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Comparative Effects Of Processing On The Cyanide Content Of Manihot Esculenta , Glycine Max And Zea Mays

Research Article

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Abstract

The effects of varying processing treatments on the cyanide content of *Manihot Esculenta*, *Zea Mays* and *Glycine Max* were determined using picrate kit method and the following mean concentrations in ppm were obtained: 0.10, 0.00, 0.00, 0.00, 0.01, 0.00, 0.02,0.00, and 0.00 for Cassava, Garri, Fufu, Tapioka, Soybean, Vitamilk, Raw maize, Roasted maize, and Boiled maize respectively. There were statistically significant differences ($P \leq 0.05$) among all raw samples analysed for the observed phytotoxin (Cyanide) levels. The results obtained from the processed and unprocessed food products generally showed a marked difference ($P \leq 0.05$) in cyanide levels between raw and processed food products and this implies that food processing has a marked effect on the cyanide content of different food types indicating success in degradation of cyanide by heat. Heat treatments therefore reduced the cyanide content (approximately 100%) in tested food crops thereby making them suitable and safer for consumption outside creating variety.

Key Words: Cyanide, Food processing, Heat treatment, Raw, Phytotoxin

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Introduction

Food crops are important sources of food for the human population and are used as food from which energy is derived to drive biochemical processes in the body anabolic and catabolic routes. In Nigeria, these food crops include cassava (Manihot escunlenta), maize (Zeamays) and soy (*Glycine Max*), and individuals generates ATP (Adenosine triphosphate) from the glucose content of these food crops. However, these food crops have some constituents like Cyanide (Okafor, 2004)that are toxic to mammals when harmful amount is consumed. Such levels could lead to serious side effects such as headaches, vomiting, chest pain, blood changes, thyroid gland enlargement, effects on the brain and heart, goiter and partial paralysis. These common food crops identified ultimately, are subjected to varying processing treatments before consumption by humans and needs evaluation vis – a – vis the potential processing effects on the cyanide content.

Some parts of cassava (*Manihot Esculenta*) are edible such as the tuberous root and leaves. Most part of African countries, especially Nigeria uses this food crop as amajor source of food when it has been processed into garri, tapioca, flour (used in baking bread),andfufu. The soil in Africa is favourable for the cultivation of cassava since it is heat loving plantthat requires a minimium temperature of 80oF for its growth (Oke, 1978). The leaf of this plant is eaten as vegetable in parts of Africa and Asia due to its rich vitamin content (Oke, 1978). Some chemicals naturally present in food are cyanogenic glycosides (Okafor et al., 2001) from cassava, aflatoxin from food infected with the mould, aspergillus flavus, lysergic acid from grains contaminated by the mould clavicepspurpurea (Conn, 1973; Hartson, 1977; Lowenfels and Anderson, 1977; Obioda and Obonna, 1981). .Cassava paste is packed into bags and tied tightly to remove all possible water content so that a dry form of the processed crop is obtained which is later transferred to a sieve to obtain fine powder particles that are fried at high temperature to produce garri. Cassava can also be used to produce 'tapioca' byboiling the clean peeled root in water to a temperature above 100oC.In the same vein, this applied heat destroys the cyanide present in the crop. The boiled cassava root is thensliced into small rectangular shaped portions and soaked in hot water for about 10hours. The rectangular shaped cassava rootobtained is packaged and sold as 'tapioca'. MAIZE (*Zea Mays*) also known as corn, is used widely as food in most part of Nigeria; it could be boiled or roasted to make it edible, the leafy stalk produces ears which contain seeds referred to as kernels. This food crop was carried from Europe to Africa in the 15th and 16thcenturies (Oke, 1978). It cangrow in different climatic conditions and has a sweet corn variety which is a sugar rich varietythatis mainly used as food to humans; field corn variety serves as feed to animals . Somechemicals such as cyanogenic glucosides, aflatoxin from food infested with the mould aspergillus flavins, lysergic acid from grains contaminated by the mouldclavicepspurpurea (Conn, 1973; Hartson, 1977; Lowenfelsand Anderson, 1977; Obioda and Obonna, 1981) are naturally present in varying amount. This sweet corn is harvested early and eaten as a veg-

etable. For scientific reasons, maize is used in global context; in bulk trading however,corn is used as seen in the names of certain products made from maize such as popcorn, cornflakes and so on.

