EVALUATION OF STORAGE STABILITY OF YELLOW CAKE MADE WITH RED PALM FAT

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ABSTRACT

Yellow cakes were prepared using red palm shortening, red palm margarine and a commercial margarine at ratio of 26:15:59 respectively. The cakes were stored at freezer (-18°C±3) or refrigerator (7°C ±3), for three months and three weeks, respectively. Cakes were analysed at day 0 and after one, two, three weeks and months for their storage and oxidative stabilities. Analyses include peroxide value (PV), free fatty acid (FFA), para *anisidine value (AV), conjugated diene and vitamin E content. Results showed that cakes stored in the refrigerator, formulated and control, had high initial PV value of 4.65 and 4.04 respectively. The PV of formulated cake increased slightly until week three while for the control cake PV increased until week 2 and started decreasing. The FFA, AV and conjugated diene were higher in the formulated sample. In frozen storage, the control cake had higher PV and conjugated diene value until the first month of storage and started to decrease thereafter. The FFA and AV increased with the increase of storage period. For the formulated cake, all values measured, except for FFA, increased until month three. Vitamin E content was higher in the formulated cake than the control cake for both type of storage, and it started to decrease with increasing storage period.*

Keywords: cake, red palm fat, vitamin E, storage stability.

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INTRODUCTION

Fats contribute to the appearance, taste, mouth feel, lubricity and flavour of most food products (Mauhngu *et al*., 1999) and the amount and type of fat determine the characteristic and the consumer acceptance of that food. During food processing and storage, numerous changes take place due to the food exposure to wide range of processing conditions. One of the most important changes that occur to food is lipid oxidation. Lipid oxidation lowers the quality and nutritional value of the food (Suja *et al*., 2004). Addition of antioxidant is effective in delaying the oxidation and extending the shelf life of food (Jadhav *et al*., 1996; Decker, 1998). Recently, special attention has been given to the use of natural antioxidant because of the worldwide trend to avoid or minimize synthetic food additives (Krings and Berger, 2001). Oxidative stability of natural antioxidant in baked goods has seldom been investigated. Turmeric, betel leaves and clove effectively retarded rancidity in butter cake and extended its shelf life (Lean and Mohamed, 1999). Ranhotra *et al.* (1995) reported that antioxidant increased beta-carotene stability during baking of whole wheat bread and crackers. In soda crackers biscuit, extracts of marjoram, spearmint and peppermint showed a good antioxidant effect (Bassiouny *et al*., 1990). This study was carried out to evaluate the use of red palm fat, rich in carotenes and vitamin E, as a source of natural antioxidant on the oxidative stability of yellow cake.

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EXPERIMENTAL

Cake Preparation and Storage

Yellow cake was made using blend of Carotino® shortening, Carotino margarine (red palm fat) and commercial margarine (Planta®) at ratio of 26:15:59, respectively. The control cake was prepared using

100% commercial margarine. The cakes were prepared by creaming the fat blends (100 g) and sugar (200 g) until light and fluffy. Two eggs were beaten and slowly added, the mixing bowl was scraped. The dry ingredients were sifted together (200 g flour, 7.5 g baking powder, 5 g vanilla and 2 g salt) and added alternatively with the milk (150 ml) into the mixture. The batters were baked for 50 min at 175°C. The cakes were cooled, packed in polypropylene film and stored in either refrigerator (7±3°C) or freezer (-18±3°C) and were analysed at weekly or monthly intervals for three weeks or three months, respectively.

Oil Extraction

The oil was extracted from the cakes as described in Bassiouny *et al*. (1990).

Peroxide Value (PV)

The PV was determined according to the AOCS method Cd 8b-90 (1989).

Free Fatty Acids (FFA)

FFA content was measured according to MPOB test method (2005).

Anisidine Value (AV)

The AV of the fat samples was measured as described in MPOB test method (2005).

Conjugated Diene

The fat solution from the AV was used to measure the conjugated diene according to MPOB test method (2005).

Vitamin E Content

The vitamin E content of the samples was measured according to the AOCS method C-8-89 (1989), by high performance liquid chromatography (HPLC) using a Hewlett Packard HP 1100 system with fluorescence detector (excitation 259 nm, emission 325 nm) with a YMC 150 x 6.0 mm column.

