African Journal of Biochemistry Research Vol. 4(7), pp. 175-178, July 2010
Available online at http://www.academicjournals.org/AJBR
ISSN 1996-0778 ©2010 Academic Journals

Full Length Research Paper

Evaluation of nutritional and antinutritional characteristics of Obeche (*Triplochition scleroxylon scleroxylon)* and several Mulberry (*Morus alba)* leaves

S. A. Adeduntan[1] and A. S. Oyerinde[2]*

[1]Department of Forestry and Wood Technology, Federal University of Technology, P. M. B. 704, Akure, Nigeria.
[2]Department of Agricultural Engineering, Federal University of Technology, P. M. B. 704, Akure, Nigeria.

Accepted 6 May, 2010

The biochemical composition of some selected varieties of White Mulberry and Obeche leaves were investigated to ascertain their nutritional and antinutritional values. Three varieties of white Mulberry leaves (S_{36}, S_{54} and K_2) were harvested from Ondo State sericulture centre while Obeche leaves were harvested from Aponmu Forest Reserve located in Ondo State, Southwestern Nigeria, for analysis. Proximate chemical composition, minerals and anti-nutritional contents were determined on dry matter basis for the samples. The percentage of crude protein in all the samples was significantly higher ($P \leq 0.05$) with 34.31, 21.66, 21.585 and 21.24% in Obeche, S_{36}, S_{54} and K_2, respectively. Similarly, crude fibre follow the same trend with 20.753, 13.70, 10.81, 10.81, 13.70 and 8.74%, respectively, while the percentage water content were 73.70, 71.35, 72.16 and 76.00%, in Obeche , S_{36}, S_{54} and K_2, respectively. The results further show that the samples contain zinc in the range of 34.4 - 57.5, sodium 1069 – 1526, manganese, 14.83 – 24.37, calcium 944 – 1467, potassium 1684 – 2170, iron, 129.70 – 238.00 and magnesium, 1450 – 2196 (mg/kg). The mineral composition was generally comparable with what is obtained with other leafy vegetables. Phytate was significantly higher ($P \leq 0.05$) in Obeche. Likewise, cyanide and tannin were significantly higher ($P \leq 0.05$) in S_{36} than other treatments (Obeche, K_2 and S_{34}). However, these antinutrients (phytate, cyanide and tannin) are much lower than the pemitted values in fruits and any other food items. The result of the chemical analysis showed that all the selected Mulberry varieties and Obeche leaves contained adequate level of food nutrients required for normal body functioning.

Key words: Mulberry leaves, nutritional characteristics, Obeche leaves, proximate composition.

INTRODUCTION

The Mulberry tree is a perennial woody plant which belongs to the family Moraceae*,* Genus *morus Morus* and species *alba.* It is a deep-rooted perennial plant, capable of thriving under a variety of conditions ranging from temperate to tropical region. Several varieties of the tree are under cultivation in Ondo State, Nigeria, where the study was carried out. Mulberry tree is recognized as food plant for silkworm as well as an economic tree (Kasiviswanathan et al., 1988; Jaiyeola and Adeduntan, 2002). Its leaves contains high protein content and is also used in cattle feed for milk production (Kasiviswanathan et al., 1988). The timber is used for furniture, tool handle and the fruits are used for making wine, while the seeds are used for making jam (Datta and Ravikumar, 1988). The Mulberry can be grown as low bush, high trunk or deep-rooted tree and as such, could be utilized in afforestation of land and anti-erosion programmes (Datta and Ravikumar, 1988). Powder of *morus Morus alba* leaves have has been used to prepare drink by some people as a healthy diet in Japan, but its chemical composition was not known (Shimizu et al., 1992).

Obeche *Trilochition* (*Triplochiton scleroxylon*) is indigenous to the humid tropical forests of Central and West Africa. It is a commercial and important timber specie

*Corresponding author. E-mail: asoyerinde@yahoo.com.

in its natural habitat, the timber is used as veneer and for light construction. The species has shown considerable promise as plantation species in tropical areas of Africa and Pacific (particularly in the Solomon Island). It has an excellent form, self-pruning and grows very fast. The main drawback with the species is its short-lived seed that has stimulated considerable research into vegetative propagation techniques. Juvenile leaf cutting have been propagated successfully in conditions of high humidity in West Africa. Obeche has being used as hedges and for environmental stability. Its wood is used as fuel wood, while the sawn timber is used in building and for light construction and the leaves are used as food.

