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Use of Seed Sprouting in Modification of Food Nutrients and Pasting Profile of Tropical Legume Flours

Owuamanam Clifford, Ogueke Chika, Iwouno Jude, and Edom Tochi

ABSTRACT

The study investigates the effect of seed sprouting on minerals, anti nutrients and pasting characteristics of flours produced from some tropical legume seeds. Samples were collected from cowpea (*Vigna ungulculata*); red kidney beans (*Phaseolus vulgaris*); and Pigeon pea (*Cajanus cajan*) and each sample was divided into two portions. A portion was sprouted while the other portion served as the control. The flours from sprouted and non-sprouted seeds were analyzed for the minerals, anti nutritional and pasting properties. The samples were found to differ significantly ($p < 0.05$) in the minerals, anti nutritional composition and pasting properties of the flours. Sprouting increased the mineral contents of the flours generally the calcium content of non-sprouted red kidney beans (13.8 mg/100 g) increased to 16.1 mg/100 g in the sprouted flour. The haemagglutinin decreased from 40.6 HU/mg in non sprouted red kidney to 6.4 HU/mg in the sprouted. The final viscosity of the non sprouted flours were higher than those of the sprouted, with non sprouted cowpea scoring the highest, 272 RVU, while sprouted red kidney beans had the least, 109.06 RVU, which implies that sprouting caused a reduction in the gel strength and elasticity of the samples. Seed sprouting effectively increased the mineral nutrients and lowered the anti nutrients, but produced steamed paste with poor gel strength.

Keywords: Legume seeds, seed sprouting, calcium, haemaglutenin, final viscosity.

Introduction

Seed sprouting is a veritable processing method used to manipulate the nutritional composition of plant seeds. The technology of sprouting or malting has been employed over many decades in beer making industry in order to modify nutritional and functional composition of cereal grains, and essentially enhance the activity of endogenous enzymes of cereals for food beverage and beer making purpose (Hough, 1996).

Sprouting of legume seeds is also not a new technology (Akpapunam *et al.*, 1996; Mahando, 2004; Harper *et al.*, 2008). According to Srilakshmi (2008), seed sprouting of legumes improves the protein and other nutritional contents and also reduces the anti-nutritional composition. Seed sprouting of legumes is however not popular in tropical Africa where it is needed most in order to enhance the nutrition, as most proteins for humans nutrition are derived from plant materials since animal protein sources are exorbitantly sold at price the poor cannot afford.

Legumes provide essential nutrients and protein with moderate energy and dietary fibre (FAO, 1988). However legumes contain anti nutritional factors such as protease inhibitors, amylase inhibitors, such as haemaglutenins, saponins, goitrogens, cyanogenic

Department of Food Science and Technology, Federal University of Technology PMB 1526, Owerri, Nigeria.
corresponding author: icliffowums@yahoo.com

glucosides, anti vitamin factors, flatulence factors, metal-binding constituents, oestrogen factors, toxic amino acids, urea, lathyrinogens, these exert deleterious effects to humans (Bradbury, 1991; Enwere, 1998). Some other limitations to utilization of legumes in developing countries include: hard-to-cook phenomenon; poor digestibility of proteins, which is attributed to storage proteins like phaseolin; and abdominal gas distension and belching, linked to presence of sugars like stachyose, raffinose, verbascose (Ihekoronye and Ngoddy). Also the sensory acceptability of legumes is limited by the beany off-flavour and odour, principally caused by lipoxygenase in ground seeds exposed to moisture level and temperature threshold for activation of the enzyme (Yarnell, 2004).

Several traditional processing methods have been employed in developing countries to mitigate these nutritional short falls of legumes, which include; soaking in water for varying time, combined soaking and dehulling, these however are not efficient in removing anti-nutrients (Sookle *et al*., 2004; Jerry and Warren, 2005). Seed sprouting of legumes, however appears more promising in removing these plant anti nutrients and at the same time, enriching the food (Akpapunam *et al*., 1996; Srilakshmi, 2008).

In tropical Africa, legumes are consumed as staple food and are prepared in a variety of ways such as boiling for prolong time and consuming the cooked beans with oil or sauce; soaking, dehulling and grinding the seeds to make pasty slurry and thereafter deep-fat-frying the paste to make *akara* balls or the slurry steamed into a cooked paste (*moin moin*) (Ihekoronye and Ngoddy, 1985; Olapade *et al*., 2005).

Olapade *et al*. (2002) reported the drudgery and labour intensive method used in traditional preparation of cowpea for *akara* and *moin moin*, and advocated for processing of the seed into flour or rather a premix; so that working class people can conveniently prepare them. Premix for *akara* and *moin moin* are now sold in markets in Nigeria and elsewhere in Africa.

The technology of seed sprouting has not been used in the preparation of premix for *akara* or *moin moin*, irrespective of obvious advantages of seed sprouting in enhancing nutritional value of legumes.

This study is designed to evaluate the mineral, anti-nutritional reduction and pasting characteristics of flours produced from sprouted and none sprouted common legumes that are consumed in tropical Africa. The study also seeks to explore use of other legumes other than cowpea in production of flour for *akara* balls and *moin moin* premixes by comparing their pasting properties.

Materials and Methods

Sources of raw materials

The dried legume seeds used in this study were cowpea (*Vigna ungulculata*), red kidney beans (*Phaseolus vulgaris*), and Pigeon pea (*Cajanus cajan*). These were purchased from Ekeonunwa market in Owerri, Nigeria.

Sample preparation

The legume seeds were subjected to cleaning and sorting and subsequently divided into two equal portions of NSPP approximately ten (10) kilograms. A portion was soaked in water at the ratio of 1:4 (seeds:water). The soaking lasted for 12 h during which the soak water was drained off every 3 h and were air rested for an hour. At the end of soaking the bean seeds were spread thinly on a moist jute bag under ambient conditions to allow sprouting to take place. However germination was stopped when the length of the rootlets measured up to 2.54 cm. At the end of germination, the bean sprouts were dried in a (air-oven) (model, DHG-9109 by Life Care Medical Ltd) dryer at an initial temperature of 60^{0}C for about 2 h and the drying was terminated when the moisture content of the cotyledon came to approximately 10%. Thereafter the rootlets and the hull were removed and the dried cotyledon milled into flour. The flour was sealed in moisture/air tight containers.