

Full Length Research Paper

Increment on the Quality Protein fraction of Cooked *Voandzeia subterranean* (*hypogea*) Seed Flour Paste Meal by Added Soya beans (*Glycean max*) and cow pea (*Vigna unguinata*) Portions

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Homogenization of *Voandzeia subterranean* bean seed flour in water with coconut or soya bean oils yielded an emulsion (milk) containing 20g protein and 30ml oil per liter whose stability was maintained after pasteurization. Curds similar to those prepared from soya beans were prepared from *Voandzeia subterranean* milk. This study investigated the effect of addition of soya bean and cow pea (*Vigna unguiculata*) fractions to *Voandzeia subterranean* (*Voandzeia hypogea*) bean seed flour on the nature of cooked *Voandzeia subterranean* (*hypogea*) bean seed flour paste meal fractions. The cooked meal fractions of *Voandzeia subterranean* bean seed flour paste prepared with palm oil and warm (65-70°C) water (*Okpa meal*) were compared with the cooked meal fractions of a liquid (suspension) flour paste prepared from a mixture of *Voandzeia subterranean* bean flour (50%), Soya bean flour (16.66%) and cow pea (*Vigna unguiculata*) bean seed flour (33.33%) with palm oil and warm water of 65-70°C. The *Voandzeia hypogea* seed flour gelatinized through the action of the heat of the paste forming water and the action of the dilute acid formed between sodium chloride (salt) and water to produce dextrans, maltose and glucose which formed glycolipides with the palm oil mixed into the flour. These glycolipides interacted with the components of the *Voandzeia hypogea* seed flour lecithin to form a 98-100% homogenous solid glycoprotein cooked meal and a 0-2% "meaty" or scrambled egg-like protein (milk curd-like) fraction. The flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans, cow pea (*Vigna unguiculata*) seed flours, palm oil and warm water of 65-70°C similarly produced a cooked paste meal composed of a white gelatinous fraction (15%); a soft yellow cooked egg-yolk-like glycoprotein fraction (5-40%) and a "meaty" or scrambled egg-like protein (milk curd-like) fraction (45-80%). From these results, it is concluded that addition of 33.33% *Vigna unguiculata* bean seed flour and 16.66% soya bean flour to *Voandzeia subterranean* bean seed flour decreased the egg yolk-like glycoprotein fraction of the cooked flour paste from 98% or 100% to 40-20% and increased the "meaty" or scrambled egg-like protein fraction from 0%- 2% to 45-80%. These results suggest that addition of *Vigna unguiculata* and soya beans seed flours to *Voandzeia hypogea* seed flour in the presence of vegetable oil and warm-hot water produced 45%-80% cooked milk curd-like protein fractions of *Voandzeia hypogea* seed paste meals that are suitable for the feeding of infants, the sick and the elderly.

Keywords: *Voandzeia hypogea*, protein increment, subterranean, soya beans cow pea, *Vigna unguiculata*, *Glycean max*

INTRODUCTION

Voandzeia subterranean (L) Thouars (*Voandzeia hypogea*), bean seed is eaten as a major source of vegetable protein in West Africa especially in Central and Eastern Nigeria. It is eaten as a roasted seed snack, as a cooked seed snack, as a cooked seed porridge meal or as a cooked seed flour paste meal (Pusztai A 1989; Akinyele IO and Akinlosotu A 1987; Jaffe WG 1980; Barimalaa et al., 2004).

A number of seeds of tropical plants which supported moderate growth were found to contain only low levels of essentially non-toxic lectin and to have great potential as dietary protein sources. These seeds included *Abelmoshus esculentus*; *chenopodium quinoa*; *Phaseolus calcaratus*; *Phaseolus lathyroides*; *Parkia biglandulosa*; *Papaver somniferum*; *Sesania Arabica*; *Terminalia catappa*; *Vigna sinensis* and *Vaandzeia subterranea* Thouars seeds (ward et al. 1991). Cowpeas were found to constitute 30.2 and 30.3% of the protein intake of reactor and non-reactor children of 30 months-3 years of age; in a mixed diet (Barimalaa et al., 2004) in a study designed to determine the contribution of cowpea to the total nutrient intake of residents of rural areas of Ibadan, Nigeria (Akinyele IO and Akinlosotu A 1987).

Lectins are factors which are considered as anti-nutritional or toxic and need to be removed or inactivated by extensive washing and heat-treatment of seeds which contain them (or their flour paste) prior to their utilization in a diet (Jaffe WG 1980; Grant et al., 1982; (Nigel HP (1980; ward et al. 1991). Despite the fact that the lectin in *Vigna sinensis* and *Vaandzeia subterranea* Thouars (*Voandzeia hypogea*), was low levels of essentially non-toxic lectin the flour pastes used in this study were subjected to heat treatment. This study investigated the differences between the fractions of the seed flour pastes of *Voandzeia subterranean* bean seed flour paste prepared with warm (65-70°C) water (*Okpa meal*)⁵ and the cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours prepared with the same warm water of 65-70°C.