Some plant species with edible fruits in lowland rainforest ecosystem of Southwestern Nigeria is noted to contain large quantities of protein and vitamins especially vitamins A, B and C (Okafor, 1979; Akachuku, 1997). Their consumption therefore is able to augment the diet of people thereby preventing kwashiorkor and malnutrition especially in children. Some literature knowledge about the anti nutritional characteristics of these leaves should be stated. This study examined the nutrients and anti-nutrient potentials of Obeche leaves and three varieties of Mulberry leaves as a step towards establishing a wider and more purposeful utilization of these indigenous and exotic plant species.

MATERIALS AND METHODS

Obeche leaves which was collected at different parts of the branches (that is, top, middle and base) was collected were obtained from Akure Forest Reserve, Aponmu, while the varieties of the Mulberry leaves (S_{36}, S_{54} and $K_{2,}$) were collected from Ondo State Ministry of Agriculture Sericulture centre, Akure. The Mulberry varieties were given equal silvicultural treatments, while the analysis of the samples was carried out in triplicate using the standard procedures (AOAC, 1990). Each of the leaf samples of Obeche and the three Mulberry varieties were was oven dried at 60°C, pulverized and sieved through a 2 mm mesh screen and further dried at 60°C to constant weight, labeled and stored in an air-tight plastic jar at 4°C until required for analysis.

Proximate chemical compositions of various samples were analysed and crude protein, crude fibre, crude fat and crude ash were determined by using the methods of Association of Official Analytical Chemist (AOAC, 1990). The samples were dissolved in 10% HCL, filtered and diluted to 100 ml before estimation of their heavy metal contents. The nitrogen free extract (carbohydrate) was estimated by subtracting the sum of weights of crude protein, crude fibre, crude fat and crude ash from the total dry matter. Phosphorus was determined by the Phosphovanado molybdate method of (Ranjhan and Krisha, 1980) while the other minerals were determined after wet digestion with a mixture of nitric, sulphuric and perchloric acids using an Atomic Absorption Spectrometer (AAS: Model SP 9). A corning flame photometer - 410 was used for the determination of Na and K.

Extraction and precipitation of phytate were done by the method of Wheeler and Ferrel (1971) as used by Aletor (1995); Enujuigha and Ayodele (2003). Iron in the precipitate was determined by the method of Makower (1970.) Tannin values were obtained by adopting the method of (Markar and Goodchild, 1996), while hydrogen cyanide in the samples was obtained determined by AOAC (1990) method.

Data generated obtained from proximate, minerals and anti-nutrition properties were subjected to one-way analysis of variance (ANOVA), Steel and Torrie (1960), where significant differences were observed and mean separation was done by Duncan Multiple Range Test (DMRT) (Duncan, 1955).

RESULT AND DISCUSSION

Proximate chemical composition of the leaf samples is presented in Table 1. Here, a wide variation was noticed in the samples and the result of chemical analysis of Obeche and Mulberry leaves differ significantly. The crude protein ranged from 21.24 to 21.66% in Mulberry leaves while Obeche leaves contain 34.31%. This shows higher protein content compared with some major vegetable leaves such as (FAO, 1990). Table 1 revealed that Obeche has the highest protein content followed by S_{36}, S_{54} and K_2 with the least value. The high protein values observed is in agreement with Kasiviswanathan et al. (1988) and it is an indication that both Mulberry and Obeche can be of food value in man, silkworm and animal. The limitation to the full utilization of Obeche leaves could be due to high concentration of anti-nutritional factors mainly phytate and cyanide. This result equally indicated higher levels of crude protein compared to the commonly cultivated legumes such as cowpea; pigeon pea and lima beans as it was reported by Aletor and Adeogun (1995). Thus all species of Mulberry and Obeche leaves tested in this work could serve as substitute for existing plant protein and since the biomass yield of Mulberry plant is very high at very shortest time (Adeduntan, 2003), coupled with lower cost of production, it could be highly recommended as food for man and animal (Silkworm) man, animal and Silkworm. The level of carbohydrate in Mulberry varieties and Obeche were 56.442, 49.04, 47.227 and 30.04%, respectively with K_2 having the highest values and Obeche having the least value. There is corresponding relationship between the carbohydrate content of the leaves and their protein values. As protein values increases in some variety their corresponding carbohydrate value decreases. Thus, the higher the protein, the lower their corresponding carbohydrate, a situation that is very advantageous for rural sector of the economy that is facing food crisis today.