Statistical Analysis

Statistical analysis was carried out using SAS program. Mean values for the tested parameters were analysed using analysis of variance procedure followed by Duncan's multiple range test to determine significant differences.

RESULTS AND DISCUSSION

PV is the most widely used indicator of the fat oxidation, it measures lipid peroxide and hydroperoxides formed during the initial stages of oxidation and values are reported as milli-equivalent of peroxide per kg of fat (Hamilton and Kristein, 2003). Changes occurred in PV, FFA, AV and conjugated diene of cakes during refrigerator storage are given in *Figure 1*. Initially the formulated and control cake had high PV value. The PV of the formulated cake increased gradually from 4.65 meq kg^{-1} in week 0 to 5.95 meq kg^{-1} in week three. Meanwhile the control cake had high PV in week 0 and two, and start decreasing to 2.74 meq kg^{-1} by week three. This could be attributed to the breakdown of hydroperoxides to volatile and non-volatile compounds. As explained by Aidos *et al*. (2001) the PV increase with time to a maximum level after which it decomposes rapidly to secondary products leading to a subsequent decrease in the PV. The result indicated that the decomposition of peroxides in the control cake occur at higher rate than the formulated cake.

An increase in FFA value was observed in both cake samples. However, by week three the control sample had considerably higher FFA content than the formulated cake. Similar trend was noticed for the AV of the control cake that had higher AV throughout the storage period, except for week 0. This might be due to the formation of secondary oxidative products resulting from the breakdown of hydroperoxide (Lean and Mohamed, 1999). The conjugated diene increased with the progress of storage time until it reached it maximum at week three. However, the value decreased slightly for the control cake.

The vitamin E content of the fat extracted from the stored cakes is shown in *Figure 2*. The total tocopherol and tocotrienol contents were significantly higher in the formulated cake than the control cake and that was due to the higher amount of vitamin E in the red palm fat (Benade, 2001) compared to the commercial fat. The total vitamin E content of the formulated cake in the third week was higher than its amount in the control cake including the content at week zero. No significant differences were observed for tocopherol content during the second and third week of storage. In control cake, a significant reduction of tocopherols was observed only during the third week of refrigerated storage. Whereas, the tocotrienol content drops significantly in both cakes with progress of storage period.

