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CHEMICAL COMPOSITIONS OF ARIL CAP OF AFRICAN OAK (AFZELIA AFRICANA) SEED

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ABSTRACT: *African oak is one of the underutilized legumes in Nigeria. Information on various parts of this legume is required to enhance its utilization in foods and food products. Feeding of fowls with the flour made from the aril cap of the seed showed no harmful effect on them. The flour was then analyzed for chemical properties. Proximate analysis showed that the cap was appreciable in protein (5.69%), fat (18.5%), carbohydrates (63.91%), and fibre (5.4%) but low in ash (1.5%). The value of each of the anti – nutrients analyzed was below the lethal level. Although the cap was found to be low in ash content, it had appreciable amounts of some essential elements. These are sodium (7.10±1.00), potassium (148.0±0.10), calcium (7.02±0.00), magnesium (109.12±1.02 ppm), phosphorus (11.20±1.10 ppm), and iron (0.25±0.02mg/g).The vitamin components of the cap determined were A (234.7±0.00µg/g), C (4.0±1.00mg/100g), E (1.1±0.02mg/100g) and the B – vitamins; B_1, B_2, B_6 and B_{12} (2.0±1.01, 33.0±0.11, 4.3±1.00 and 4.8±0.10)mg/100g, showing good amounts of the vitamins. Due to high proximate, vitamins, minerals and insignificant anti – nutrient compositions of the aril cap of the African oak seed, it could be used in both human and animal foods. There is therefore a need for food industries and feed formulators to utilize the cap.*

KEYWORD: African Oak, Proximate, Anti – Nutrients, Vitamins, Minerals.

INTRODUCTION

African oak (Afzelia africana) is a wild plant which belongs to the family leguminoceae and ceasalpinoceae sub family (Enwere, 1998). The pod contains about 6 – 12 elliptical, long shaped glossy black seeds with cap like waxy orange aril which are released, if not harvested, by explosive mechanism. Legumes are important ingredients in human diet in many parts of the world due to their high protein and starch contents (Czuchajowska*et al;* 1998). It has been reported that the seed is high in proximate composition, containing about 27.04% proteins, 31.71% crude fat, 3.27% ash, 33.09% total carbohydrates and 5.28% moisture (Enwere, 1998, Onweluzo, 1991 and Purseglove, 1991).

The thick walled pod, green when immature but black when matured is used in making local soap while the foliage which is proteinuous provides nutrition to animals and when fermented is used as food by humans. Burkill (1985) reported that African oak is medicinal for various ailments. The bark as well as the foliage in combination with some other herbs is used as pain killer – stomach troubles, arthritis / rheumatism as well as laxative. Acceptable biscuit from blends of *A. africana* and wheat flours has been reported (Onweluzo and Morakinyo, 1997). Flour obtained from the seed is mainly used in Nigeria for thickening of soup.

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During processing of the seed to flour, the cap like aril is either burnt or discarded along with glossy black seed coat. It was observed that when discarded, the orange aril caps attract chickens that pick them up from the black seed coat. The observation called for the investigation into the nutrient composition of the cap. This would lead to understanding of the suitability of the cap in both human food and animal feeds.

Food safety is a concern of all. A proper understanding of the proximate, anti - nutrient, vitamins and mineral compositions of the aril cap of the seed might lower its wastage during processing of the seed. There is paucity of literature on the nutrient and the anti – nutrient composition of this part of the seed. This study is therefore worthwhile in unraveling the potentials of the cap in food and food products as well as animal feed.
The result of this study will provide information to nutritionists, health care officers, industrialists etc on both industrial raw material and local consumption of the cap. The aim of this study therefore is to contribute to the limited information on the composition of the aril cap of African oak.

MATERIALS AND METHODS

SampleCollection and Preparation
Mature fruits were harvested from a plant in a bush at Ayah in Ibaji Local government Area of Kogi State, Nigeria. The pods were opened and the seeds removed with the cap. The caps were then dethatched from the seeds, sun dried, milled and packaged in air – tight glass jug for analysis.

Trial Test
Samples were measured (15g) from the flour into five plastic feeding troughs and placed at different locations outside for the chickens. This was repeated consecutively for one week. Every morning after the chickens were released from their house, the droppings were inspected for blood spots and any visible physical abnormalities.

