**Title: Effect of Cooking on the Thiocyanate Content of Bitter leaf and Water leaf Sold In Egah Market, Idah, Kogi State, Nigeria**

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**Abstract**

Raw Water leaves and Bitter leaves and other leafy vegetables are considered as agents of transmission of goitrogens which interfere with iodine uptake and cause goiter. Water leaves and bitter leaves are plants of both nutritional and medicinal uses. This study examined the effect of cooking on the goitrogenic (thiocyanate) content of water leaves and bitter leaves. A total of (20g) of water leaves and bitter leaves were randomly collected, raw and cooked. All samples were examined according to standard methods for determination of thiocyanate. The result of the analysis showed that raw bitter leaves contain thiocyanate of 0.89±0.009 and 0. 74±0.005 in cooked condition while raw water leaves contain thiocyanate properties of 0.86±0.006 and 0.85±0.002 for cooked. These findings provide evidence for the risk of acquiring goiter from the consumption of raw water leaves and bitter leaves, which is reduced when cooked. Effective procedures are necessary to reduce goitrogenic contents of leafy vegetables.

**Key words:** Water leaves, Bitter leaves, Goitrogens, Thiocyanate, Cooking, Goiter

**INTRODUCTION**

Goitrogens are chemical that are ingested in food or drugs example includes the cyanogenic glucosides and thiocyanate found in some plants that can suppress thyroid functions in different ways (Marcelle, 2011).Some goitrogens induced antibodies that cross-react with the thyroid: others interfere with thyroid perioxidase (TPO), the enzymes responsible for adding iodine during production of thyroid hormones (Dasgupta, 2008). These substances are found in food such as cassava, millet, waterleaf, maize, bamboo, bitter leaf, shoots, and sweet potatoes, their main sources are the cyanogenic glycosides and glucosinolate found in the plant kingdom. When the diet is overly rich in goitrogens, the thyroid swell and trap as much iodine as goitrogen, forming a goiter or a lump in the neck (Adwork, 2006). Thioglycoside under a rearrangement to form isiothiocyanate derivative and in some instances thiocyanate (Task *et al*., 2002). Thiocyanate or isiothiocyanate like compound primarily in habit the iodine concentration mechanism of the thyroid, and their goitrogenic activity can be overcome by iodine administration (Chandra *et al*., 2004) .

Goitrogens consists of the following category; Thiocyanate, Cyanogenic glucosides and Glucosinolate. Thiocyanate is group of components formed from the combination of carbon and nitrogen. Thiocyanate is found in various foods and plants. They are produced primarily from the reaction of free cyanide with sulfur; it is also break down product of glucosinolate Gals. Although thiocyanate is less harmful than cyanide in human, they are known to affect the thyroid gland reducing the ability of the gland to produce hormone that are necessary for the normal function of the body (ATS DR, 2006).

Thiocyanate (SCN) is a complex anion which is potent inhibitor of iodine transport. It is the detoxification product of cyanide and easily be measured body fluid (Erdogan, 2003). The development of goiter critically related to the balance between iodine and thiocyanate a goitrogen found in some African diet (Tource *et al*., 2003). Thiocyanate make it harder for the gland to absorb iodine because they compete with iodine for entry into the gland this effect can be minimized by supplementing the diet with iodine, where the excess iodine can then crow out the thiocyanate (F.A.O, 2008). Consumption of naturally occurring goitrogen, certain environmental toxin and cigarettes smoking can significantly increase thiocyanate concentration level capable of affecting the thyroid gland. Goiter Endemic were reported to develop when the critical urinary cosine isiothiocyanate anion decrease below 3 microgram iodine per magnesium thiocyanate (Eardogan, 2003).

Structure of thiocyanate

S = C =N

Goiter is a swelling of the thyroid gland which can lead to swelling of the neck or larynx. The disease is associated with hypothyroidism or hyperthyroidism. The enlarge thyroid comprises the trachea and esophagus leading to symptoms such as coughing,breathing difficulties and swallowing (Norman, 2011). Goiter cases are minimal in affluent countries where table salt is supplemented with iodine. However it is still prevalent in India, china, east and central Africa. In Africa, goiter is endemic in many countries notably Congo, Uganda, Kenya and Sudan. The prevalence is as high as 81% in some part of these countries (Elnour *et al*., 2000). It is the chief consequence of iodine deficiency, resulting from either low intake or ingestion of goitrogen (Narwal *et al*., 2013). The global salt iodization program has resulted in the reduction in goiter prevalence. The persistence of goiter in some area with adequate iodine prophylaxis suggests the existence of our goitrogenic factors.