The fat content of the leaves were as shown in Table 1. S_{36} has the highest fat level of 8.02% followed by S_{54} with 6.05% while Obeche and K_2 are 5.46 and 5.31% respectively. These results signify that there are significant differences among the samples in fat levels and it agreed with the result obtained in the nutrient composition in Mulberry leaves carried out in Asia, UN (1993). The ash content was the lowest in K_2 (8.219%) and the highest in S_{36} (12.63%); Obeche and S_{54} has 9.22 and 9.65% respectively. High ash content was considered to be a good source of mineral food (Enujiugha and Agbede, 2000). The fibre content was (Enujiugha and Agbede, 2000). The fibre content was lowest in K_2 (8.274%) with

Table 1. Proximate composition of Mulberryleaves and Obeche leaves.

Samples	Moisture content (%)	Crude protein (%)	Crude fat (%)	Ash (%)	Crude fibre (%)	Total carbohydrate
S_{36}	79.35± 0.69[a]	21.66 ± 0.0[b]	8.02 ± 0.30[a]	12.63 ± 0.20[a]	10.8 ± 0.80[c]	47.27 ± 0.41[c]
Obeche	73.70 ± 0.13[c]	34.31 ± 0.0[a]	5.46 ± 0.00[c]	9.22 ± 0.04[c]	20.73±0.15[a]	30.04 ± 0.17[d]
S_{54}	72.16 ± 0.41[d]	21.55 ± 0.0[c]	6.05 ± 0.00[b]	9.65 ± 0.16[b]	13.70±0.18[b]	49.04 ± 0.23[b]
K_2	76.00 ± 0.44[b]	21.24 ± 0.0[d]	5.31 ± 0.03[c]	8.19 ± 1.70[d]	8.74± 0.15[d]	56.42 ± 0.53[a]

Values in the same column followed by the same alphabet are not significantly different (P < 0.05).

Table 2. Anti-nutritional composition of the samples.

Samples	Phytate (mg/kg)	Cyanide (mg/kg)	Tannin (mg /kg)
S_{36}	488. 90 ± 32.47[b]	2.14 ± 0.20[a]	5.32 ± 0.13[a]
Obeche	997.80 ± 130.27[a]	1.12 ± 0.20[b]	3.54 ± 0.04[c]
K_2	451.30 ± 0.00[b]	1.01 ± 0.00[b]	3.65 ± 0.01[c]
S_{54}	456.80 ± 9.45[b]	1.24 ± 0.20[ab]	3.78 ± 0.00[b]

Values in the same column followed by the same alphabet are not significantly different (P < 0.05).

Obeche having the highest of 20.73%. The lowest level of fibre in K_2 may be attributed to its high carbohydrate content of 56.41% while Obeche that has the highest fibre resulted in the lowest carbohydrate 30.04%. Generally, the result of the proximate analysis of the samples (S_{36}, S_{54}, K_2 and Obeche) shows significant differences for crude protein, ash, crude fibre and carbohydrate but there were no significant differences in crude fat of Obeche and K_2.

Table 2 shows the level of anti-nutrients in various samples (S_{36}, S_{54}, K_2 and Obeche), which hinder the utilizable nutrient in them. The LSD (Least significant differences) shows that there are significant differences in the phytate levels of the samples. The phytate content ranged from 451.3 mg/kg in K_3, 456.8 mg/kg in S_{54}, 488.9 mg/kg in S_{36} to 9797 mg/kg in Obeche. Phytin-p is known to be the primary storage form of phosphorus in mature legume seed (Enujiugha and Agbede, 2000). The high phytin content in Obeche has nutritional significance as it does not only make phytin-p unavailable to humans and monogastric but it also lowers the availability of many other essential minerals as reported by Aletor (1995).

The phytate contents of these leaves are less than what is obtained in some fruits such as guava (327 mg/100 g), Plantain (553.08 mg/100 g), and banana (847.53 mg/100 g) whereas the lethal standard value for phytate is 2500 mg/100 g (FAO, 1990).