Chemical Analysis
The flour was analyzed for proximate, anti – nutrients, vitamins and minerals. The proximate composition of the flour from the aril cap were determined using methods described by AOAC (1990) for moisture content, Adeniji *et al.* (2007) and Adekalu *et al*. (2011) for crude fibre, Onwuka, (2005) for fat and ash content, Adekalu *et al.* (2011) for crude protein. Carbohydrate content was calculated by difference.

Anti – nutritional Factors
The protease inhibitor, oxalate, Phytates, Cyanogenic glycoside and Hemmaglutinins contents of the aril cap were determined according to methods described by Onwuka, (2005) and Ibitoye, (2005).

Vitamin Contents
The flour was analyzed for vitamins; A (Onwuka, 2005), C (Adekalu *et al.* 2011), B1, B2, B6 B12 (AOAC, 1984) and E (Emmanuel *et al*. (2011).

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Mineral composition
Minerals such as Sodium, Potassium, Calcium, Iron, Magnesium and Phosphorus content of the sample were determined using Atomic Absorption Spectrophotometer (BUCK Scientific Model 2010 VGP) according to AOAC 1984 describe by Ibitoye, (2005). In this method, 1g of the sample was weighed into a round bottom flask, 5ml of 1:1 of Trioxonitrate (v) acid: Tetraoxosulphate (vi) acid was added and digested in the fume chamber. The digest was diluted by adding 10ml of distilled water into 50ml volumetric flask and the minerals were then measured.

Statistical Analysis
Data generated were statistically analyzed using mean and standard deviation. The difference in the composition was tested using t – test (Iwe, 2002) and Egbekun andAkubor (2008)

RESULTS AND DISCUSSION

Trial Test
It was observed daily basis that flour in each container was devoured completely the moment the fowls come around the feeding trough. After the first three days, the point where the samples were placed became a point of call when the fowl were released every morning. Observation of the droppings did not show any blood spots. The absence of blood spot and or any other physical abnormalities indicated that the cap was not harmful to the chickens.

Chemical Analysis
Proximate Composition
The proximate composition of the aril cap of the *A. africana* seeds are presented in table 1. The result showed that the cap had high percentage of carbohydrate (63.91 ±0.00), and fat (18.50±0.11). The high percentage of fibre (5.4±0.02) content of the cap could increase bulk when incorporated into food thereby encouraging bowel movement and preventing constipation. High fibre had been reported to control glycaemia and improve morbidity of diabetic patients (Odenigbo, 2001). Equally, the carbohydrate content could perform the protein sparing action, a situation were by the body utilizes the carbohydrate preferentially as a source of energy leaving the protein to perform its function of body building and tissue repairs. Good nutritional practices demands that diet should be made up of fats from both plant and animal sources (Akinjayeju, 2010).

The high fat content of the cap could make up this requirement. The cap could make contribution to the protein needs of individuals when incorporated into food. The moisture content of the cap was low. This could be advantageous since the more the moisture a food contains, the less the shelve life of the food. The cap is equally low in ash. Low ash content had earlier been reported for snacks made from *A. africana* seed flour (Onyechi *et al;* 2013), Onweluzo, (1991) for the seed.
Ant – nutrient Contents
Table 2 shows the anti – nutrient content of the cap. Protease inhibitor (12.01±0.02) and Hemmaglutinins (25.01±0.10) were higher than Cyanogenic glycosides, Phytates and oxalates of the cap. Liener (1980) had reported that legumes had high nutrients contents but their utilization is impaired by some inherent constraints such as presence of anti- nutritional factors. Although these anti – nutritional factors are present in the cap, they are not significant ($P<0.05$). For instance,

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hemmaglutinins content of the cap was below LD50 of 0.05mg/g. Reports by Manro and Bassir (1969) showed that the lethal dose of oxalate in man range from 2 – 5g/g. This study showed that the oxalate content of the cap was lower than this lethal level. Other anti – nutritional factors analyzed in this study were significantly ($p<0.05$) lower than lethal level.

