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Effect of Pre-Treatment Conditions on the Anti- Nutrients of Dried Unripe Plantain (Musa Parasidiaca) and the Application in Dough Making

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ABSTRACT:This study was carried out to establish the effect of pretreatments on the anti-nutrients of solar and oven dried unripe plantain flour and the application of the flour in dough making. Unripe plantain flour was prepared from mature unripe fruit by subjecting them to different pretreatment combinations using Box Behnken experimental design at three levels and three variables; blanching temperature at 50^{o}C, 60^{o}C and 70^{o}C, blanching time at 5min, 7.5min, 10min, and potassium metabisulphite concentration of 1%, 1.5%, 2% to give 17 experimental runs with the unpretreated flour as control making samples. Pretreated unripe plantain flour samples were oven and solar dried and milled into finer texture. The flour samples were evaluated for anti-nutrients. In addition, samples of 'Amala' (Dough) were prepared from the flour samples and evaluated for acceptability using preferences test. Data generated were statistically analyzed. For oven dried flour samples. Result of anti-nutritional factors has shown that the oxalate level of the unripe plantain flour samples ranged from 0.01-0.36g/100g while phytate, saponin and tannin were not detected. The mean scores of "Amala" prepared from the flour samples ranged from: colour, 6.35-7.45; aroma, 5.90-6.85; taste, 6.15-7.20; mouldability, 5.75-7.15; mouthfeel, 5.85-7.30; consistency, 5.90-7.40; overall acceptability, 6.15-7.30. For solar dried flour samples. Result of anti-nutrients of the flour shows that oxalate and phytate level ranged from 0.28-0.64% and 0.01-0.08% respectively while saponin and tannin was not detected. The mean scores of 'Amala' prepared from the flour sample ranged from: colour, 6.55-7.95; aroma, 6.25-8.20; taste, 6.35-8.25; mouldability, 7.15-8.00; mouthfeel, 6.75-7.75 consistency, 7.00-7.55 and overall acceptability, 6.08-7.75. Conclusively, result of the analysis shows that the pretreatment conditions were able to partly reduced the anti-nutrients of the plantain flour. The dough of the pretreated flour samples was preferred better than that of untreated sample. Data documented will be useful in the pretreatment of unripe plantain to obtain flour with desirable properties that will find useful application in various foods.

KEYWORDS:Anti-nutrients, Pretreatment, Oven, Solar, Dough

I. INTRODUCTION

Plantains, (Musa parasidiaca) the fourth most important food crop after rice, wheat and maize are grown in about 120-130 tropical countries in the world. It is cultivated in the tropics and is an important staple food in sub-saharan Africa. Plantains serve as source of nutrient and household income for about 500 million people in Africa, Asia and South America.

[1]. It is a rich source of micro-nutrients such as iron, zinc, potassium and sodium.

[1]. reported between 14.3 to 36.5µg/g of iron in plantain, depending on the cultivar. Plantain cultivation is attractive to farmers due to low labour requirements for production compared with cassava, maize, rice and yam. The total world production is estimated to be over 76 million metric tons.

[12]. About twelve million metric tons are produced in Africa annually. Nigeria is one of the largest plantains producing country in the world.

[12]. It is the largest producer in West Africa with annual production of about 2.4 million metric tons mostly obtained from the southern states

[8]. However, about 35-60% post-harvest losses had been reported and attributed to lack of storage