 Vegetables are edible part of the plant which are usually cooked and salted before consumption with other food. Fresh vegetables are important foods both from Economic and nutritional point of view and vegetables of all types are valuable part of our diet. They play important parts in maintaining general good health owing to the presence of mineral elements and vitamins (Aadegunwa *et al*., 2011). Leafy vegetables are consumed as cooked complements to the major staple like cassava, cocoyam, corn, bitter leaf, water leaf, millet, rice and plantain (Nwanekezie and Obiakor-Okeke, 2014)

Bitter leaf (*Vernonia amygdalina*) is a shrub or a small tree belonging to the family Asteraceae. It is a popular African vegetable which grows in several part of the tropic. It is called *Olubu* in Igbo, *ituna* in Tiv, in Edo, *Etidot* in Ibibio and *Ilo* in Igala. The plant is drought tolerant though it grows better in humid environment (Ikeh *et al*., 2014). It is used to a large extent in tropical countries for its culinary and medicinal purposes, and also in the traditional treatment of malaria, diabetes, diarrhoea, urinary tract disease, hepatitis, gastrointestinal problem, skin disorder, cough, constipation and in the treatment of wound (Ajebesorne and Aina, 2004). A number of chemicals including edotides and sesquiterpene lactones have been isolated from the bitter leaf (*Venonia amygdalina*). Bitter leaf though bitter in taste contains essential vitamins such ad vitamin A, C and E, vitamin B1 and B2

Water leaf (*Talinum triangulare*) belongs to the family of portulacacea, the leaves are small, soft and green in clolour and used medically in the treatment of cardiovascular disease such as stroke and the leaves are also used in the treatment of diarrhoea and gastrointestinal disorder. The leaves are also rich in iron and can be used to treat anemia hence it is used in maintaining of good health in developing countries. Water leaf is a rich source of mineral such as calcium, potassium, magnesium and pectin proteins.

Dietary or nutritional thiocyanate is a very important substance necessary for optimal health and well being. Thiocyanate is found in specific foods common to the indigenous African diet. When thiocyanate is present in the diet, it act as an oxygen carrier and increases the capacity of the blood to transport the life given oxygen to every single cell of the body. Because of its oxygen enhancing properties, a diet rich in thiocyanate is effective in helping mitigate sucking of the red blood cells (Medani *et al*., 2010).

Thiocyanate promotes cell growth, has protective profit in case of toxic and mutagenic cell exposure and stimulate the immune response and the phagocytosis (Braucer *et al.*, 2006) arthritis and rheumatism gastric intestinal disorder and cardiovascular disease. If the body lack in a sufficient diet in nitroloside and thiocyanate in food, it causes a disease in the number of favorable intestinal bacteria and subsequent increase in unfavorable organism. This may lead to constipation, yeast infections, colon and rectal cancer (Kirk, 2010). This study determined the effect of processing on goitrogenic (thiocyanate) content of water leaf

**MATERIALS AND METHODS**

**SAMPLES COLLECTION** The leaf of *Vernonia amygdalina* and *Talinum triangulare* were purchased from Egah market in Idah, Idah Local Government Area of Kogi State and transported for determination of thiocyante in the biochemistry Laboratory of Science Laboratory Technology Department, Federal Polytechnic Idah, Kogi State.

**SAMPLE PREPARATION** The fresh sample of water leaf and bitter leaf was separated from a stalk using a knife, the leaves were washed in a bowl using distilled water so as to remove sand and other impurities. The washed samples were weighed using a weighing balance. Two bowls were labeled A and B where A stand for raw and B stand for cooked ' 20g of water was measured and poured into the bowl A and the sample process was repeated in bitter leaf and water leaf, both were boiled for a period of 25 minutes and 200ml of water was added and mercury chloride was added and 30 minutes was allowed for color development at room temperature and was taken for analysis.

**METHOD OF PROCESSING**

BOILING: This involved placing fresh leave sample of *V. Amygdalina* in boiling water for some minutes.

SQUEEZE: Washing with boiling: this process involved the tearing apart of tissues with hand and subsequent boiling in water (Babalola *et al*., 2010)

 **DETERMINATION OF THIOCYANATE IN WATER LEAF AND BITTER LEAF** Thiocyanate content in water leaf and bitter leaf in their cooked and raw conditions were determined using UV-Visible spectrometer.

Thiocyanate in water leaf and bitter leaf were treated with 5ml of 20% trichloroacetic acid, mixed and centrifuged at 10,000 rpm for l 5min. the sample were filtered and the residue in the filter paper was washed repeatedly with distilled water and the volume of filtrate was made up to 15ml. 5ml samples were treated as in (a) and the thiocyanate content was determined from the standard curves.