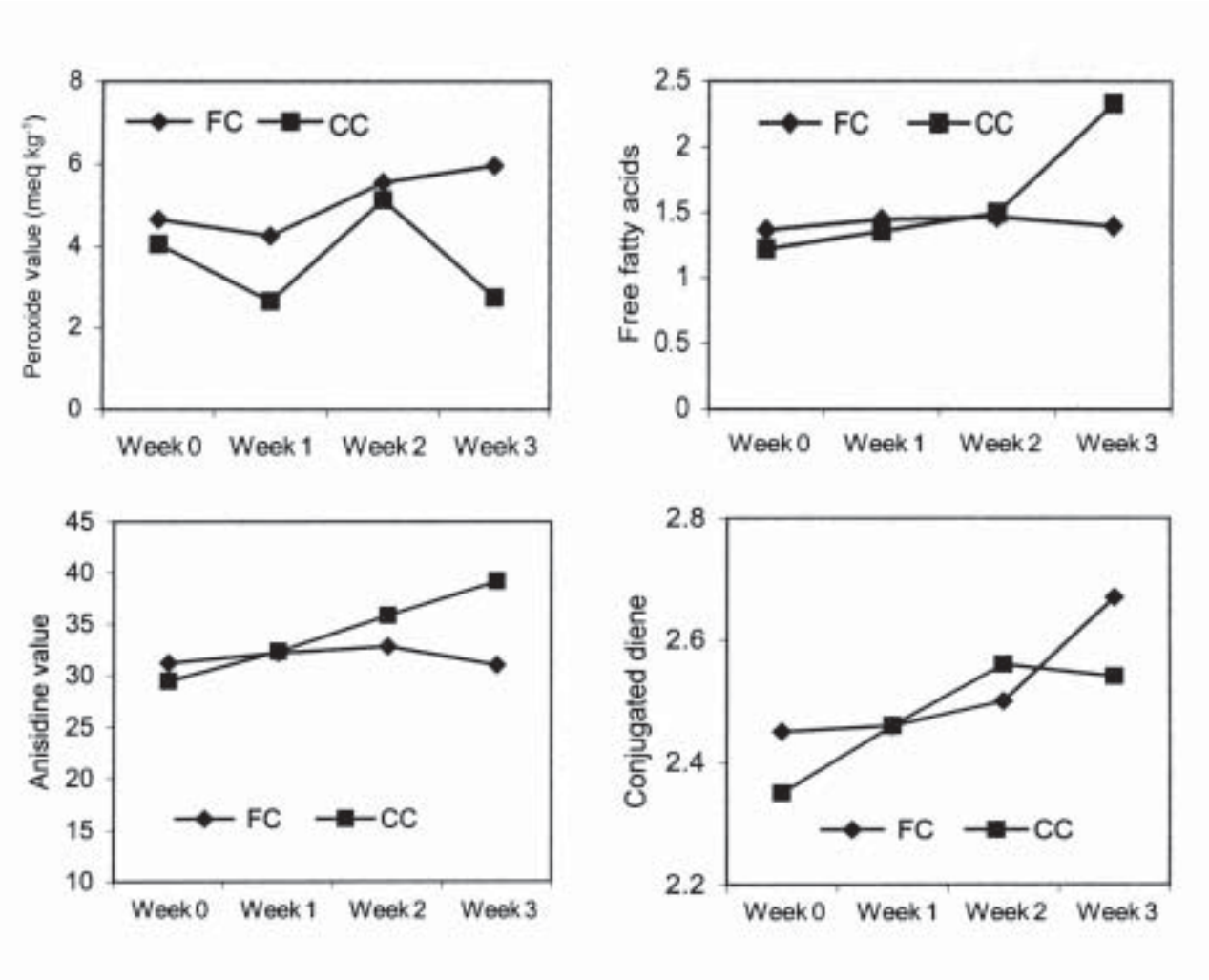

Figure 1. Peroxide value, free fatty acids, anisidine value and conjugated diene of the refrigerated yellow cake. FC- formulated cake, CC- control cake.

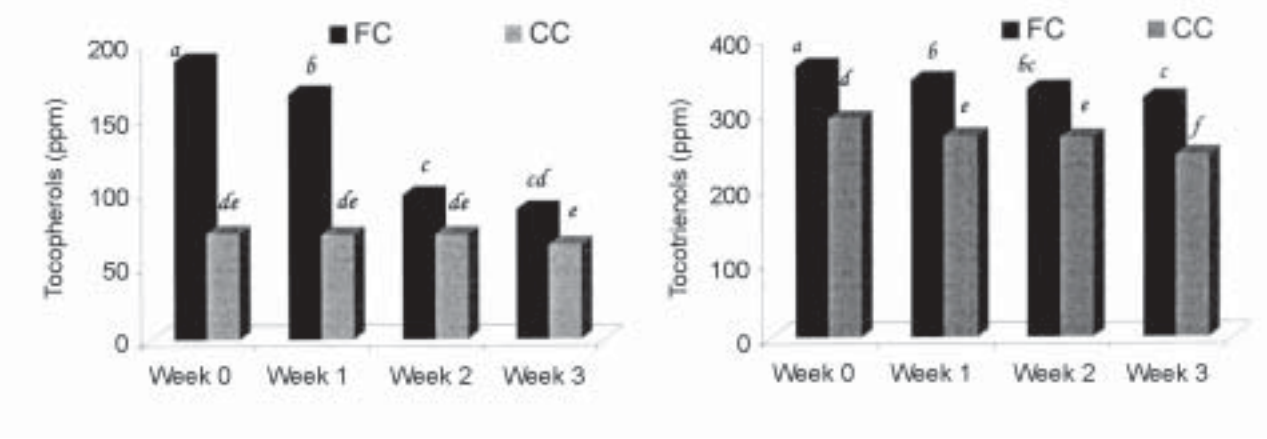

Figure 2. Vitamin E content of the refrigerated yellow cake. FC- formulated cake, CC- control cake.

