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Full Length Research Paper

Levels of anti-nutritional factors in some common leafy edible vegetables of southern Nigeria

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Twelve commonly eaten green leafy vegetables were analyzed for their antinutritive factors. It is known that these factors interfere with nutrients bioavailability and utilization when in high concentration. Antinutritive factors analysed for included oxalate, phytate, hydrocyanide, saponin and Tannin. Standard methods of analysis were employed. Results showed that the oxalate level ranged between 080-2.60ug/g, phytate 4.12-11.00ug/g, hydrocyanide 0.12-0.28ug/g and tannin 0.04 -0.26ug/g. These values are low to significantly interfere with nutrients bioavailability and utilization. They are below established toxic level.

Keywords: Antinutritive factor, Moringa Oleifera, nutrient bioavailability, green leafy vegetables, Southern Nigeria.

INTRODUCTION

The importance of the nutritional status of vegetables by Nigerians has resulted in the increased demand of knowledge of the nutrient of food. Green leafy vegetables are important component of the dietary regime of humans because they provide the necessary vitamins, and minerals (Fasuyi, 2006). They however also contain antinutrients which reduce the bioavailability of these nutrients (Akindahunsi and Salawu, 2005, Binita and Khetarpaul, 1997). Aletor and Adeogun,(1995),however, reported that some antinutrients exhibit protective effects thus making them serve dual purpose. Oxalate binds to calcium to form calcium oxalate crystals; these prevent the absorption and utilization of calcium by the body thereby causing diseases such as ricket and osteomalacia (Ladeji et al., 2004). The calcium crystals may also precipitate around renal tubules causing renal stones. Phytic acid combines with some essential elements such as Fe, Ca, Zn and P to form insoluble salts called the phytates which are not absorbed by the body therefore making these minerals biounavailable. Saponins are naturally oily glycosides occurring in wide variety of plants. When eaten, they are non-poisonous to warm blooded animals but are poisonous when injected into the blood stream (Applebaum et al., 1969).

Tannins are water soluble phenolic compounds with a molecular weight greater than 500 and with the ability to precipitate proteins from aqueous solution. They occur almost in all vascular plants. They combine with digestive enzymes thereby making them unavailable for digestion (Abara, 2003; Binita and Khetapaul 1997).

Despite the fact that these vegetables are widely consumed because of the accepted nutritional value, there is lack of sufficient information on the antinutritional factors in these vegetables. This study was therefore undertaken to determine the level of antinutritional factors in some common edible leafy vegetables.

MATERIALS AND METHODS

Samples were collected from farms within Delta State University, Abraka, Delta State, Nigeria and environs. Others were purchased from the local market. The leaves were destalked, washed and air dried. Samples were pound to powder using mortar and pestle and then sieved.

analysis of samples

Total oxalate was determined according to Day and Underwood (1986) procedure. Phytate was determined using Reddy and Love (1999) method. Saponin was determined using the method of Birk et al., (1963) as modified by Hudson and El Difrawi (1979). Tannin was determined using the method of Trease and Evans (1978) while the hydrocyanic acid content was determined using the alkaline titration method of AOAC (1990).

