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Stability and Acceptability of Spiced Palm Oil

Evelyn N. Bede and Chinenye U. Chigbu
Department of Food Science and Technology, Federal University of Technology, Owerri, Nigeria

Abstract: This study was carried out to determine the oxidative stability and acceptability of palm oil mixed with spices. Spiced palm oil samples were prepared by adding separately 100 g of dry ground spices "Uziza" (*Piper guineense*), "Uda" (*Xylopia aethiopica*) and "Ehuru" (*Monodora myristica*) to 500 mL of fresh palm oil. The products were stored in closed transparent glass bottles and kept on the shelf for 20 weeks at room temperature. The oxidative stability of these spiced samples of palm oil were compared with that of the control sample. All spiced samples were relatively stable within 8 weeks of storage, after which they showed increase in the Peroxide Value (PV) with sample D (palm oil spiced with Ehuru) having the highest PV value (20 mg kg^{-1}) and sample B (palm oil spiced with Uziza) the least value (17.5 mg kg^{-1}) among the spiced samples by 20 weeks of storage. Sample A (palm oil without spice) showed the highest PV value of 32.5 mg kg^{-1} within the same storage period. However, sensory studies indicated that the palm oil sample spiced with Ehuru had the same level of acceptability as the control sample.

Key words: Palm oil, spices, oxidative stability, acceptability, PV, control sample

INTRODUCTION

Beta-carotene is one of the more abundant carotenoids in fruits and vegetables and it is recommended by health professionals that diets rich in fruits and vegetables may help reduce the risk of cancer and heart diseases. (Perelson and Ellendogen, 2002). Carotenoids are the precursors of vitamin A and vitamin A deficiency has been identified to promote blindness in children in developing countries (Thylefors, 1985) increase morbidity and mortality in young children and leads to impaired cellular functioning. (Chandra and Au, 1981; Machili, 1984).

Animal foods such as eggs, milk and liver are good sources of preformed vitamin A, however they are expensive and out of reach of the poor segments of the population in developing countries such as Nigeria. This category of the population depends on green leafy vegetables and fruits as their major sources of beta-carotene.

However, a study by Pee *et al.* (1995) showed lack of improvement in vitamin A status with increased consumption of dark green leafy vegetables. This may not be unconnected with the domestic and traditional cooking processes as studies have shown that loss of beta-carotene in leafy vegetables during cooking processes ranges from 16-67% during boiling (Gayathrri *et al.*, 2004). There is therefore need to encourage the consumption of other sources of beta-carotene which may not undergo domestic cooking processes.

Red palm oil is the plant source with the highest provitamin A content: one teaspoon provides between 400 and 500 μg Retinol Equivalents (RE), sufficient to meet the requirement of a child (Delisle, 2006). The red palm oil also provides healthful antioxidants and its provitamin A carotenoids are well absorbed and utilized by the body because of the presence of fat and the absence of a vegetable matrix (Delisle, 2006; Solomons, 1998). Palm oil can be consumed in many traditional dishes without undergoing any cooking processes (especially when the oil is fresh). Palm oil can be taken raw with yam, cocoyam, plantain in cooked or roasted forms, preparation of 'abacha', 'achara' soup and other uncooked local delicacies. Palm oil is usually stored traditionally in earthen pots, plastics and metal drums. During this storage period, the oil becomes rancid due to oxidation, thereby developing off flavor and taste, which retards raw consumption of the oil, as consumers prefer using it in cooked preparations in order to mask the off taste and flavor.

The addition of spices to fresh palm oil is expected to retard oxidation and maintain freshness in the oil. This will prolong the use of the palm oil in its uncooked state thereby improving the intake of the provitamin A content. Spices, on the other hand have now been known to maintain the nutritional value of food , enhance the keeping qualities of the food products and increae their shelf life (Chipault *et al.*, 1956; Hirahara *et al.*, 1974; Farag *et al.*, 1989; Economou *et al.*, 1991).

