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Antioxidative and flavouring effects of *Aframomum danielli* on biscuits

Afolabi M. O.[1]* and Adegoke G. O.[2]

[1]Department of Food Science and Technology, Bowen University, Iwo, Osun State, Nigeria.
[2]Department of Food Technology, University of Ibadan, Ibadan, Oyo State, Nigeria.

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Antioxidative and flavouring effects of *Aframomum danielli* seed crude ethanolic extract on biscuits were studied. The degree of oxidation during storage was monitored by determining the acidity of the extracted fat from the biscuit samples using the standard method. Biscuits were baked with *A. danielli* seed extract at the following levels of addition: 100, 200, 300, 400, 500 ppm and a sample using butylated hydroxytoluene (BHT) at a level of 200 ppm, with a synthetic flavour (vanilla) added at a level of 50 ppm. A control sample was baked without the inclusion of *A. danielli*, BHT or synthetic flavour. The crude ethanolic extract of *A. danielli* seed at a concentration of 400 ppm was very effective as an antioxidant in the biscuit samples within the period of10 weeks of monitoring at a temperature of 25°C. Based on taste, aroma and acceptability scores, the flavour of *A. danielli* extract was not noticeable in biscuit until it was 500 ppm.

Key words: Antioxidative, flavouring effects, *Aframomon danielli,* biscuits.

INTRODUCTION

The term biscuit refers to a thin flat baked product made from flour, salt, sweetening agents, fat and food additives (Coup and Sanderson, 1987). Serious consideration is given to the shelf life of biscuits, so far as palatability is concerned (Hoseney et al., 1998). Many manufacturers are prepared to remove from the shelves, products which are ninety days old, thereby accepting this period as the maximum shelf life.

It is thought that the ninety days period is much too low and could be extended, especially if oxidative rancidity is prevented by including antioxidants in the recipe (Buck, 1991; Smith, 1972). Better results is obtained if the moisture content of the finished product is low (2.5%) and the biscuit wrapper is hermetically sealed (Smith, 1972).

The use of food additives such as antioxidant will eliminate the problems of flavor deterioration and loss of nutritional value during storage, distribution and hawking by the retailers especially where added fat/oil levels is high in the recipe (up to 20%) as it is in the case of cookies (Gisslen, 1985). Presently, in the biscuit industry, synthetic antioxidants like BHT/BHA are the antioxidants being used to prevent oxidation and flavour deterioration during shelf life of biscuits. There has been an increasing concern about possible adverse affects of synthetic food additives, especially butylated hydroxyl anisole (BHA) and butylated hydroxyl toluene (BHT) on baked products (Alice, 1998; SON, 1987). This has stimulated the research for a natural food additive that could serve as an

*Corresponding author. E-mail: afolabiolutoyin@yahoo.com. Tel: +2348054255743.

antioxidant in such products. Example of the additives that may be used as substitutes is *Aframomon danielli*. *A. danielli* has been reported to have antioxidant and antimicrobial properties in addition to its flavour (Adegoke and Gopala Krishna, 1998; Adegoke et al., 2000a, b). The objective of this study was to investigate the possibility of replacing synthetic antioxidants (BHA and BHT) in baked biscuits with *A. danielli* seeds extract.

MATERIALS AND METHODS

A. danielli seeds, soft wheat flour and other ingredients were procured from a local market in Ibadan, Oyo state, Nigeria. Specially refined palm oil sample (free from any antioxidant and anti microbial agent) were obtained from a local manufacturer of vegetable oil and the equipment and facilities of a local bakery in Ibadan were used to bake the biscuit samples.

Spice preparation

A. danielli seed were sorted, cleaned, dried and pulverized in attrition mills, after which the powdered spice were packed in polythene bags. Then after, 25.1 g of the powdered spices was weighed into flask and refluxed in the soxhlet apparatus for 3 h, using 95% ethanol as the solvent (Adegoke et al., 2000). Solvent was evaporated off at 80°C to give the antioxidant extract.

Biscuit ingredients and baking

Biscuit recipe

The biscuits were produced using the method described by Akpapunam and Derbe (1994). The basic recipe was 100 g flour, 31 g vegetable oil, 10 g sugar, 2 eggs, 1 g baking powder. The dried ingredients were weighed and mixed manually till well blended.

Vegetable oil was added and rubbed in until uniform. The egg was added and the dough formed was kneaded manually on a flat table until a smooth consistency was obtained. The dough was cut out into round shapes using biscuit cutter. The dough pieces were transferred into greased bakery trays and baked in a hot oven at 160°C for 15 min. The biscuits were cooled on racks, packaged in sealed cellophane film and stored at 25°C. Various biscuit samples were baked as follows:

1. A control sample was baked with no anti oxidant (BHT), synthetic flavour and *A.danielli.*
2. The second set of samples were baked with *A. danielli* at the following level of addition: 100, 200, 300, 400 and 500 ppm.
3. The last sample was baked with BHT at a level of 200 ppm with a synthetic flavour (vanilla) added at a level of 50 ppm.