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facilities and inappropriate technologies for processing
[11]. Usually, harvested at a mature but unripe stage, plantain ripens within 2-7 days, making it highly perishable crop particularly in the overripe stage. Plantain may therefore be processed into flour when it is matured but not ripen. Traditionally, sun drying is the common method used in processing plantains into flour. According to
[4].Drying adds value to plantain flour in addition to preservation. Moisture removal from plantain seems to be an appropriate and economical means of preserving plantainresulting in shelf stable and convenience products. Currently, unripe plantain flour is being processed into a thick paste product known as 'Amala', which is medically recommended for diabetic patient
[1]. Ripe plantain powder is used in bakery and confectionery industries, in infant diets and the treatment of intestinal disorders.
[1]. Drying is one of the oldest methods used in the processing of agricultural produce and a lot of research has been carried out on the drying of different crops. The main purpose of drying is to remove water to a level where microbial spoilage and deterioration reactions are greatly minimized. Different drying methods can be used for drying plantain fruits. Drying methods commonly used in food system include; sundrying, oven drying, spray drying, drum drying, flash drying, microwave-oven drying and freeze drying. Microwave-oven and freeze-drying have also been previously used to dry plantain flour. The colour change in plantain during processing could be due to enzymatic browning reactions taking place in the pulp after mashing since no pretreatment operation was carried out on the plantain fruits before pulping. Colour is an important physical parameter in flour quality. The colour and other quality parameters of plantain flour can be improved by pretreating the plantain fruits before drying. Pretreatments are the operations carried out on raw materials before processing to improve the appearance and other properties of the materials during processing. Different preparatory processes have been developed for fruit drying, among which are lemon juice, salt solution, honey dip, ascorbic acid, sulphiting, osmotic pretreatment, and blanching.
[6]. However, sulphiting and blanching are the pretreatments commonly used in the processing of plantain to flour. Sulphites inhibits enzymatic browning by reducing o-quinones to colourless diphenol.
[12]. By reacting irreversibly with o-quinone to colourless products. Blanching of plantain fruit before processing have been reported to improve the colour and other physicochemical properties of plantain flour. Therefore, pretreatment methods such as sulphiting and blanching can be employed to limit enzymatic and non-enzymatic browning in foods especially plantain pulp. Information on the optimization of pretreatment conditions such as blanching temperature, blanching time and sulphite concentration on the anti-nutrients of dried unripe plantain flour in relation to drying methods as well as acceptability of such dough is still scarce. Such results should provide a practical and economic process which would gain wide application in the processing of plantain flour especially at industrial level.

II. METHODOLOGY

Matured unripe plantain (Musa paradisiacae) fruit bunches was purchased from Oje market in Ibadan City, Nigeria. All reagents used were of analytical grade.

Sample preparation and pretreatment (Solar drying)

The treatment combinations used was according to the Box Behnken experimental design at 3 levels and for 3 factors; sulphiting, blanching temperature and time.

[5]. This design results in 17runs (samples) of pretreatment and the control sample without pretreatment making it 18 samples all together. 2kg of the matured unripe plantain were washed, peeled manually using a stainless-steel knife and sliced into uniform thin slices 2mm thickness using a domestic plantain slicer for each sample. Potassium metabisulphite solution at concentrations of 1%, 1.5% and 2% was prepared by dissolving 10g of a salt in 100ml of water, 15g and 20g also in 1000ml of water for each concentration. Blanching was carried out on the sliced samples in hot water using a water bath at 50^0C, 60^oC, 70^oC temperatures for 5min, 7.5min and 10min time respectively. The blanched unripe plantain slices were then soaked in the potassium metabisulphite solution for 10min after which the slice were drained and dried in a solar house using solar energy to a constant weight so as to remove moisture and to aid a commercial milling machine and sieved to obtain uniform particle size using a 250µm aperture screen. The unripe plantain flour obtained was packaged in air-tight ziploc bag, sealed, labeled and kept at room temperature for further analysis.

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Preparation of Pretreated Plantain Flour (Oven dried)

In this present study, past method of other workers was used.

[5].The matured green plantain fruit bunch was De fingered and 2kg of plantain finger were weighed. The weighed unripe plantain washed. Peeled and sliced into water so that browning reaction will not occur. The slice unripe plantain was divided into 17 portions and given various pretreatments as mentioned above, while an untreated portion serve as control. The pretreated pulp was drained and dried in hot air oven at $60^{O}C$ for 24hour to obtain dry chips. The dried chips were milled using milling machine. It is then sieved through 250µ sieve aperture.

Analysis of Anti-nutrients

Tannin

Determination of tannins was done according to the literature method.

[2]. The tannin were extracted into boiling distil water for one hour. Colour development was done with folin-dennis reagent and sodium carbonate solution. Absorbance was measured spectrophotometrically at 750nm. The tannic acid concentration was calculated from the tannic acid standard curve

Oxalate

Oxalate was determined by the method described in the literature.

[7]. The oxalate was extracted with dilute HCl at $50^{0}C$ and treated with ammonium hydroxide and glacial acetic acid. Further treatment with $Cacl_2$ solution, precipitated calcium oxalate, which was solubilized with hot dilute H_2SO_4 and titrated against $KMnO_4$ as equivalent to 2.2mg of oxalate.

Saponin

Saponin content was determined by the modified method in the literature.

[10]. Saponin was extracted for 2 hours in a reflux condenser containing pune acetone. Exhaustive re-extraction over heating mantle the with methanol in the soxlet apparatus was done for 2 hours. The extract was weighed after allowing the solvent to evaporate. The saponin content was calculated as a percentage of the sample.

