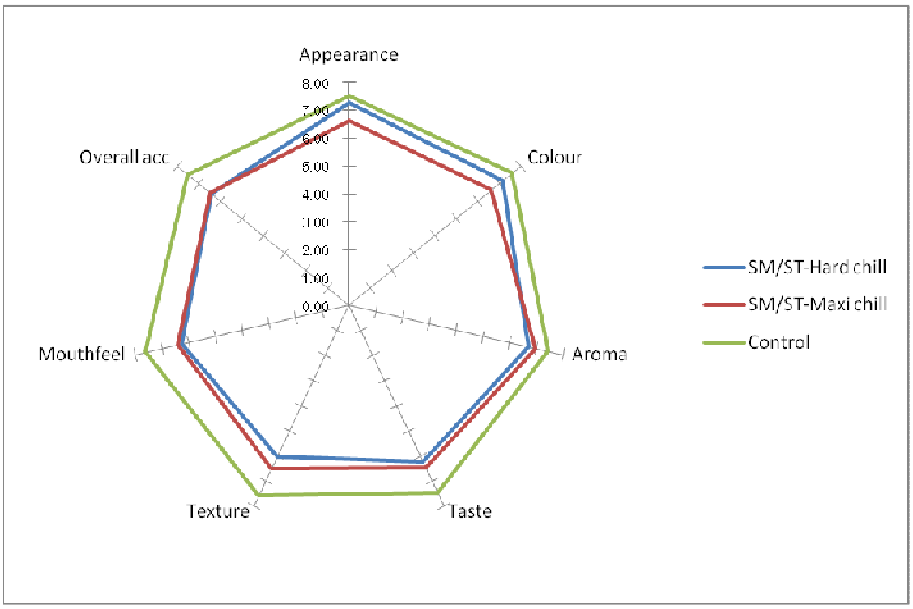

Figure 8. Sensory profile of sodium metabisulphite plus steam pretreat "ampesi" *D. rotundata* var. *fitaa*

and Ngoddy, 1985). However, the energy content depends on the varieties and maturity of the yams as stored yams are reported to significantly decrease in moisture, carbohydrate, protein, fat, ash, fibre, calcium, phosphorus (Mozie, 1984; Akinnusi *et al*., 1984). Therefore, postharvest effects couple with pretreatment conditions on *D. rotundata* var. *fitaa* had effect on the sensory attributes as depicted in figures 1-8. Additionally,

the starch content of *D. rotundata* var. *fitaa* under pretreatment conditions influenced the sensory attributes of the fried and boiled "ampesi" samples. Often, the associative forces and crosslink within the starch granules increase with age of tuber and starches with lower pasting temperature are generally easier to cook and vice versa (Madsen and Christensen, 1996). In studies reported by Rasper and Coursey (1967) the authors observed that the high viscosities of starch attained by *D. rotundata* was significant in the manufacture of pounded yam and its sensory evaluation results (Akinwande, 2007).

CONCLUSION

Sodium metabisulphite (0.1%) with maxi chill (-26°C) pretreatment for fried yam surpassed all the other treatments as the best sensory accepted product of *D. rotundata* var. *fitaa*. The most sensory accepted product of boiled yam "ampesi" was sodium metabisulphite (0.1%) with hard chill (-24°C) pretreatment of *D. rotundata* var. *fitaa*, appropriate for packaged convenience food uses.

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