

Effects of Autoclaving Periods on the Sensory Attributes of Water Yam (*Dioscorea Alata Poir*) in Mubi, Adamawa State

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Abstract

The experiment examined the effects of processing periods on the sensory attributes of water yam (*Dioscorea alata Poir*). Yam tubers were washed, processed and sliced into cubes. Treatments consisted of yam autoclaved at the temperature of 121°C and pressure of 100 kPa using five different autoclaving periods (0, 5, 10, 15 and 20 minutes with 0 minute as the control) laid out in a Completely Randomized Design (CRD). Descriptive sensory analysis was conducted by five trained panelists using a 7-point descriptive scoring method. Data collected were subjected to Analysis of Variance. Least Significant Differences (LSD) tests were used to compare means that showed significant difference at $p \leq 0.05$. The results show that, autoclaving periods had effects on sensory attributes of water yam. The least loss in sensory quality were recorded on samples autoclaved for 5 minutes and therefore, recommended for Utra High Temperature (UHT) heat treatment for better sensory attributes of cooked water yam.

Keywords: processing period; colour; mealiness; sensory; softness; water yam; wetness

Introduction

Yam may be left in the soil for some time but don't store well once they are dug up. Harvested, yams are either consumed or sold immediately but some are stored in simple or special structures to be used or marketed later. It is necessary to make use of yam as soon as it is dug. The storage of yam by farmers only last for 5 – 6 months (Wilson, 1987). Yam storage, processing and preservation methods vary from place to another but generally the methods employed by farmers include one of the following; traditional yam barns where yams are tied in columns supported on sticks framework using ropes; improved yam barn is an improvement on the traditional yam barn in which modern construction materials like corrugated iron sheet, wire mesh and timber are used; and small holder farmers can also store their produce in pits and *in situ* storage until when required for consumption or sale nonetheless, all these methods cannot extend the shelf life beyond six months under ambient temperature (Mahungu and Otiende, 2004; Ahmed *et al.*, 2018).

In Nigeria and indeed most yam producing areas, farmers largely employ traditional methods of processing and preservation into yam chips and flour (Ajibosin *et al.*, 2005). This method involves peeling and proper washing of yam tuber and then slicing into cubes. The cubes then are sun dried and preserve as chips or processed further into flour by milling. However, these traditional methods are inadequate to meet up with the present postharvest challenges confronting the farmers which include quantitative and qualitative losses. Some studies were carried out on the effect of cooking on the organoleptic properties, proximate and anti-nutritional composition of different varieties of root and tuber crops (Addy, 2012, Ezeocha and Ojimekwe, 2012; Lawal *et al.*, 2012; Ahmed *et al.*, 2018) but little emphasis was focused on the effect of autoclaving periods on the sensory attributes of water yam. Thus this study purposely seek to explore the effects of heating periods on the sensory attributes of water yam using autoclave to proffer solutions to some of these challenges through Utra High Temperature (UHT) heat treatment to preserve,

minimize losses and provide a new, convenient technology for yam processing.

Materials and Methods

The experiment was carried out at the Animal Nutrition Laboratory of the Department of Animal Production, Adamawa state, (ADSU), Mubi, Nigeria in 2015. Water yam (*D. aata*) was used for the research. Yam tubers were washed, peeled and diced into cubes of about 3cm×3cm×2cm and put in boiling water (100 °C) for 15 minutes. Treatments consisted of yam autoclaved at 121 °C and 100 kPa at five different processing periods of 0, 5, 10, 15 and 20 minutes with 0 min as the control and laid out in a Completely

Randomized Design (CRD) then replicated three times with each treatment containing 10 pieces.

Descriptive sensory analysis was conducted by five trained panelists using scoring difference method as described by Ahmed *et al.*, 2018. The sensory quality attributes determined were colour, mealiness, taste, softness and wetness, while the level of perception was assessed using a 7- point scale (Table 1).

Data collected were subjected to Analysis of Variance (ANOVA) using SAS (1999). Least Significant Differences (LSD) tests were used to compare means that showed significant difference at $p \leq 0.05$.