(a) Thiocyanate in Water leaf and Bitter leaf deep colouring pigment in the vegetable was separated by (Alos) column which retained all the colouring pigment release thiocyanate quantitatively. Three gram of water leaf and bitter leaf (triplicate) was crushed with clean sand (GR, E, Merck), extracted with distilled water and the watery extract column was repeatedly with glass distilled water and the volume of eluent was adjusted to 50ml

five ml Eluent was taken separately into two tubes, mixed with 5ml of 0.4m ferric Nitrate in N-Nitiric Acid and to one, 1 drop of mercuric chloride (5%) was added to block thiocyanate.

Absorbance of both blank all test sample were measured at 460nm. Thiocyanate contents in test samples were computed from standard curve.

 (b) Determination of Thiocyanate in Bitter leaf and water leaf.

Three (3) gram vegetable (triplicate) was crushed with clean sand, extracted with distill water (25ml) as refluxed for 20 minutes in a conical flask.

The substance was cooled and filtered. The residue in the filter paper was repeatedly washed with distilled water and the volume of the filtrate was made up to 50ml. 5ml filtrate sample were treated as in (a) and thiocyanate content was determined from standard curve.

**RESULT**

The result of the analysis showed that raw bitter leaves contain thiocyanate of 0.89±0.009 and 0.74±0.005 in cooked condition while water leaves contain thiocyanate properties of 0.86±0.006 under raw and 0.85±0.002 for cooked.

**Table of Average value of thiocyanate in mg/Kg wet weight**

|  |  |  |
| --- | --- | --- |
| Samples | Uncooked  | Cooked |
| Bitter leaves | 0.89 ± 0.009 | 0.74± 0.005 |
| Water leaves  | 0.86 ± 0.006 | 0.85 ± 0.002 |

**DlSCUSSION**

The giotrogenic properties were measured in the present study of raw and cooked condition because these food stuffs are generally consumed after cooking. A relative variation in the content of goitrogenic properties was found between cooked and raw conditions, but thiocyanate content was found to have decreased after cooking. Oruma *et al*. (2021) in a similar study reported the reduction of the Goitrogenic (cyanogenic glycosides and glucosinolates) Content of Pumpkin Leaves (*Telfairia occidentalis*) and Spinach Leaves (*Spinacia olairaceae*). Of the two vegatables studied, water leaves had the highest thiocyanate content in raw and cooked conditions respectively. Bitter leave has 0.89 ± 0.009mg/kg thiocyanate in raw condition and 0.74 ± 0.005mg/kg thiocyanate in cooked condition. Raw water leaf had 0.86 ± 0.006mg/kg but after cooking 0.85 ± 0.002mg/kg thiocyanate was found. A significant proportion of human diets are composed of Astaracea and portulacacea vegetable that include bitter leaf and water leaf respectively.

Thiocyanate content of bitter leaf and water leaf were measured in both cooked and uncooked plants because these plants are often consumed after cooking. The study showed that thiocyanate content decreased in cooked water leaf followed by bitter leaf and in uncooked state, the thiocyanate content of water leaf was high compared to bitter leaf which shows that thiocyanate content was reduced. During cooking because cooking cause greater reduction. Thus, appear to be the most effective method of reducing thiocyanate content. This was partly due to the heat sensitive nature of the active principle and the fact that cooking destroys active enzymes involved in thiocyanate formation at about 72°C (Tewe, 2003). This can also be attributed to the prior processing step such as drying and grinding. Previous studies revealed that drying and grinding reduces the thiocyanate content of than cooking alone (Tewe, 2003). Earlier studies revealed that heating reduces thiocyanate content, whereas, the effect of boiling is more reliable and constant (Master, 2008).

**CONCLUSION**

The result obtained from the effect of processing on goiterogenic thiocyanate content of water leaf and bitter leaf showed that the thiocyanate content of water leaf is reduced in cooked condition than in bitter leaf, therefore individuals who use bitter leaf and water leaf should ensure that they are cooked to decrease the thiocyanate content as cooking was found to reduce the content of thiocyanate to a level suitable for regular consumption especially when the cooking time was extended to 30 minutes. The content of thiocyanate was reduced in cooked leaves than in raw leaves. Water leaf and bitter leaf should be cooked before consumption as cooking reduces the level of thiocyanide in them.Other processing methods such as frying, air drying should be iivestigated to determine the best means of reducing goitrogens in leaves.

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