The cyanide content of the leaves is 1.10 01 mg/kg in K_2, 1.12 mg/kg in Obeche, 1.264 mg/kg in S_{54} and 2.14 mg/kg in S_{36} which indicated the highest level. This result is far below the standard permitted value for cyanide in fruits and in any other food value. The minimum standard cyanide value in leaves is 30 mg/kg FAO (1990). These levels of cyanide may not have much effect on man and silkworm.

Table 2 also shows the tannin levels in the samples. S_{36} has the highest tannin content of 3.54%, 5.32 mg/kg followed by S_{54} (3.78% mg/kg), K_2 (3.65% mg/kg) and Obeche (5.32%, 3.54 mg/kg). These values obtained are considered to be lower when compared with the standard value of 37%, mg/kg (FAO, 1990). Thus these leaves are safe for consumption by man and livestocks. Goldstein and Swain (1963) described Tannin as phenolic com-pounds with degree of hydrozylethyn with molecular size that is sufficient to form complexes with proteins. Rubino and Davidoff (1979) reported that cyanide of any part of plants causes accident and often total cyanide poisoning.

There are significant differences in the zinc content between Obeche and the rest samples (S_{54} and K_2). S_{36} has the highest zinc content with 57.50 mg/kg followed by Obeche 48.60 mg/kg while both S_{54} and K_2 has 34.40 mg/kg. Zinc, which has been found to be an essential component of enzymes that plays critical role in protein and carbohydrate synthesis. The deficiency of zinc can cause break down in immense function of host defensive mechanism. S_{36} have the highest magnesium content followed by Obeche with 17.00 mg/kg, both K_2 and S_{54} has 14.50 mg/kg.

Calcium in Obeche was significantly lower than any other samples with 944.7 mg/kg while K_2 and S_{54} ranked second with value of 13.75 1375 mg/kg and S_{36} ranked the highest with 1467 mg/kg as shown in Table 2. The values of calcium detected are in order of which is noted to be good for bone formation and osmo-regulation. Potassium level in S_{36} is significantly higher than all other treatments with 2170 mg/kg while the level in Obeche, which is 1703 mg/kg, is significantly higher than those of K_2 and S_{54} with value of 1684 mg/kg each as shown in Table 3. In man, potassium is good for nerves and muscle functions. The values of iron in K2 and S54 are 141.75 and 141.57 mg/kg, respectively. The value in

Table 3. Mineral elements of Mulberry leaves and Obeche.

Samples	Zinc (mg/kg)	Sodium (mg/kg)	Manganese (mg/kg)	Calcium (mg/kg)	Potassium (mg/kg)	Iron (mg/kg)	Magnesium (mg/kg)	Co	Cd	Lead	Cu
S_{36}	57.50 ± 0.45[a]	1526 ± 0.8[a]	24.37 ± 0.47[a]	1467 ± 1.05[a]	2170 ± 0.35[a]	238 ± 0.66[d]	2196.4 ± 1.23[a]	ND	ND	ND	ND
Obeche	48.60 ± 0.46[b]	1069 ± 0.31[c]	14.83 ± 0.25[c]	944 ± 0.47[c]	1703 ± 0.44[b]	129.7 ± 0.46[c]	1700 ± 0.55[b]	ND	ND	ND	ND
S_{54}	34.40 ± 0.56[c]	1081 ± 0.32[b]	18.27 ± 0.21[b]	1375 ± 0.7[b]	1684 ± 0.53	141.7 ± 0.45[b]	1450 ± 0.36[c]	ND	ND	ND	ND
K_2	34.40 ± 0.46[c]	1081 ± 0.55[b]	18.23 ± 0.25[b]	1375 ± 0.43[b]	1684 ± 0.29	141.5 ± 0.49[b]	1450 ± 0.35[c]	ND	ND	ND	ND

Values in the same column followed by the same alphabet are not significantly different ($P < 0.05$). ND: Not detected.

Obeche is the least (129.7 mg/kg) while S_{36} has the highest value. The mineral element in Table 3 however indicated further those elements of copper, cadmium and lead that were not detected but their absence is not a nutritional disadvantage.