Table 1: A 7-point Scale Scoring Difference Test sensory Properties

Points	Colour	Mealiness	Taste	Softness	Wetness
7	Bright	Mealy	Sweet	Soft	Wet
5	Slightly bright	Slightly mealy	Slightly sweet	Slightly soft	Slightly wet
3	Slightly dark	Soggy	Bland	Slightly hard	Slightly dry
1	Dark	Waxy	Bitter	Hard	Dry

Results and Discussion

The colour of autoclaved water yam (Table 2) revealed a highly significant ($p < 0.01$) decrease in its colour scores when compared to the control. The highest decrease in colour of 1.73 was recorded on the water yam autoclaved for 20 minutes and the yam that was not autoclaved was assessed as bright (6.50) by the panel of assessors then followed by yam autoclaved for 5 minutes (6.17) while the yam autoclaved for 20 minutes (Table 2) was scored slightly dark (4.2). The highly significant difference between the treated and untreated samples may be linked to thermal degradation of colourless complex phenolic (proanthocyanadins and lignin) to coloured phenols (anthocyanidins) which concurred with Babajide *et al.* (2006) and Ahmed *et al.* (2018) that high temperature causes colour changes in white yam due to degradation of phenolic compounds.

Highly significant ($p < 0.01$) difference was recorded in terms of mealiness between treated and untreated samples (Table 2). Yam treated for 5 minutes in autoclave was perceived mealy (6.23) by the panel of judges and yam autoclaved for 20 minutes was categorized as soggy (5.07). The highly significant effect may be caused by steam pressure and high

temperature that led to gelatinization. This finding is in agreement with Opara (1999) who opined that steam pressure and temperature of 77.5 °C would cause gelatinization in white yam. It is also in line with Ahmed *et al.* (2018) who reported similar finding on white yam subjected to varying autoclaving periods.

The mean scores for taste of autoclaved water yam during descriptive sensory analysis ranged from 6.03 to 4.67, yam sample autoclaved for 5 minutes was scored slightly sweet (5.77). The autoclaved water yam for 20 minutes was scored bland (4.67) which was highly significant ($p < 0.01$) from all the autoclaved samples (Table 2). The highly significant difference is might be due to formation of browning substances on the untreated sample during processing, which was degraded by high steam pressure and heat and this result is congruent with Samir *et al.* (2005) cited in Adedeji (2010) and Ahmed *et al.* (2018), who stated that bitterness is caused in yam by browning during processing.

The treated samples displayed a highly significant ($p < 0.01$) difference from the untreated samples as shown in Table 2. Yam autoclaved for 5 minutes was awarded highest score of slightly soft (5.77) and yam

autoclaved for 20 minutes was the least preferred as slightly soft (5.03). The highly significant preference level that occurred between treated and untreated samples might be due to steam pressure as reported by Opara (1999) and Ahmed *et al.* (2018) that yam cooked under steam pressure soften.

The mean scores for wetness of autoclaved yam ranged from slightly wet (5.83) to slightly dry (4.70) and highly significant ($p < 0.01$) difference existed among the treated and untreated samples (Table 2).

Treatment with autoclave for 5 minutes had highest descriptive rating of slightly wet (5.83) by sensory assessors, while sample autoclaved for 20 minutes had the least rating of slightly dry (4.70). The highly significant differences recorded might be due to high temperature and steam pressure the autoclaved samples were subjected to. This result is in tandem with that of Baah (2009) and Ahmed *et al.* (2018) who observed that cooking temperature increase dryness of white yam due to evaporation of water.

Table 2: Effect of autoclaving time on organoleptic properties of white yam

Treatments	Colour	Mealiness	Taste	Softness	Wetness
0 min	6.50a	6.73a	6.03a	6.50a	7.00a
5min	6.17b	6.23b	5.77b	5.77b	5.83b
10 min	5.77c	6.20b	5.40c	5.53c	5.80b
15 min	5.00e	5.50c	5.27d	5.23d	4.83c
20 min	4.77f	5.07d	4.67e	5.03e	4.70d
LSD	0.108	0.097	0.089	0.108	0.106
Level of probability	**	**	**	**	**

** Highly significant at 1% level of probability.

Conclusion

The results of this research showed that among the five periods studied, autoclaving for five minutes has the less effects on sensory attributes of water yam and thus, it is recommended as the best period for Ultra High Temperature (UHT) heat treatment processing method for water yam in order to obtain product with good sensory attributes.

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