MATERIALS AND METHODS

De-hulled *Voandzeia subterranea* bean seeds were milled into very fine flour. This *Voandzeia subterranean* seed flour was mixed with pure grade one red palm oil in the ratio of 10 (flour) : 1 (palm oil) in a mixing bowl until all the oil was mixed into the flour until the flour was changed to yellowish colour.

The palm oil mixed- flour was made into a watery suspension with warm water of 65-70°C, salted to taste, measured into white cellophane bags and tied up. These small bags were put into boiling water in an aluminum cooking pot on the fire and left to cook for 25-35minutes.

The cooked meal fractions of *Voandzeia subterranean* bean seed flour paste prepared with warm (65-70°C) water (*Okpa meal*) were compared with the cooked meal fractions of a flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans, *Vigna unguiculata* seed flours in the ratio of 6: 2: 1 was made into a watery paste with warm water of 65-70°C after it had been mixed with one tenth of its volume of first grade palm oil.

The palm oil mixed- *Voandzeia subterranean*/ *Vigna unguiculata* /soyabean flour was made into a watery suspension with warm water of 65-70°C. This mixture was made to be tasty with sodium chloride and tied in white cellophane bags and cooked in boiling water in an aluminum cooking pot for 25-35minutes.

RESULTS

The cooked meal fractions of *Voandzeia subterranean* bean seed flour paste prepared from *Voandzeia subterranean* bean seed flour mixed with palm oil and warm water of 65-70°C produced a cooked *Okpa meal* which consisted of a 98%-100% homogenous yellow cooked egg yolk –like glycoprotein meal fraction and sometimes a 0-2% “meaty” or scrambled egg-like (milk curd-like) protein fraction as well (figure 1). Both fractions were semi-solid when hot and set on cooling.

The cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours on the one hand and warm water of 65-70°C on the other; produced a cooked paste meal composed of a white gelatinous fraction (15%); a soft yellow cooked egg-yolk-like glycoprotein fraction (5-40%) and a watery “meaty” or scrambled egg-like (milk curd-like) protein fraction (45-80%) (figure 2 [a].

Increasing the temperature of the paste mixing water, increased the proportion of the milk-curd-like fraction to percentages above 90% (figure 2 [b] and figure 2 [c] of cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours.

DISCUSSIONS

Heat from the 65-70°C water with which the *Voandzeia subterranean* seed flour or the mixture of *Voandzeia subterranean*, *Vigna unguiculata* and soya beans seed flours was made into a paste, caused the breakage of the α -1-4 and α -6-4 glucosidic bonds of the carbohydrate portion (Arubi PA 1999) of these flours and gelatinized them partially or totally into dextrans, maltose and glucose. Dilute hydrochloric acid formed by the



Figure 1. The cooked meal fractions of *Voandzeia subterranean* bean seed flour paste prepared from *Voandzeia subterranean* bean seed flour mixed with palm oil and warm water of 65-70°C produced a cooked *Okpa meal* which consisted of 100% homogenous yellow cooked egg yolk-like glycoprotein meal.



Figure 2[a] The cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours and palm oil in warm water of 65-70°C produced a cooked paste meal composed of a white gelatinous fraction (15%); a soft yellow cooked egg-yolk-like glycoprotein fraction (5-40%) and a watery "meaty" or scrambled egg-like protein (curd) fraction of 45%-85%.



Figure 2[b] The cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours and palm oil mixed in warm water a little hotter than 65-70°C produced a cooked paste meal composed of a white gelatinous fraction (15%); a soft yellow cooked egg-yolk-like glycoprotein fraction (5-20%) and a watery "meaty" or scrambled egg-like protein (curd) fraction of 55-90%.



Figure 2[c): The cooked meal fractions of the flour paste prepared from a mixture of *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours and palm oil mixed in warm water of 80-90°C produced a cooked paste meal composed of a white gelatinous fraction (15%); a soft yellow cooked egg-yolk-like glycoprotein fraction (5-40%) and a watery “meaty” or scrambled egg-like protein (curd) fraction of 85-95%.