The storage stability of frozen cake *(Figure 3)*, was similar to those stored in the refrigerator. PV of the formulated cake increased slightly up to three months of storage. However, for the control cake, the PV started to decrease at second month and thereafter. The hydroperoxides that quickly formed during the first month of storage were rapidly degraded to secondary products. This result indicated that the oxidation rate of control cake was higher than the formulated cake. The decline in PV with storage was noticed in butter cakes containing black pepper leaf extract (Lean and Mohamed, 1999). Chapman *et al*. (1996) reported a reduction in both PV and total oxidation, totox value, for cookies and crackers prepared using menhaden oil base shortening. The PV of all cakes were below the critical values given by Robards *et al*. (1988), who reported that edible oils with PV of 7.5 meq kg^{-1} were deemed unacceptable from sensory point of view.

The FFA of both cakes increased gradually until month three, except for the FFA of formulated cake that showed a slight decrease by the end of the storage period. The initial AV of control cake was high and increased gradually to 28.85 in month three. In contrast, the AV of formulated cake was significantly ($p<0.05$) low in week 0 and it increased rapidly during the first and second month, which indicates the rapid rate of secondary products formation. However the value declined at month three, which could be attributed to the formation of dimmers (Lean and Mohamed, 1999).

The conjugated diene of formulated frozen cake had similar behaviour with PV. However, in the third month the conjugated diene was slightly lower than the value in month two. As with the PV, the conjugated diene will reach a maximum during the progress of oxidation and decreases when the rate of decomposition of hydroperoxides exceeded the rate of their formation (Frankel, 2005). On the other hand, the conjugated diene of the control cake was fluctuating; the value was higher during the initial and first month and declined during the last two months of storage, which could be attributed to the decomposition of the primary oxidation products.