Phytate

Spectrophotometer method was used.

[9]. A weighed processed sample (2g) was extracted by mixing it with 50mls of 0.2N Hcl solution and shaken for 30 minutes. It was filtered through whatman No 42-filter paper to obtain the extract. Meanwhile standard phytate solution (sodium phytate) was prepared and diluted to a chosen concentration. An aliquot, 0.5mls of the extract as well as 1mil of the standard phytate solution was pour inside tubes and treated with 1ml ferric solution (ferric ammonium sulphate). The tube was covered with stoppers and boiled in a water bath for 30 minutes. They were cooled in ice for 15 minutes and then allowed to attain room temperature, then 2.0mls of 2,2-Bipyrimidine solution was added to each tube, mixed well and their respective absorbance was read in a spectrophotometer at 519 nanometer wavelength.

Sensory evaluation of stiff dough ("Amala")

The sensory attributes namely colour, taste, aroma, mouldability, mouth feel and overall acceptability of stiff dough were excavated using a 9-point hedonic scale quality analysis with 9- like extremely, 8-like very much, 7- like slightly, 3-dislike, 2- dislike very much, 1- dislike extremely.Twenty panelists were randomly selected from the student of the department of food Technology, MoshoodAbiolaPolythecnic, Abeokuta, Nigeria. The selected panelists were those accustomed to eating "Amala".

Statistical analysis

All data generated from the experiment were analyzed in duplicate and subjected to analysis of variance (ANOVA). Duncan's Multiple Range Test (DMRT) for mean separation to detect least significance among the means was carried out using the statistical software of statistical package for the social sciences (SPSS), Version 16.0.

III. RESULTS AND DISCUSSION

Anti- Nutrients of Oven dried Plantain Flour

Antinutritional factors are chemical compound synthesized in natural food or feed stuffs by the normal metabolism of species and by different mechanism (for example, inactivation of some nutrients, dimunition of the digestive process or metabolic utilization of food/feed) which exerts contrarily to the optimum nutrition.

[14]. The result of antinutrient factors showed that the oxalate content of the plantain flour samples was significantly reduced ($p>0.05$) by pretreatment. The control sample had highest value (0.36mg/g) while plantain flour sample blanched at $60^{o}C$ for 10min and 1% of potassium metabisulphite had the least value

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(0.01mg/gTable1) while the pretreated plantain flour samples had values ranged from 0.01-0.031mg/g (Table1). Oxalate is an anti-nutrient which under normal conditions is confined to separate compartments. When released, oxalic acid binds with nutrients, rendering them inaccessible to the body. If food with excessive amounts of oxalic acid is consumed regularly, nutritional deficiencies are likely to occur, as well as severe irritation to the lining of the gut. It is evident that anti-nutrients and phytochemicals have both adverse and beneficial effects in humans.

[15]. For example, phytic acid, lectins, phenolic compounds and tannins, saponins, enzyme inhibitors, cyanogenic glycosides, and glucosinolates reduce the bioavailability of certain nutrients and impair growth in children. On the contrary, when phytic acid, lectins, and phenolic compounds and saponins were used at low levels, they exhibited hypoglycemic, hypocholesterolemic and anticancer properties.

[17]. However, saponin, phytate and tannin were not detected in the flour samples. This could be due to varietal difference, environmental and growth conditions of the plantain used.

Sensory Evaluation of Oven dried Plantain Flour

The results of the sensory attributes of pretreated oven dried unripe plantain flour samples and untreated portion are presented in table 2. The stiff dough was evaluated in terms of colour, aroma, taste, moudability, mouth feel, consistency and overall acceptability. The colour of the untreated unripe plantain flour (control) was not significantly different ($P<0.05$) form the pretreated unripe plantain flour likewise the dough ("(Amala"). The same trend was observed on other sensory parameters measured. However, plantain flour samples of pretreatment combination BT 60 ^{0}C, Bt 7.5 mins, Pmc 1.5 %; BT 50 ^{0}C, Bt 7.5 mins, Pmc 2 % and BT 70 ^{o}C, Bt 5.0 mins Pmc 1.5 % were better preferred in terms of mouth feel. Plantain flour samples of pretreatment combinations. BT 50 ^{0}C, Bt 7.5 mins Pmc 2.0 % and BT 70 ^{0}C, Bt 5.0 mins Pmc 1.5 % were better preferred in terms of consistency while plantain flour samples of pretreatment combinations BT 50 ^{0}C, Bt 7.5 mins Pmc 2.0 %; BT 60 ^{0}C, Bt 10 mins, Pmc 1 %, BT 60 ^{0}C, Bt 10 mins, Pmc 2 % and BT 60 ^{0}C, Bt 7.5 mins, Pmc 1.5 % were better preferred in terms of overall acceptability.