interaction of sodium chloride (salt) and water also gelatinized the starch of the flours of Heat from of *Voandzeia subterranean*, *Vigna siensis* and soya beans seed flours into dextrans, maltose and glucose in the presence of heat. The dextrans, maltose and glucose thus formed interacted with the palm oil mixed into these flours to form glycolipids. It was the interaction between the glycolipids formed from the *Voandzeia subterranean* seed flour or the mixture of *Voandzeia subterranean*, *Vigna unguiculata* and soya beans seed flours and the lecithin of *Voandzeia subterranean*, *Vigna unguiculata* and soya beans seed flours that formed the mixed *Voandzeia subterranean* bean, Soya beans and *Vigna unguiculata* seed flours cooked paste meal fractions of 15% white gelatinous fraction; 5%-40% cooked egg-yolk-like glycoprotein fraction and the 45%-80% watery “meaty” or scrambled egg-like (milk curd-like) protein fraction (Nigel HP and John CC 1980; Silvano P 2002; Utoh-Nedosa UA 2011) or the 98%-100% egg-yolk-like fraction and the 0%- 2% watery “meaty” or scrambled egg-like (milk curd-like) protein fractions produced by *Voandzeia subterranean* bean flour paste.

Since curds (Nigel HP and John CC 1980) similar to those prepared from soya beans were prepared from *Voandzeia subterranean* milk produced by homogenization of *Voandzeia subterranean* bean seed flour in water with coconut or soya bean oils that contained 20g protein and 30ml oil per liter, this study has shown that addition of *Vigna unguiculata* and Soya bean flour fractions to *Voandzeia subterranean* seed flour enhanced the curd produced by cooked *Voandzeia*

subterranean seed flour paste from 0% or 2% to 45%-80%.

CONCLUSIONS

From the findings of this study, we conclude that addition of 33.33% *Vigna unguiculata* and 16.66% Soya bean flour fractions to *Voandzeia subterranean* seed flour enhanced the curd and thus the protein fractions produced by cooked *Voandzeia subterranean* seed flour paste from 0% or 2% to 45% to 80%. These 80% milk curd-like proteins produced by the addition of *Vigna unguiculata* and soya beans seed flours to *Voandzeia hypogeal* seed flour in the presence of vegetable oil and warm-hot water produced cooked seed paste meals are suitable for the feeding of infants, the sick and the elderly.

REFERENCES

- Akinyele IO, Akinlosotu A (1987). Contribution of Cowpea *Vigna unguiculata* in a mixed diet to the nutritional intake of rural children in Ibadan, Br J. of Nutrition, 58(1): 31-9.
- Arubi PA (1999). Production and Organoleptic Assesment of Akara From Bambara ground nut (*Voandzeia subterranean* (L), Thouars, Plant Foods for Human Nutrition, Volume 53(4): 313-320
- Barimalaa IS, Agoha G, Oboh AC, Klin K (2004). Studies on Bambara Groundnut Flour Performance in Okpa Preparation, Journal of the Science of food and Agriculture, Vol. 85(3): 413-417
DOI 10.1023/A:1008005119326
- Grant G, More LJ, Mckenzie NH, Pusztai A (1982). Effect of Heating on the haemagglutinating activity and nutritional properties of bean (*Phaseolus vulgaris*) seeds. J. of Science of Food and Agric. 33: 1324-1326
- Grant G, More LJ, McKenzie, Dorward PM, Stewart JC, TeleK L,

- Pusztai A (1991). A Survey of the nutritional and haemagglutination properties of several tropical seeds, *Livestock for rural Development*, Volume 3, <http://www.cipav.org.co/lrrd/lrrd3/3/tropap.htm>
<http://www.springerlink.com/cintent/jx7w61625222x673>
<http://www3.interscience.wiley.com/journal/113323583/abstract>. DOI 10.1002/jsfa.2740311106
- Jaffe WG (1980). *Haemagglutinins: Toxic Constituents of Plant Foodstuffs*, Liener I E. (Ed), Academic Press, New York.
- Nigel HP (1980). Properties of some protein fractions from bambara groundnut [*Voandzeia subterranean* (L.), Thouars] <http://www3.interscience.wiley.com/journal/113442148/abstract>. DOI 10.1002/jsfa.2740320108
- Nigel HP, John CC (1980). Milk Processing and rehydration characteristics of bambara groundnut [*Voandzeia subterranean* (L.), Thouars], *Journal of the Science of Food and Agriculture*
- Pusztai A (1989). Biological effects of dietary lectins: Recent Advances in Anti-nutritional factors in Legume Seeds, Huisman J, van der Poel TFB. & Liener IE. (Eds), Pudoc., Wageningen, The Netherlands.
- Silvano P (2002). Dry extract rich in isoflavonoids and process of preparation: European patent application EP1174144 FPO. <http://www.freepatentsonline.com>
- Utoh-Nedosa UA (2011). Skin firming, Skin Smoothing and Skin blemishes elimination and anti-aging effects of increased protein intake in the form of *Voandzeia hypogea* seed meal, *American Journal of Agriculture and Biological Sciences*, 6(4): 549-552