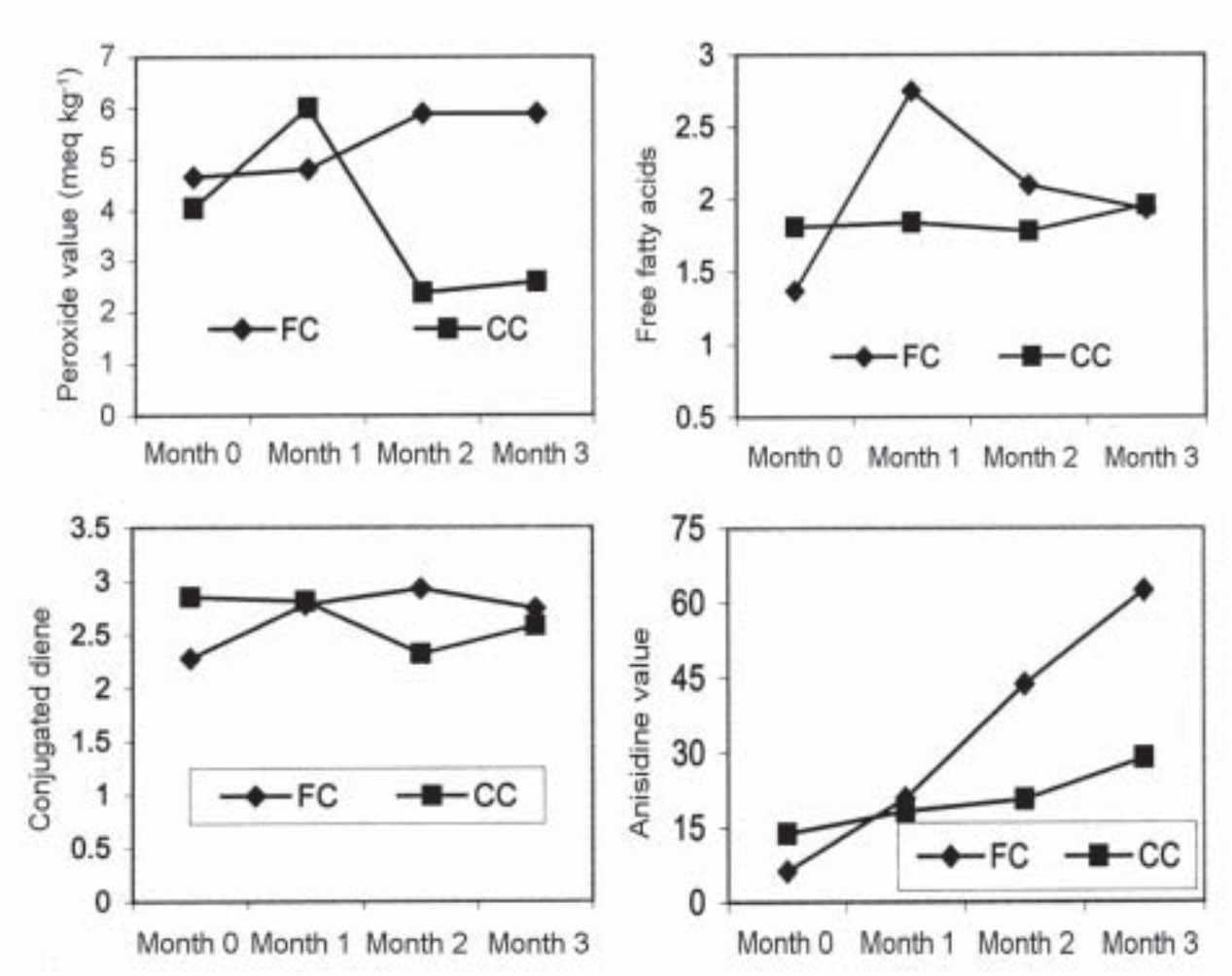

Figure 3. Peroxide value, free fatty acids, anisidine value and conjugated diene of frozen yellow cakes. FC- formulated cake, CC- control cake.

The pattern of tocopherol and tocotrienol found in frozen yellow cake were similar to those found in the refrigerated cakes. In all fat extracted form the cakes stored in the freezer, the tocopherols and tocotrienols were higher in the formulated cake, and the tocotrienols was higher than their corresponding tocopherols in both cakes *(Figure 4)*. The vitamin E content of formulated and control cakes decreased with frozen storage. Losses of vitamin E in control cake stored in refrigerator or freezer were 14% or 21%, while in the formulated cake the losses were 25.8% and 19%, respectively. For both type of storage, the amount of tocotrienols was higher than their corresponding tocopherol isomers.

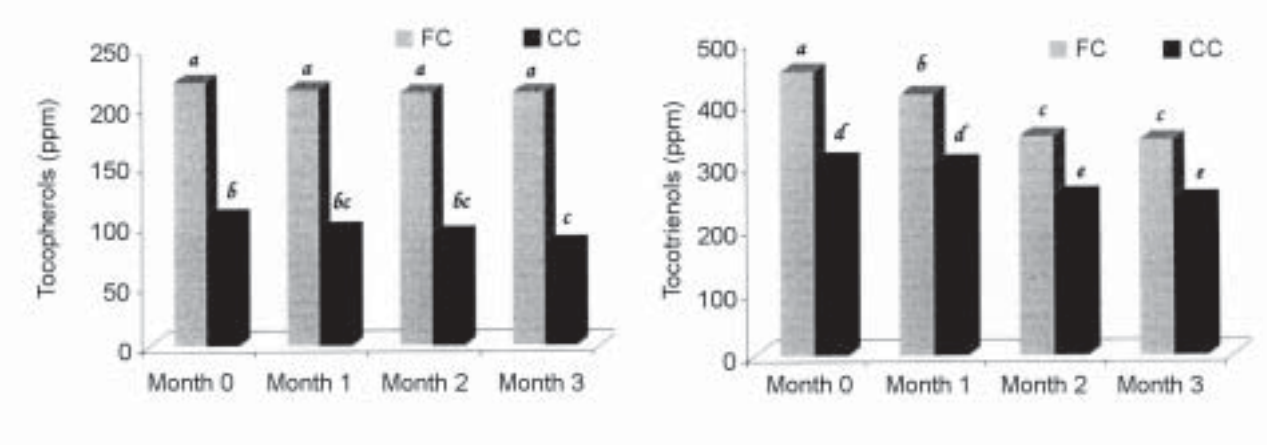

Figure 4. Vitamin E content of frozen yellow cakes. FC- formulated cake, CC- control cake.

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