Maize can be ground into flour (Oke, 1978). Freshly harvested maize crops are assembled and packed into bags or othercontainers for transportation from the farm land to processing locations where the outer layers of the crop are removed to expose the grains attached to a stock.These grains are processed into different products depending on what is desired; it could be transferred into a pot and boiled to a temperature above 100oC for about 10 hours to obtain boiled corn. During the cookingprocess, salt is added to the crop to enhance its taste. The freshmaize could also be roasted on fire to give roasted corn, the covering layers of the maize plant are removed and the grains attached to stock exposed after which the maize is placed on a metal surface under which heat from char coal is applied to the maize through the openings on the metal surface. This applied heat changes the colour of the maize from white to light brown, and this is done for about 40minutes while turning to ensure even heating. SOY (*Glycine Max*): Soy also known as *Glycine Max* or soy bean is a fabaceus leguminous food crop that is rich in proteindue to its rich essential amino acid content (Lawrence, 2010). It is used to produce Soy milk, infantformula, et cetera. it contains isoflavones that helps to prevent occurrence of osteoporosis, cardiovascular diseases as well as cancer (Oke, 1978). Soy contains a certain percentage ofcyanide sugars that are harmful to individuals when consumed at a toxic concentration. It is a good source of protein that contains small amount of saturated fats and does not contain cholesterol; this food crop is called soy bean by Americans and soyabean by the British, most Nigerians do call it soyabean where it is used for several milk products such as Vitamilk (Oke, 1978), powder and paste. Soy bean is an agricultural crop of tremendous economic importance; this crop and food items derived from it form dietary components of numerous people (Davut, 2011). Another product gotten from Soy isvegetable oil which is derived from processing and is widely used in industries.

Soy beans contains a reasonable am/ount of phytic acid, alpha – linolenic acid,isoflavones,genistein and daidzen (Oke, 1978). Cyanide is a chemical that can exist as a gas or solid and that is poisonous when consumed orinhaled (CEC, 2006). It is a compound that is made up of cyano group –CN, that consist of triple bonded carbon atom to nitrogen. Most cyanides are highly toxic to mammals; it forms compound with other chemicals when attached to them such as hydrogen cyanide , sodium cyanide and so on (Nartey, 1978). Some bacteria, algae and fungi do produce cyanide which also exist in food crops such as *Manihot Esculenta* (cassava), *phaseolus Lunatus* (Lima beans) commonly called Akidi by the Igbos in Nigeria, *Glycine Max* and maize (*Zea Mays*) (CEC, 2006).

Materials And Methods

The materials, reagents and chemicals used in this research work are of high quality and analar gradeand include – cyanide buffer, cyanide reagent, cyanide indicator reagent, hydrochloric acid, sodium hydroxide, test tubes, 5ml glass caps, plastic spatula, plastic pipet (0.05ml), pH short range test paper (pH 9-14), plastic stirring rod, comparator, picrate acid and analysis kits

Sourcing and preparation of samples

Samples used in this research work were purchased fromdifferent markets in Port Harcourt, Rivers State (mile 3 market, mile 1 market and Everyday supermarket). These samples include – freshly harvested cassava tuber, tapioca, fufu, garri, freshly harvested maize, roasted maize, boiled maize, soy bean, and vita milk (made from soy). The samples where cut into small portions and placed in a well labeled transparent container with cover.

Determination of the cyanide content in choice samples

Picrate kit method was used to determine the cyanide levels in certain food samples in a step by step analytical procedure that depends mainly on colour changes in the sample being analysed; each cyanide level has his own colour code from which the cyanide level in a particular sample can be determined through the following procedures – the portable balance was placed on its U-shaped plastic mount so that it swings freely, pestle and mortar were used to grind roasted or hard samples into powder. The process involves comparing a derived colour to the colours in a cyanogenic kit colour chart to determine the level of cyanide in each sample. The flour was added to an empty spatula until balance was gained. Developed colour was compared with the colour on the cyanogenic kit colour chart which indicated the presence or abscence of cyanide and the concentration if present.

Statistical Analysis

Means and standard errors of triplicatedeterminations were calculated and tabulated. Analysis of Variance, ANOVA was done using EXCEL WINDOWS 2003.

Results

The levels (ppm) of cyanide in Garri, Cassava tuber, Maize, boiled maize, roasted maize, tapioca, fufu, and vitamilk are as shown in table 3.1. Detectable ranges of 0.01ppm to 0.10ppm were obtained for Cassava tuber, soya bean and raw maize while cassava tuber ranked highest among all measured samples.

Discussion

Availability of cyanide in choice food items and effects of processing was evaluated by picrate kit method which involves comparing derived colours to the colours on a cyanide comparator colour chart. Nigerian staple food crops (Cassava and Maize) and Soya bean gave phytotoxin (cyanide) values that exceeded WHO limit (0.00 ppm) for cyanide in food in food materials. Food crops are important sources of food nutrients (Lawrence, 2010), energy, protection and repair to the human population. The processing of food crops into food products has a significant effect on the properties of the food in terms of taste, aroma and colour, as well as changes in the chemical compounds present in such a food such as cyanide (Bo urdoux et al., 1980), which is a chemical that can exist as a gas or solid, and that is poisonous to the body when consumed or inhaled. The cyanide values obtained from the different samples in this work showed 100% degeneration by heat treatment for the different processed food samples (Fig 3.1).
Processing, therefore reduced the cyanide content in food crops thereby making them suitable and safer for consumption outside creating variety. Significant elavated levels of 0.1ppm cyanide content was observed for raw cassava tuber. Twocyanogenicglycosides, Linamarin and Lotaustralin occur generally in manihotspecies. Linamarin accounts for 93-97% of the total cyanogenic

glycoside content of cassava (Nartey, 1978). When an individual is exposed to high levels of cyanide, his brain and heart could be affected, chest pain, vomiting, blood discharges, thyroid gland enlargement, liver damage and headaches are all effects of exposure to cyanide (Ekpechi, 1973; Hartley et al., 1963). There were statistically significant differences ($P \leq 0.05$) among all raw samples analysed (Table1). The results obtained from the processed and raw samples implies that varying food processing has a marked effect on the cyanide content of different tested food types; thus indicating success in degradation of cyanide by heat.