Table 1 Levels of antinutritional factors

Vegetables Botanical	Common names	Oxalate ug/g	Phytate ug/g	Hydrocyanide ug/g	Saponin ug/g	Tannin ug/g
Vernonia amygdalina	**Bitter leaf**	2.30±0.35	8.59±0.36	0.22±0.08	0.12±0.02	0.04±0.01
Corchorous olitorius	**Ewedu**	0.80±0.15	9.39±0.55	0.23±0.02	0.13±0.01	0.12±0.02
Talinum triangulare	**Water leaf**	2.60±0.45	6.49±0.25	0.13±0.01	0.12±0.01	0.18±0.01
Solanum monocarnum	**Garden egg leaf**	0.70±0.25	7.39±0.66	0.17±0.01	0.28±0.01	0.11±0.01
Telfariria occidentals	**Pumpkin leaf**	1.20± 0.44	6.59±0.33	0.21±0.05	0.14±0.02	0.21±0.01
Abelmoschus esculentus	**Okro leaf**	1.20±0.25	6.75±0.45	0.22±0.03	0.24±0.13	0.13±0.02
Moringa Oleifera	**Drum Stick**	2.50±0.33	11.00±0.23	0.14±0.02	0.25±0.11	0.22±0.02
Ocimum gratissimum	**Scent leaf**	1.00±0.06	13.00±0.40	0.13±0.03	0.12±0.01	0.26±0.03
Jatropha Curcas	**Hospital too far**	1.10±0.11	6.89±0.25	0.11±0.04	0.22±0.02	0.12±0.02
Androgen citrates	**Lemon grass**	0.09±0.01	6.11±0.22	0.09±0.01	0.14±0.03	0.20±0.01
Manihot esculentus	**Cassava leaf**	1.00±0.22	5.39±0.22	0.23±0.01	0.12±0.01	0.17±0.01
Amaranthus hybridus	**Green leaf**	0.60±0.02	4.12±0.45	0.10±0.01	0.20±0.01	0.19±0.01

statistical analysis

All determinations were done in triplicate. Mean and standard deviations were calculated and data obtained were subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Results of the phytochemical analysis are presented in Table 1: Antinutritive factors limit the use of many plants due to their ubiquitous occurrence as natural compounds capable of eliciting deleterious effect in man and animals (Kubmarawa et al., 2008).Oxalate tends to render calcium unavailable by binding to the calcium ion to form complexes (Al-Rais et al., 1971; Ladeji, 2004, Nkafamiya et al., 2006). The oxalate content in these vegetables ranged between 0.09-2.50ug/g. There was no significant difference among vegetables ($p<0.05$). The insoluble calcium oxalate may precipitate around soft tissues like kidney, causing kidney stones (Oke, 1969). The values obtained from this study were below the established toxic level.

The phytate value recorded was between 4.12-11.00ug/g. There was no significant difference among the vegetables ($p<0.05$). These values obtained are below the toxic level. According to Oke (1969) a phytate diet of 1-6% over a long period of time decreases the bioavailability of mineral elements in mono gastric animals. Phytic acid acts as a strong chelator forming protein and mineral-phytic acid complexes thereby decreasing protein and mineral bioavailability (Fasusi et al., 2003; Erdman, 1979. Phytate is associated with nutritional diseases such as rickets and osteomalacia in children and adult, respectively.

Cyanogens are glycosides of a sugar, sugars and cyanide containing aglycone. Cyanogens can be hydrolyzed by enzymes to release a volatile HCN gas. Excess cyanide ion inhibits the cytochrome oxidase which stops ATP formation and so tissues suffer energy deprivation and death follows rapidly. High level of HCN has been implicated for cerebral damage and lethargy in man and animal. The levels found in this work were between 0.09-0.23ug/g which are below recorded lethal level. There was no significant difference among the vegetables ($p<0.05$).

Results obtained for Saponins in these vegetables ranged between 0.12 – 0.25ug/g. These values are low when compared with the results from other works (Umaru et al., 2007; Ekop 2007; Nkafamiya et al., 2007; Nkafamiya et al., 2010). Saponins are glycosides containing polycyclic aglycone moiety of either C_{27} steroid or C_{30} triterpenoids attached to a carbohydrate. High Saponin level has been associated with gastroenteritsis manifested by diarrhea and dysentery (Awe and Sodipo, 2001).

Tannins are water soluble phenolic compounds with a molecular weight greater than 500 and with the ability to precipitate proteins from aqueous solution. They occur in all vascular plants. Tannin binds to proteins making them biounavailable (Bagepallis et al., 1993; Aleto, 1993; Sotel et al., 1995). From the results, the level obtained was between 0.04-0.26ug/g. There was no significant difference in the Tanin level

among the vegetables ($p<0.05$). These values are low compared with other
workers (Chinma and Igyor 2007; Umaru et al., 2006; Ekop, 2007; Abidemi et al., 2009; Amoo et al., 2009; Nkafamiya et al., 2007).

In conclusion, the results indicated the presence of antinutritional factors but they were present in such low levels that there is no fear of significant intervention with nutrients utilization.

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