Analysis of samples

Chemical analysis

The acidity of extracted fat was determined using the method of Onwuka (2005) as follows: About 25 g of the powdered biscuits was weighed into flask and refluxed in the soxhlet apparatus for 3 h, using 95% ethanol as the solvent. Solvent was evaporated off at 80°C to give the extracted oil from the biscuits and the weight of the extracted oil was determined. To the oil in the flask were added mixture of 25 ml diethyl ether, 25 ml 95% ethanol and 1 ml phenolphthalein solution (1%), carefully neutralized with 0.1 M NaOH. The resulting solution was titrated with aqueous 0.1 M NaOH with constant shaking until a pink colour which persisted for 15 s was obtained.

The acidity (as palmitic acid) = Titre (ml) x 5.61 / weight of sample of biscuit used

The moisture content of baked biscuit samples were determined using AOAC (1984) method. The energy value of biscuit samples was determined using the oxygen bomb calorimeter as described by Anon (1960).

Sensory evaluation

The sensory evaluation of the freshly baked biscuit samples was conducted using multiple comparison test (Larmond, 1977). A panel of 20 judges assessed the biscuit samples for aroma, taste and overall acceptability. The samples were scored using a 6 point hedonic scale where 6 represented excellent and 1 represented very poor. The results were analyzed using analysis of variance (Snedecor, 1956).

RESULTS AND DISCUSSION

Effects of moisture content on biscuits at ambient condition

The moisture content values obtained for the baked biscuits ranged between 2.5±0.01 and 2.7± 0.72%. The Standard Organization of Nigeria (1987) set a standard of 5.0% max and with lower value, the condition for safe keeping being enhanced. The moisture content is fairly low for each sample from week 0 to week 10, an indication that the samples were well preserved against moisture (Table 1).

Effects of treatment on energy value under ambient condition

Table 2 shows the data obtained for energy value for various samples. There were no appreciable differences in energy value over the period of examination among the treatment except for control and sample with 100 ppm level of addition of *A. danielli*.

This was probably due to the fact that there had been no appreciable reduction in protein, carbohydrate and fat level due to activities of micro organisms and enzymes reaction that might have degraded the nutrients.

Effects of treatment on the sensory score of the biscuit samples

The result of the physical assessments (Table 3) conducted by the panel of 10 on the taste, aroma, and overall acceptability indicated that the assessors rated the aroma of the biscuit sample without any significant

Table 1. Moisture content (%) of sample during storage at ambient condition.

Week	Control	100 ppm *A. danielli*	200 ppm *A. danielli*	300 ppm *A. danielli*	400 ppm *A. danielli*	500 ppm *A. danielli*	200 ppm BHA/BHT
0	2.5±0.01	2.5±0.05	2.5±1.20	2.5±0.03	2.5±0.16	2.5±0.60	2.6±0.34
2	2.5±0.10	2.5±0.03	2.5±0.84	2.5±0.05	2.5±0.63	2.5±0.71	2.5±0.76
4	2.5±0.03	2.6±0.40	2.6±0.02	2.6±0.71	2.6±0.14	2.6±0.89	2.5±0.59
6	2.6±9.10	2.6±0.39	2.5±0.11	2.6±0.83	2.5±0.09	2.5±0.67	2.5±0.52
8	2.6±0.20	2.6±0.07	2.6±0.29	2.7±0.12	2.7±0.14	2.7±0.50	2.6±0.43
10	2.6±0.30	2.7±0.11	2.7±0.31	2.7±0.99	2.6±0.97	2.6±0.67	2.7±0.72

*Mean of three readings ± standard deviation.

Table 2. Effects of treatment with *A.danielli* on energy value of biscuits under ambient condition.

Week	Control	100 ppm	200 ppm	300 ppm	400 ppm	500 ppm	BHA/BHT
0	670±23	680±30.	700±20	675±10	650±25	660±50	690±20
2	650±10	680±10	690±30	650±10	675±25	695±35	680±15
4	600±25	660±20	670±20	660±20	685±40	645±10	690±25
6	580±33	650±27	685±17	670±15	690±23	670±22	700±18
8	590±22	640±21	685±19	650±19	720±13	675±33	670±43
10	570±13	620±32	710±10	670±27	690±17	665±17	650±37

*Mean of three readings ± standard deviation.

Table 3. Effects of treatment on the sensory scores of biscuits sample.

