STUDIES ON THE FUNCTIONAL AND BIOCHEMICAL PROPERTIES OF *KARIYA* SEED DEFATTED FLOUR AND STORAGE STABILITY STUDIES OF ITS OIL

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ABSTRACT

This study determined the physicochemical properties and storage stability of kariya oil, functional properties and *in-vitro* protein digestibility of the fermented and un-fermented kariya flours. It also evaluated the effect of processing on anti-nutrients and antioxidant properties of kariya seed flour with a view to increasing the utilization of kariya seed.

A portion of dried kariya pods obtained from ornamental kariya trees in Obafemi Awolowo University, Ile-Ife were sorted, shelled and some were allowed to ferment naturally for 96 hr. Samples were taken for analysis at 24 hr interval, milled and defatted (solvent cold extraction). Crude oil was extracted from another portion using soxhlet extraction method. Part of the extracted oil was refined by degumming, neutralization and bleaching. Portions of crude and refined oil were stored at ambient and refrigeration temperature (5 °C) with or without added butylatedhydroxyltoluene (BHT) for 90 days. Samples were taken at 15 days interval for analysis. Physicochemical (pH, bulk density), functional [water, swelling and oil absorption capacities (WAC, SC and OAC)], least gelling concentration (LGC), foam capacity and stability (FC and FS), emulsifying activity and emulsion stability index (EAI and ESI)], anti-nutrients (oxalate, saponin and tannin), *in-vitro* protein digestibility (IVPD) and antioxidant activitiy were evaluated using standard procedures. Data obtained were analysed using descriptive and inferential statistics.

The physicochemical result showed that all the samples were acidic in aqueous solution, the bulk density ranged between 0.53 g/ml for raw fermented kariya (RFK) to 0.59 g/ml for both cooked unfermented and raw unfermented kariya (CUK and RUK). Cooked fermented kariya (CFK) and RFK had the lowest and highest WAC (106.63, 137.47%) respectively, sample RFK and CUK had the lowest and highest OAC (47.73, 84.50%). The foam capacities for samples CFK, CUK, RFK and RUK, and were 14.29, 20.00, 26.32 and 33.33% respectively while the emulsifying activity index for samples RUK, CUK, CFK and RFK were 8.75, 24.19, 24.95 and 29.79 m^2/g, respectively. All the processing treatment were found to increase the *in-vitro* protein digestibility and reduced the anti-nutrient level in the kariya seed. The kariya seed extracts exhibited high DPPH (2,2-diphenyl-2-picrylhydrazyl hydrate) radical scavenging activity (RFK, IC_{50} 2.68 mg extract/ml; RUK, IC_{50} 3.37 mg extract/ml; CUK, IC_{50} 2.82 mg extract/ml; CFK, IC_{50} 2.69 mg extract/ml), metal chelating (RFK, IC_{50} 1.13 mg extract/ml; RUK, IC_{50} 0.69 mg extract/ml; CUK, IC_{50} 0.39 mg extract/ml; CFK, IC_{50} 1.31 mg extract/ml), ferric reducing antioxidant power (RFK, 0.28 (AAE μg/g); RUK; 0.26 AAE μg/g; CUK; 0.09 AAE μg/g; CFK; 0.56 AAE μg/g), total phenol content (RFK, 1.21 (GAE μg/g); RUK, 0.47 GAE μg/g; CUK, 0.60 GAE μg/g; CFK, 0.90 GAE μg/g). The primary oxidation products formed were very low, but rose significantly as the storage period increased. Refractive index remained almost constant while other physical and chemical properties of the oils such as peroxide value and acid value increased wth an increase in the storage period

In conclusion, kariya seed flour could find application as food ingredients in the manufacture of confectionary foods owing to its high water absorption capacity and swelling capacity. The kariya extracts could be employed as natural antioxidant and the oil could be suitable for domestic and industrial applications.

Keywords: kariya oil, *in-vitro* protein, kariya pods, kariya trees, kariya seed, Obafemi Awolowo University

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A number of oil seeds have been characterised but the vast majority have not been adequately evaluated. This is also particularly valid for the Nigerian flora which has one of the most extensive floras in the continental of Africa (Oderinde and Ajayi, 1998). There has been a focus on non conventional oil seeds for possible development and use (Obasi and Okolie, 1993). *Hildegardia barteri* (Kariya) falls into this group of underutilized species of plants.

Kariya (*Hildegardia barteri)* is primarily an ornamental tree in West Africa that grows from the Ivory Coast to Nigeria and is called the Krobo Christmas tree (Irvine, 1961), grown only for its bright beautiful flowers which blossom during the dry season. The flowers, which are usually borne on leafless branches, mature into one-seeded pods (Hildergadia Notes, 2009), which was about 50 mm in length, bearing a peanut-like seed in a nutshell. The mature pods drop completely when dry and are disposed as refuse in many places, only in few parts of West Africa the kernels are eaten raw or roasted like peanuts and have a flavour resembling peanuts (Inglett *et al.*, 1973), or used as condiments in traditional food preparations.

The proximate analysis showed that kariya kernels contain 17.5, 37.5, 2.8 and 6.5% of crude protein, crude fat, ash and crude fibre, respectively (Ogunsina *et al*., 2011). The fatty acid profile of kariya oil shows that it has 77% of saturated fatty acids and 23% of unsaturated fatty acids. The fat contains an almost equal amount of myristic, palmitic, stearic and linolenic acids, which is quite uncommon among oil seeds. Palmitic acid was the major fatty acid which was up to 29.4 %, while stearic, myristic and linolenic acids were 23.8, 23.3, and 21.5%, respectively. It also contains small amount of linoleic acid (1.43%) and trace amounts of lauric (0.6%) and oleic (0.03%) acids. During storage time, oil compositions can be influenced by several storage conditions. Fatty acid composition is the most important factor which determines oils susceptibility to oxidation. The types of fatty acids present in an oil, and in particular their degree of unsaturation, determine the type and extent of chemical reactions that will occur during storage (Morello *et al*., 2004). The unsaturated fatty acids are more succeptible to lipid oxidation on saturated fatty acids. Unsaturated fatty acids, though desired from nutritional point of view, adversely affect sensory quality of product due to oxidation (Offord *et al*, 1997).

Fermentation is one of the oldest technologies used for food preservation. Many benefits are attributed to fermentation. It preserves and enriches food, improves digestibility and enhances the taste and flavor of foods. Fermentation has been reported to improve nutritional quality, structural properties, shelf–life, and also observed to reduce antinutrients present in plant foods (Chavan and Kadam (1989), Hudson (1991), Reddy and Pierson (1994), and Steinkraus (1994)). In the Orient, fermented plant foods include soy sauce/soy paste, 'tempeh', 'sufu' and 'natto' (Hudson, 1991). In West Africa, Nigeria in particular, locust bean (*Parkia biglobosa*) is fermented into 'dawadawa' (in Hausa) or 'iru' (in Yoruba). 'Dawadawa' or 'iru' is a high protein supplement, traditionally added to soups or stews as a taste enhancer. The average per capital intake of 'dawadawa' among some Hausas in the Northern Nigeria constitutes 1.4% of the daily calories intake and 5% of the total protein intake