Conclusion

Food Processing has a marked effect on the cyanide content of food crops as was evidentin this work. Presence of cyanide was observed in raw food samples while there was no trace of cyanide in processed samples, which indicates the elimination of cyanide from the raw samples by various processing methods. Food processing should be adequately done to reduce the possibility of cyanide intake by individuals so as to prevent inherent toxicity and to drive good public health.

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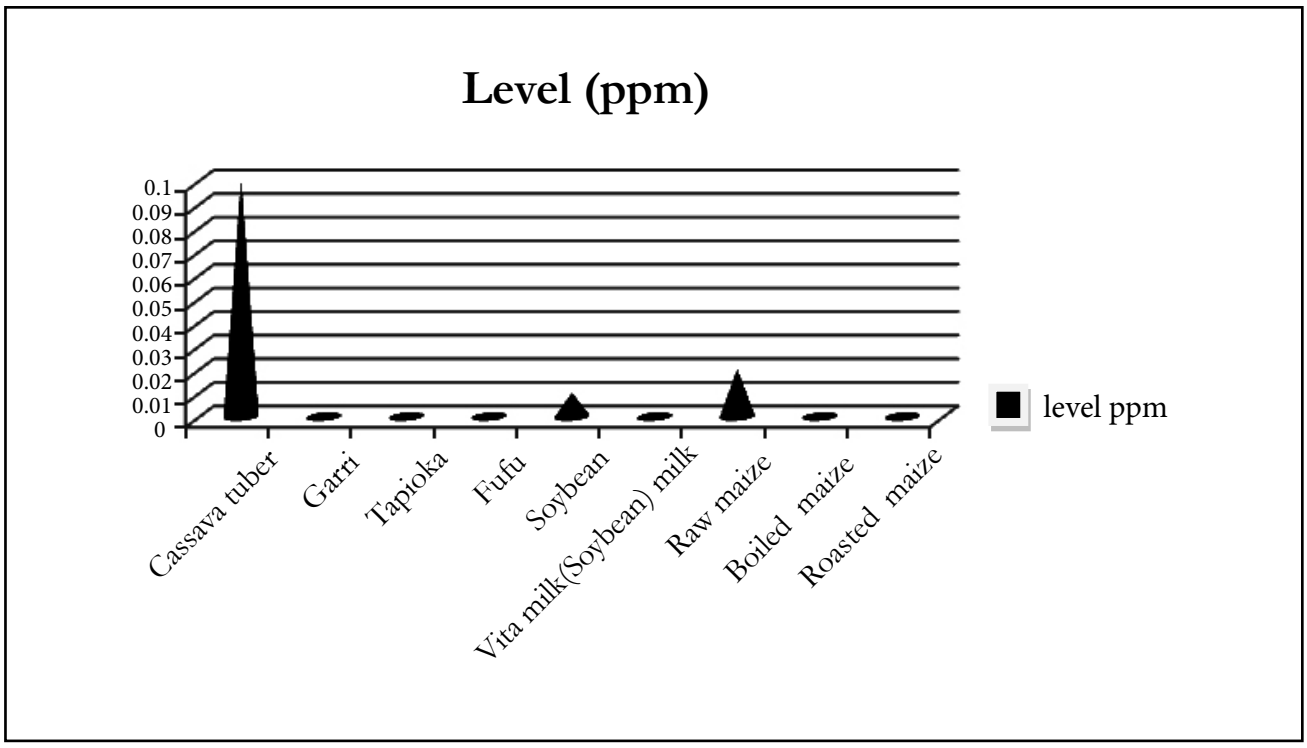
Table 1: Mean Cyanide content of Choice Food items

Sample	Mean concentration (ppm)
Garri	0.00a±0.00
Cassava tuber	0.10b±0.02
Tapioka	0.00a±0.00
Fufu	0.00a±0.00
Soybean	0.01c±0.00
Raw maize	0.02cd±0.001
Boiled maize	0.00a±0.00
Roasted maize	0.00a±0.00
Vita milk(soybean milk)	0.00a±0.00

Values are mean ± SE of triplicate determinations. Means in the same colum with the same alphabet are not significantly different ($P \leq 0.05$).

Figure 1: Effect of Processing on Cyanide content of Cassava, Soya bean andMaize samples



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