Anti- Nutrients of Solar dried Plantain Flour

The result of anti-nutritional properties of pretreated solar dried plantain flour is presented in table 3. Of all the four antinutrients determined only two were detected oxalate and phytate while saponin and tannin were not detected. The oxalate content of the pretreated samples was significantly ($P<0.05$) different from one another. The value varied between 0.28-0.64. The control sample had the highest value of 0.64 while the sample pretreated at 70^{0}c for 5 minutes at 1.5% concentration had the lowest oxalate content (0.28%). The values of oxalate in his present work is lower than the values (0.82%) reported for plantain flour,[1]. This may due to the pretreatment condition applied to the plantain and the drying method applied varietal differences may also responsible. This study showed that the phytate content of the plantain flour samples were also significantly different ($P<0.05$) from one another. The values obtained in this research work varied between 0.01-0.07%. The control sample had the highest phytate content of (0.08%) while samples pretreated at 70^{0}C for 7.5 minutes at 1% PMC, 70^0 C for 10 minutes at 1.5% PMC, 70^0 C for 5 minutes at 1.5% PMC, 60^0 C for 10 minutes at 2% PMC and 70^0 C for 7.5 minutes at 2% PMC had the same lowest oxalate content (0.01%). However, the values obtained in this research work were higher than the values (0.000063) reported for phytate in plantain flour.

[1]. This may be due to varietal difference, pretreatment and drying methods, age, or maturity or cultural practices.

Sensory Evaluation Result of Solar dried Plantain Flour

Table 4 shows the result of the sensory qualities of "Amala" prepared from unpretreated (control) and pretreated solar dried unripe plantain flour. The sensory characteristics of the "Amala" (the hot water reconstituted unripe plantain flour) samples was rated by the panelists in terms of color, taste, aroma, mouldability, mouth feel, consistency and overall acceptability. "Amala" prepared from the unpretreated (control) unripe plantain flour had the highest preference in terms of aroma and tastes (Table 4). However, there were no significant differences ($p<0.05$) between the pretreated unripe plantain flour samples and the control sample in terms of mouldability, mouth feel and consistency. Whereas, in terms of color and overall acceptability, it has shown that many of the pretreated unripe plantain "amala" were preferred the same as control sample. Difference in color may be attributed to the pretreatment combinations used which may have resulted in the inactivation of enzymes responsible for browning of the solar dried unripe plantain flour.

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BT (^{O}C)	Bt (min)	PMC (%)	OXALATE	SAPONIN	PHYTATE	TANNIN
60	7.5	1.5	0.23 ± 0.00^{h}	ND	ND	ND
70	7.5	1.0	0.11 ± 0.00^{m}	ND	ND	ND
50	5	1.5	0.31 ± 0.00^{c}	ND	ND	ND
60	5	2.0	0.21 ± 0.00^{j}	ND	ND	ND
60	7.5	1.5	0.22 ± 0.00^{i}	ND	ND	ND
60	7.5	1.5	0.23 ± 0.00^{h}	ND	ND	ND
70	10	1.5	0.14 ± 0.00^{l}	ND	ND	ND
50	7.5	1.0	0.24 ± 0.00^{g}	ND	ND	ND
60	7.5	1.5	0.22 ± 0.00^{i}	ND	ND	ND
50	7.5	2.0	0.33 ± 0.00^{b}	ND	ND	ND
70	5	1.5	0.17 ± 0.00^{k}	ND	ND	ND
60	10	1.0	0.01 ± 0.00^{n}	ND	ND	ND
60	10	2.0	0.28 ± 0.00^{e}	ND	ND	ND
50	10	1.5	0.29 ± 0.00^{d}	ND	ND	ND
60	7.5	1.5	0.25 ± 0.00^{f}	ND	ND	ND
60	5	1.0	0.22 ± 0.00^{i}	ND	ND	ND
70	7.5	2.0	0.21 ± 0.00^{j}	ND	ND	ND
Control			0.36 ± 0.00^{a}	ND	ND	ND

Table 1: Anti-nutritional factors of pretreated and un pretreated Oven dried unripe plantain flour