Mineral Analysis

Some minerals such as calcium, magnesium, phosphorus and sulphur are important for building up the component of bone and the other supportive tissues and iron for the formation of haemoglobin (Enwere 1998). Table 3 shows the minerals analyzed of the aril cap. Although the cap was found to be low in ash, it contained some of the essential elements in appreciable quantity. It was found that the cap was high in

potassium, magnesium and iron. High iron content of the cap agreed with observations by Pamplona – Roger (2006) which states that nuts, legumes and cereals contain more iron than meat except liver. It could contribute significantly to the iron needs of pregnant and menstruating women. It is important that persons who have increased daily iron requirements to use supplements from plants supplies aside pharmaceuticals. For growth and bone development, the cap could make up for the calcium and, phosphorus requirements of the young children. This study revealed that the cap contained up to 148ppm of potassium. This amount could address ache, constipation, depression, oedema, excessive water consumption, fatigue, glucose intolerance in the elderly (Akinjayeju, 2010). The high amounts of magnesium in the cap could equally be helpful in addressing nervousness, muscular irritability as well as weakness, and according to Akinjayeju, (2010) heart attack. According to Pamplona – Roger (2006), magnesium acts as catalyst of many chemical reactions taking place in organisms that are related to combustion of nutrient and production of energy and exert an important function in the nervous system.**Vitamin Contents**

The vitamin contents of the aril cap of the African oak are presented in Table 4. The cap was found to be high in vitamins A, B_2, B_6 and B_{12}. Onyechi, *et al.* (2013) had reported high vitamin A content of snack made from *A. africana* seed. The presence of vitamins A and E could have a protective effect against diabetic and cardiovascular diseases. Adeyeye (1998) had shown correlation between anti – oxidant and diabetic control. Diseases caused by the deficiency of the intake of the B – vitamins are as varied as the vitamins themselves (Akinjaiyeju, 2010). The presence of these B vitamins and in appreciable amounts could help in the fight against such deficiency diseases as beriberi (vitamin B_1), nervousness and anaemia (vitamin B_6), megaloblastic and perniciousanaemia (vitamin B_{12}) (Akinjayeju, 2010). The presence of the water soluble vitamin C could

help in the cementing of the body cells and fighting mouth infections. The application of this cap in foods and food products could help in the prevention of scurvy (gum bleeding).According to Abitogun and Arawande (2009), variations in food intake from different wild plant sources have different effect on the nutritional status of humans. Wild plants can serve various purposes such as food additives in supplementing the food obtained from home gardens and other forms of agriculture. This study showed that the aril cap of A. africana could serve as food supplements. In this way it can be used as acomponent of local response to food insecurity. Its use in foods would reduce the wastage during processing of the seed.

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CONCLUSION

This study revealed that the aril cap of African oak (A. africana) seed is nutritionally rich. It can compete with the seed from which it is detached. Due to high proximate, vitamins and essential mineral elements as well as insignificant amounts of anti – nutritional factors and the fact that cap was not harmful to the chickens was an indication that it could be used in both human and animal foods.

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Table 1: Percentage proximate composition of African oak seed cap

Moisture	**5.00**± 0.10
Ash	**1.50** ± 0.01
Crude fibre	5.40 ± 1.10
Crude fat	18.5 ± 1.20
Crude protein	5.69 ± 0.02
Carbohydrates	69.91 ± 0.00

Values are mean of triplicate determinations ± SD

Table 2: Anti – nutrient contents of African oak (Afzelia africana) seed cap

Cyanogenic glycoside (mg/100g)	**2.3** ± 1.02
Phytates (mg/100g)	6.3 ± 0.20
Oxalates (mg/100g)	0.6 ± 0.00
Protease inhibitor(mg/100ml)	12.01 ± 0.01
Hemmaglutinins (mg/100ml)	25.01 ± 0.01

Values are mean of duplicate determinations ± SD.

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Table 3: Mineral constituents of flour of African oak seed cap

Sodium (ppm)	7.10 ± 1.00
Potassium (ppm)	148.00 ± 0.10
Calcium (ppm)	7.02 ± 0.00
Magnesium(ppm)	109.12 ±1.02
Phosphorus(ppm)	11.20 ± 1.10
Iron(mg/g)	0.25 ± 0.02

Values are mean of triplicate determinations ± SD

Table 4: Composition (mg/100g) of some vitamins in Afzelia africana seed cap

Vitamin A	**234.70** ± 0.10
Vitamin C	4.00 ± 0.01
Vitamin E	1.10 ± 0.02
Vitamin B_1	2.00 ± 0.10
Vitamin B_2	33.04 ± 0.02
Vitamin B_6	4.31 ± 0.01
Vitamin B_{12}	4.83 ± 0.10

Values are mean of triplicate determinations ± SD

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