CONCLUSION AND RECOMMENDATION

Obeche (*Triplochiton scleroxylon*), contained very high protein and crude fibre that is very essential for man, livestock and silkworm's growth. Its leaves have been eaten by some communities in Ondo State, Nigeria, but its consumption has not been widespread. It is therefore suggested that the leaves be subjected to further treatments or processing to reduce the toxic level before processing for consumption and K_2 S_{54} varieties of Mulberry leaves should be encouraged by local farmers to feed their silk worms and livestock because they contain lower phytate, cyanide and tannin content, and are rich in essential minerals which are made available for utilization. This work thus, supports the consumption of Mulberry and Obeche leaves by man. As it has been reported by Datta (1992) that Mulberry leaves serves as a source of delicious vegetable, which is very rich in protein.

REFERENCES

Adeduntan SA (2003). Effect of fertilizer application on the growth and folia composition of Mulberryleaf. Appl. Trop. Agric. Res., 11: 18-22.

Aletor VA (1995). Compositional Studies on Edible Tropical Species of Mushrooms. Food Chem., 54: 265-268.

Aletor VA, Adeogun OAOA (1995). Nutrient and anti-nutrient composition of some tropical leafy vegetables. Food Chem., 53: 375-379.

Akachuku IO (1997). Status of Forest Food Plant Species and Environmental Management in southeast Nigeria. In Oduwaye, E. A; Obiaga, P. C. and Abu, J. E. (Editors), Proceedings of 24th Annual Conference of Forestry Association of Nigeria, Ibadan, Nig., pp. 21-29.

AOAC (1990). Official method of Analysis. Association of Analytical Chemists, Washington D.C, 15th ed.

Datta RK, Ravikumar C (1988). Sericulture and Rural Development International Congress on Tropical Sericulture practice. Lead paper 1, Central Silk Board, India, pp. 4-5.

Datta RK (1992). Guidelines for bivoltine rearing central silk board. Ministry of Textile, Government of India, 39, Mahatma Gandhi Board, Banglare.

Duncan B (1955). Reddy. N.R. Multiple Range f-tests Biometrics, 11: 1-41.

Enujuigha UM, Agbede JO (2000). Nutritional and Anti-nutritional Characteristics of African oil bean *pentadethra marophylle Benth* seed. Appl. Trop. Agric., 5: 1-4.

Enujuigha UM, Ayodele OM (2003). Nutritional status of lesser- known oil seeds. Int. J. Food Sci. Tech., 38: 1-4.

FAO (1990). World meat situation and outlook, commodities and trade division Food and Agriculture Organisation Italy, Rome.

Goldstein JL, Swain T (1963). Change of ripening fruits. Phytochem., 2: 271-283.

Jaiyeola V, Adeduntan SA (2002). Sericulture in Ondo state: A means of alleviating rural poverty. In Forestry and Challenges of sustainable livelihood Proceedings of the 28th Annual Conference of the Forestry Association of Nigeria held in Akure, Ondo state, pp. 202-207.

Kasiviswanathan K, Parankumar T, Chowdhary PC, Somashakara KS (1988). Moricultural practical International congress on Tropical Sericulture practices, Lead paper 2. Central silkboard Bangalore, Indian, p. 11.

Makower RV (1970). Extraction and Determination of phytic acid in beans (*phaseolus lunatus*). Cereal Chem., 47: 28-292.

Markar AOS, Goodchild AV (1996). Qualifications of tannins. A laboratory manual. ICARDA, Akeppo, Syria, 4: 25.

Okafor JC (1979). Edible Woody Plants in Rural Economy of Nigeria Forest Zone. In Okali, D. U. U. (Editor). Proceeding of a MAB state of Knowledge workshop on the Nigeria Rainforest Ecosystem, Nigeria, pp. 262-301.

Ranjhan SR, Krishna G (1980). Laboratory Manual for Nutrition Resesarch, eds. Ranjhan, SR. and Krishna, G. Vicas publ. Co. New Delhi, India, p. 450.

Shimizu P, Yazawa M, Takede N (1992). Aromatic acid in leaves of *morus alba* and their possible medical value, Sericologia, 32(4): 633- 636.

Steel RCD, Torrie, JH (1960). Principles and procedures of statistics 1st ed. McGraw-Hill, New York.

United Nations (UN) (1993). Techniques of silkworms rearing in the tropics table 1. Nutritive compositions in Mulberryleaf page24.Campion, D. G. 1972. Some observations on the use of pheromone traps as a survey tool for Spodoptera littoralis. Cent. Overseas Pest Res. Rep., 4: 10.

Wheeler VE, Ferrel RE (1971). A method for phytic acid determination in wheat fractions. Cereal Chem., 48: 312-316.