Corresponding Author: Evelyn N. Bede, Department of Food Science and Technology, Federal University of Technology, Owerri, Nigeria

In this study, the oxidative stability and consumer acceptability of some gourmet palm oil produced by the addition of some local spices "Uziza" (*Piper guineense*), "Uda" (*Xylopia aethiopica*) and "Ehuru" (*Monodora myristica*) to the raw palm oil, was carried out. Local spices were used to retard oxidation of palm oil and avoid its associated problems to health as well as maintain freshness, create variety of raw palm oil in order to enhance raw consumption of palm oil, thus increasing intake of beta carotene and reducing incidences of Vitamin A Deficiency (VAD) diseases.

MATERIALS AND METHODS

Palm oil was obtained using a traditional method of processing. In this processing method, freshly harvested ripe palm fruits were boiled until the mesocarp softened. The cooked palm oil was manually mashed using wooden pestles and the oil pressed out using a hydraulic press. The oil was boiled for some time to boil off H_2O and separate the sludge from the oil. The palm oil produced was used in the preparation of the spiced palm oil. The spices, Uziza (*Piper guineense*), Uda (*Xylopia aethopica*) and Ehuru (*monodora myristica*) were sourced from a local market in Owerri, South east Nigeria.

Physical properties of the palm oil were determined. The properties determined were saponification value, iodine value, density, smoke point and freezing point. The procedures for determining these properties are already detailed in literature (AOCS, 1981, 1984, 1989; Mondy, 1980; BSI, 1995).

Preparation of the spiced palm oil samples: Dry Uziza, Uda and Ehuru fruits were ground separately until they could pass a sieve of 0.5 mm. One hundrad gram of each spice were added, respectively in three conical flasks containing 500 mL of palm oil each. A fourth conical flask containing 500 mL of palm oil had no spice and this served as the control.. The conical flasks were closed and kept at room temperature for 24 h with periodic shaking (Antoun and Tsimidou, 1997) to produce the different gourmet palm oil. The four palm oil samples which are; palm oil without spice (sample A), palm oil+Uziza (sample B), palm oil+Uda (sample C) and palm oil+Ehuru (sample D) were kept on a shelf in transparent closed glass containers for 20 weeks at room temperature.

Stability studies of spiced palm oil: Stability studies were carried out at room temperature. The spiced palm oil samples were transferred to a series of closed transparent glass bottles of about 10 mL volume. They were all kept on the shelf at room temperature. Oxidation rates were determined by periodic measurements of peroxide value taken every two weeks for 20 weeks. The peroxide values were determined according to the IUPAC 2.501 method (IUPAC, 1987). To ensure repeatability, every measurement was taken in duplicate.

Sensory evaluation studies: The sensory evaluation of the different samples of spiced palm oil (palm oil without spice, palm oil+Uziza, palm oil+Uda, palm oil+Ehuru) was carried out using a 40 untrained member panel who were randomly picked from students and staff of the Federal University of Technology Owerri, Nigeria. The oil samples were labeled and served with warm roasted yam (*Dioscoria* sp.), a local delicacy that is traditionally eaten with raw palm oil. The panelists were to smell, taste and rank them in order of their degree of odor, flavor, taste, colour and overall acceptability. The panelists used a seven point hedonic scale.:

- Disliked extremely
- Disliked moderately
- Disliked slightly
- Neither liked nor disliked
- Liked slightly
- Liked moderately
- Liked extremely

All scores were converted to ranked data prior to statistical analysis. An analysis of variance was performed on ranked panel scores using a two-way ANOVA model. Significant differences among means were determined using the T-test under a level of significance of 0.05.

RESULTS AND DISCUSSION

The physical characteristics of the palm oil were determined before the preparation of the special palm oil samples. The determined characteristics are already shown in Table 1.

To determine the rate of oxidation in the palm oil samples, peroxide values of the samples were determined every 14 days. Figure 1 shows the variation of peroxide value with storage time in weeks. It can be observed that the spiced palm oil samples appeared relatively stable within a period of 8 weeks. Within this period, the control palm oil sample (sample A) had already doubled its peroxide value, indicating a pronounced rate of oxidation. Between the 8th and 12th week, all samples showed increase in the peroxide values. By the 12th week, the peroxide value of the control oil sample (sample A) had increased by almost 400% while those of the spiced

Table 1: Physical properties of the palm oil sample

Physical property	Value
Saponification value	204.21
Iodine value	53.75
Relative density (Room temp.)	0.8067
Smoke point	1350 C
Melting/freezing point	28 C

