EFFECT OF PACKAGING MATERIALS AND STORAGE PERIODS ON THE QUALITY OF YELLOW-FLESHED PLANTAIN FLOUR

Introduction

Plantains are highly perishable, with a substantial proportion of the harvested crop lost from the farm gate to the marketplace, because of poor handling, storage, and transportation of the fruits. Though work has been done on the utilization of plantain fruits for different food uses, losses may occur in peak production periods when farmers do not harvest the entire crop because of market saturation (Adeolu and Enesi, 2013). Unripe plantain finger is processed traditionally into flour. The flour is used for several traditional dishes ranging from *akara, ukpo ogede*, soups, baked products and may be reconstituted in boiled water to make *amala* which is eaten with any Nigerian soup (Onuoha et al., 2014).

However, deterioration of floury products is usually attributed to the moisture content of the product, and the water activity and relative humidity of the storage room, as well as the permeability of the packaging materials to air and moisture (Lawal et al., 2014; Adebowale et al., 2017). Awoyale et al. (2016) reported in their study that the oxygen transmission of polyethylene is 500 mm/100 cm^2 in 24 h and 25 °C, polypropylene 160 mm/100 cm^2 in 24 h and 25 °C and polyvinyl chloride between 8 to 160 mm/100 cm^2 in 24 h and 25 °C. The percentage water absorption of the packaging materials is rated as polypropylene > polyethylene > polyvinyl chloride. These researchers also added that the water vapour transmission of polyethylene is between 1-1.5 g/100 cm^2 in 24 h, polypropylene 0.25 g/100 cm^2 in 24 h and polyvinyl chloride 4-10 g/100 cm^2 in 24 h (Awoyale et al., 2016). Various studies have been reported on the effect of different packaging materials (high and low-density polyethylene bags, polypropylene woven sacks and container) and storage conditions on the quality attributes of floury products. For instance, Adebowale et al. (2017) reported that the best packaging material with less quality losses in the storage of water yam flour at 25 °C and 36% relative humidity for 24 weeks was the plastic container, attributed to its good barrier properties. Awoyale et al. (2020) also reported that packaging yam flour in polyvinyl chloride container may keep most of the sensory properties preferred by the consumers when stored for up to 4 months.

Unripe plantain flour is hygroscopic and gets spoilt if not correctly processed, packaged and stored, these changes that occurs during packaging and storing can affect the quality characteristics

especially the carotenoid content of the flour. Thus, the need to evaluate the effect of packaging materials and storage periods on the quality of yellow-fleshed plantain flour.

Materials and Methods

Mature unripe plantain (Musa paradisiaca) bunches of PITA-17 and *agbagba* (Plate 1) varieties were obtained from the banana breeding unit of IITA, Ibadan, Oyo State, Nigeria. The packaging materials: polypropylene woven sacks (PPS), polyethylene nylon bag (PEN) and polyvinyl chloride container (PVC) were purchased from a local market (Aleshinloye) in Ibadan, Oyo State, Nigeria.

Plate 1. *Agbagba* plantain variety

Fresh bunches of green, physiologically mature plantain were cleaned and washed properly with clean water to remove adhering sand particles and dirt, after which they were peeled, and sliced (1mm) (Plate 2) (Kure et al., 1999). The slices were spread in a single layer on drying trays and dried at 65 °C for 48 h in a cabinet dryer (Akin-Idowu et al., 2011). Dried plantain slices were milled into flour using a hammer mill of 250 μm sieve size.

Plate 2. Sliced plantain chips

The processed plantain flours were aseptically weighed (200g/pack) into PEN sealed with an electric sealer, PPS sealed with a stitching machine and PVC covered with a lid. The packaged samples were kept in a cupboard at room temperature (28-30 °C) for 24 weeks and monitored for functional, pasting, and chemical properties including the total carotenoid content of the plantain flour, at every four weeks until the end of the 24 weeks of storage. The functional, pasting, and chemical properties as well as the total carotenoid content of the stored flour was analyzed using standard methods.

Achievements

The study showed that the packaging materials had significant effect on the chemical compositions including the total carotenoid content and pasting properties (except peak time) but with no significant effect on functional properties (except bulk density and dispersibility) of the stored unripe plantain flours. There was also significant effect of storage periods on chemical compositions including the total carotenoid content, pasting (except for peak time and pasting

temperature) and functional properties of the plantain flours. Varietal effect was observed in chemical compositions including the total carotenoid content and pasting properties (except peak viscosity and pasting temperature). Among the functional properties, it was only the bulk density, swelling power and water absorption capacity of the stored unripe plantain flour that were affected by the varieties. It is very important to add that the PEN retain more of the carotenoid at the 3 months of storage for both varieties, while the PPS retain more of the carotenoid at the 6 months of storage for both varieties.

This study is also part of an M.Sc. graduate research work titled 'Effect of different packaging materials and storage periods on the quality characteristics of plantain flour from two varieties of plantain, and the texture attributes of their dough (*amala*)' by Atobatele Oluwaseun Blessing from the Department of Food Technology, University of Ibadan, Oyo state, Nigeria, funded by the RTB project.

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