Values with similar letters within the same column are not significant ($p< 0.05$) different. ND – not detected.
The values are mean + standard deviation mean of three replicate

BT(^{O}c) – Blanching Temperature
Bt(min) – Blanching Time
PMC (%) – Potassium Metabisulphite Concentration

Table 2: Sensory Attributes of Oven Dried PretreatedUnriped plantain flour

BT(^{O}C)	Bt (min)	Pmc (%)	Colour	Aroma	Taste	Mouldability	Mouth feel	Consistency	Overall acceptability
60	7.5	1.5	7.40^{a}	6.50^{a}	6.45^{a}	6.95^{a}	7.10^{a}	6.65^{ab}	7.30^{a}
70	7.5	1.0	7.15^{a}	6.85^{a}	6.65^{a}	6.65^{a}	6.85^{a}	6.60^{ab}	6.95^{a}
50	5.0	1.5	6.65^{a}	6.45^{a}	6.45^{a}	6.20^{a}	6.45^{a}	6.40^{ab}	6.60^{a}
60	5.0	2.0	6.55^{a}	6.55^{a}	6.25^{a}	6.60^{a}	6.60^{a}	5.90^{ab}	6.40^{a}
60	7.5	1.5	6.85^{a}	6.55^{a}	6.15^{a}	6.40^{a}	6.35^{a}	6.50^{ab}	6.35^{a}
60	7.5	1.5	6.65^{a}	6.30^{a}	6.40^{a}	6.75^{a}	6.75^{a}	7.00^{ab}	6.45^{a}
70	10.0	1.5	6.60^{a}	6.85^{a}	6.75^{a}	6.65^{a}	6.65^{a}	6.40^{ab}	6.15^{a}
50	7.5	1.0	6.45^{a}	6.35^{a}	6.40^{a}	6.86^{a}	5.85^{a}	6.75^{ab}	6.40^{a}
60	7.5	1.5	6.75^{a}	6.15^{a}	6.65^{a}	6.30^{a}	6.65^{a}	6.75^{ab}	6.65^{a}
50	7.5	2.0	6.95^{a}	6.65^{a}	7.05^{a}	7.15^{a}	7.10^{a}	7.42^{ab}	7.30^{a}
70	5.0	1.5	6.60^{a}	6.60^{a}	7.20^{a}	6.90^{a}	7.30^{a}	7.20^{ab}	6.90^{a}
60	10.0	1.0	6.50^{a}	6.45^{a}	6.55^{a}	7.05^{a}	6.45^{a}	7.35^{ab}	7.10^{a}
60	10.0	2.0	6.35^{a}	6.55^{a}	6.55^{a}	6.00^{a}	6.55^{a}	6.85^{ab}	7.20^{a}
50	10.0	1.5	7.45^{a}	5.90^{a}	6.55^{a}	5.75^{a}	6.30^{a}	6.65^{ab}	6.90^{a}
60	7.5	1.5	7.00^{a}	6.35^{a}	6.85^{a}	6.35^{a}	6.50^{a}	6.30^{ab}	7.15^{a}
60	5.0	1.0	6.70^{a}	6.85^{a}	6.95^{a}	6.70^{a}	6.75^{a}	6.70^{ab}	7.00^{a}
70	7.5	2.0	6.70^{a}	6.40^{a}	7.00^{a}	6.70^{a}	6.80^{a}	6.55^{ab}	6.50^{a}
1Control			7.15^{a}	6.60^{a}	7.05^{a}	6.60^{a}	6.70^{a}	6.20^{ab}	6.95^{a}

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Table 3. Anti-nutrient properties of solar dried unripe plantain flour

BT^{0}C	Bt (min)	PMC (%)	Oxalate %	Saponin %	Phytate %	Tannin %
60	7.5	1.5	0.49e	ND	0.04^{d}	ND
70	7.5	1	0.42f	ND	0.01^{h}	ND
50	5	1.5	0.54cd	ND	0.02^{g}	ND
60	5	2	0.52de	ND	0.02^{g}	ND
60	7.5	1.5	0.51de	ND	0.04^{d}	ND
60	7.5	1.5	0.51de	ND	0.04^{d}	ND
70	10	1.5	0.38g	ND	0.01^{h}	ND
50	7.5	1	0.53cd	ND	0.06^{e}	ND
60	7.5	1.5	0.58b	ND	0.03^{f}	ND
50	7.5	2	0.62a	ND	0.07^{b}	ND
70	5	1.5	0.28hg	ND	0.01^{h}	ND
60	10	1	0.52de	ND	0.02^{g}	ND
60	10	2	0.51de	ND	0.01^{h}	ND
50	10	1.5	0.46f	ND	0.04^{d}	ND
60	7.5	1.5	0.53cd	ND	0.03^{f}	ND
60	5	1	0.56bc	ND	0.04^{e}	ND
70	7.5	2	0.41f	ND	0.01^{h}	ND
	Control		0.64a	ND	0.08^{a}	ND