Table 2: Mean sensory scores for palm oil samples

Samples	Color	Taste	Flavor	Odor	After taste perception	Overall acceptability
Unspiced Palm oil (Sample A)	6.68^{a}	6.32^{a}	6.40^{a}	6.40^{a}	6.52^{a}	6.10^{a}
Palm oil+ Uziza (Sample B)	4.72^{b}	5.48^{b}	5.64^{b}	6.04^{b}	5.72^{b}	5.62^{b}
Palm oil+ Uda (Sample C)	1.88^{c}	3.92^{c}	4.28^{c}	4.40^{c}	5.12^{c}	4.10^{c}
Palm oil+ Ehuru (Sample D)	5.92^{d}	6.12^{a}	6.20^{a}	6.04^{b}	6.32^{a}	6.05^{a}

Values within a column for each attribute with different letters are significantly different ($p<0.05$)

samples (samples B-D) had barely doubled. It can be said from this figure that the presence of this local spices, Uziza, Uda and Ehuru in palm oil can greatly retard the rate of oxidation, hence delaying rancidity and its negative effects. The spice with the best stabilizing effects among the three was Uziza (sample B). At about 20 weeks of storage, the palm oil sample with uziza still showed the lowest peroxide value content.. Ehuru (sample D) showed the least stabilizing effect among the three species. In 20 weeks, the peroxide value of the unspiced palm oil had increased from 6.2 mg kg^{-1} to about 32.5 mg kg^{-1}.

Table 2 gives the sensory assessment table for the palm oil samples. The table showed that the palm oil sample without spice (sample A) ranked highest in all the organoleptic parameters considered. This was closely followed by sample D (palm oil+Ehuru). Sample C (palm oil+Uda) ranked lowest among the spiced oil samples. However, for the unspiced palm oil sample (sample A) and the palm oil spiced with Ehuru (sample D), there were no significant differences in taste, flavour, after test, perception and overall acceptability. This indicates an equivalent acceptable level for both samples A and B. Since Ehuru is acceptable as a spice in palm oil at the same level of the unspiced palm oil, Ehuru can be used to retard oxidation and hence extend the freshness of the palm oil for raw consumption. This raw consumption of palm oil as earlier stated is believed to result in increased intake of beta carotene a precursor of vitamin A. The poor performance of this local spices could stem from the fact that they are traditionally used in cooked preparation. Their use in uncooked dishes is rather novel and can be considered a gourmet product. The performance of Ehuru

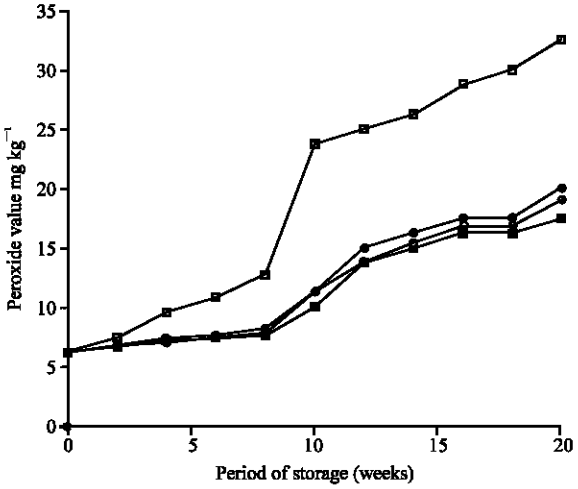

Fig. 1: Variation of peroxide value with period of storage (in weeks) for the palm oil samples. Open square (Sample A), solid square(Sample B), open circle (Sample C) and closed circle(Sample D)

in the sensory evaluation suggests that with continued use of the spices, there would be an increase in the acceptability.

From the peroxide value of the oil sample, Ehuru showed the least retardation to oxidation among the spices considered. However, when compared with the unspiced palm oil, Ehuru showed a pronounced stabilizing effect on the palm oil maintaining the peroxide values almost at the same level having a total change of about 2 mg kg^{-1} within 8 weeks of storage.

CONCLUSION

To encourage raw intake of palm oil as a means of increasing vitamin A intake in some developing countries, oil rancidity must be minimized. Addition of ehuru into palm oil has shown a pronounced stabilizing effect on palm oil and the acceptability was not significantly different from the unspiced palm oil sample.

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