Sensory attribute	Control	100 ppm	200 ppm	300 ppm	400 ppm	500 ppm	200 ppm BHA/BHT 500 ppm vanilla
Taste	2.7^{c}	3.9^{b}	3.4^{b}	2.5^{c}	2.6^{c}	4.2^{a}	4.3^{a}
Aroma	3.9^{a}	3.8^{a}	3.8^{a}	3.4^{a}	3.4^{a}	3.3^{a}	3.3^{a}
Overall acceptability	2.5^{c}	2.6^{c}	3.6^{c}	2.8^{c}	2.6^{c}	4.3^{a}	4.3^{a}

Means within a row followed by the same letters are not significantly different at 5% level of probability of Turkey's test.

difference for all the samples, and the sensory evaluation for taste result indicated that *A. danielli* (500 ppm) and the vanilla flavoured biscuit were most preferred. The result of overall acceptability show that the sample with 500 ppm *A. danielli* was *the* most acceptable sample while the control and sample with 100 ppm *A. danielli* was not acceptable at 5% level of significant.

Effects of treatment on acidity of extracted fat of the biscuit

Figure 1 gave the acidity of the extracted fat of the biscuits baked with varying levels of *A. danielli* antioxidant extracts (100-500 ppm), BHT at 200 ppm and the control (with the exclusion of *A. danielli*, BHT and any synthetic flavour).

The result shows a steady increase in acidity of extracted fat with time in the control sample. *A. danielli* was more effective at higher concentration. The critical addition point of *A. danielli* was 400 ppm. At this concentration, the effectiveness to control lipid oxidation was comparable to that of BHT.

The antioxidative properties of the seeds extract are due to the presence of antioxidant compounds in the extract which have the ability to scavenge the lipid peroxyl radicals generated in the biscuits during storage. Such compounds are phenolic compounds that are naturally present in the seeds (Adegoke et al., 2000; Afolabi et al., 2011).

Conclusion

From this study, it was found that the inclusion of the extract of *A. danielli* in biscuit recipe at a concentration of 400 ppm was found to be effective as an antioxidant, it was however discovered that the flavour of the extract is

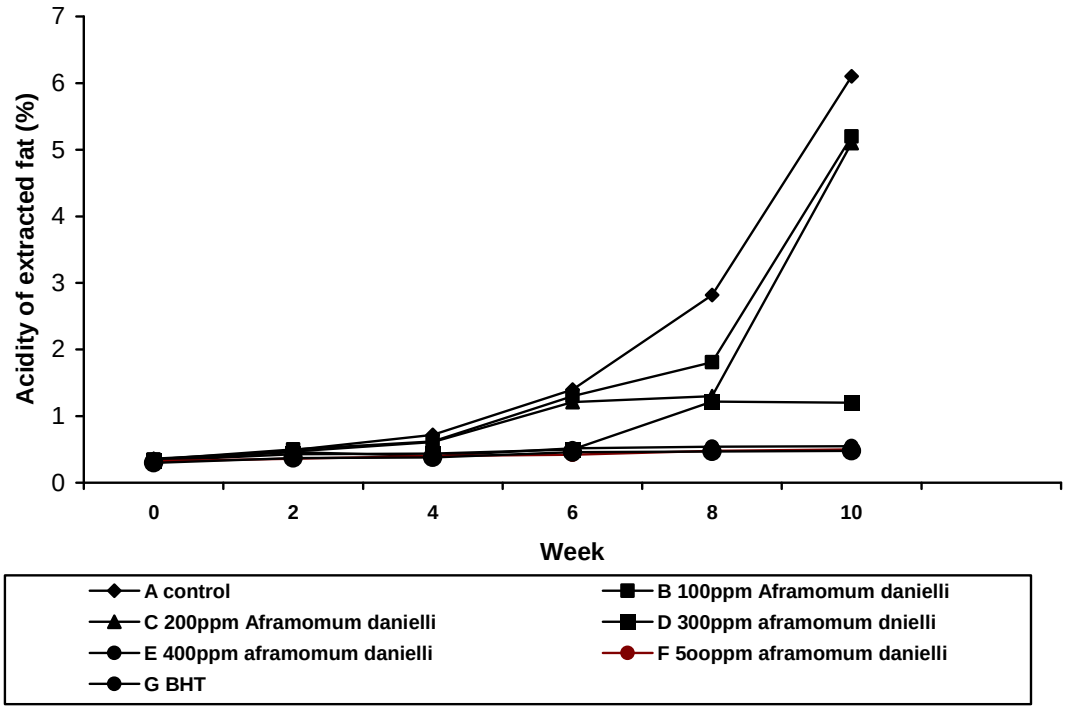

Figure 1. Effects of treatment with *A. danielli* on acidity of extracted fat of biscuit samples.

not noticeable in biscuit until it was 500 ppm. To enhance the effectiveness of the extract at lower concentration, the flavour can be purified and concentrated.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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