Values with similar letter within the same columns are not significantly (P<0.05) different
BT – Blanching temperature
Bt – Blanching time
PMC – Pottassiummetabisulphite concentration

Table 4: Sensory properties of solar dried unripe plantain flour

BT (°C)	Bt (min)	PMC (%)	Colour	Aroma	Taste	Mould ability	Mouth Feel	Consistency	Overall Acceptability
60	7.5	1.5	6.90^{ab}	6.90^{b}	6.90^{b}	8.00^{a}	7.30^{a}	7.40^{a}	6.95^{ab}
70	7.5	1	7.25^{ab}	7.10^{bc}	6.90^{b}	7.65^{a}	7.30^{a}	7.10^{a}	7.20^{ab}
50	5	1.5	6.85^{ab}	6.90^{bc}	7.05^{b}	7.65^{a}	7.10^{a}	7.00^{a}	7.05^{ab}
60	5	2	7.15^{ab}	6.85^{bc}	6.55^{b}	7.85^{a}	6.80^{a}	7.25^{a}	6.08^{b}
60	7.5	1.5	7.35^{b}	6.75^{bc}	6.55^{b}	7.75^{a}	7.10^{a}	7.35^{a}	6.60^{b}
60	7.5	1.5	6.80^{b}	6.85^{bc}	6.35^{b}	7.90^{a}	7.00^{a}	7.10^{a}	6.90^{ab}
70	10	1.5	7.10^{ab}	6.85^{bc}	6.60^{b}	7.55^{a}	6.95^{a}	7.05^{a}	6.90^{ab}
50	7.5	1	7.25^{ab}	6.95^{bc}	6.55^{b}	7.35^{a}	6.75^{a}	7.35^{a}	6.65^{b}
60	7.5	1.5	7.15^{ab}	6.85^{bc}	7.30^{b}	7.95^{a}	7.65^{a}	7.75^{a}	7.10^{ab}
50	7.5	2	7.10^{ab}	6.90^{bc}	6.95^{b}	7.70^{a}	7.00$_{a}$	7.45^{a}	6.90^{ab}
70	5	1.5	7.05^{ab}	7.10^{bc}	7.05^{b}	7.85^{a}	7.55^{a}	7.15^{a}	6.85^{ab}
60	10	1	7.40^{ab}	7.25^{bc}	6.90^{b}	7.65^{a}	6.90^{a}	7.55^{a}	7.15^{ab}
60	10	2	7.20^{ab}	6.90^{bc}	7.05^{b}	7.65^{a}	7.50^{a}	7.25^{a}	6.95^{ab}
50	10	1.5	7.35^{ab}	6.85^{bc}	6.85^{b}	7.40^{a}	7.15^{a}	7.25^{a}	7.10^{ab}
60	7.5	1.5	6.55^{b}	6.85^{bc}	6.90^{b}	7.45^{a}	7.25^{a}	7.00^{a}	7.10^{ab}
60	5	1	7.35^{b}	6.25^{c}	6.35^{b}	7.65^{a}	7.20^{a}	7.00^{a}	6.90^{ab}
70	7.5	2	6.80^{b}	6.45^{bc}	6.55^{b}	7.15^{a}	7.05^{a}	7.10^{a}	6.85^{ab}
Control			7.95^{a}	8.20^{a}	8.25^{b}	8.00^{a}	7.75^{a}	7.35^{a}	7.75^{a}

Value with similar letters within the same column are not significantly different at p<0.05
The values are mean± standard deviation. Mean of three replicate
Key: BT = Blanching temperature, Bt = Blanching time, PMC = Potassium metabisulphite concentration

IV. CONCLUSIONS

Reports obtained for oven dried plantain flour has shown that Antinutrients present in the flour samples were partly reduced as result of pretreatments, sensory evaluation result showed that the stiff dough of pretreated plantain flour was preferred better than the control sample especially in terms of aroma, taste and mouldability. The

same trend was recorded as per solar dried samples of the plantain flour as well as the resultant stiff dough.

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