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Research Article

Effect of Cooking in the Level of Anti- Nutritional Composition among Eight Varieties of Cultivars of Sweet Potatoes

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ABSTRACT

Anti-nutritional compositions (oxalate, tannin, phytate, saponin, and hydrogen cyanide) of both cooked and uncooked samples among four varieties of sweet potatoes grown in Abakaliki, Ebonyi State of Nigeria were determined. From the result, it showed that anti-nutritional factors (oxalate, tannin, phytate, saponin, alkaloid, hydrogen cyanide), were present in all the varieties of sweet potatoes. The results showed that the sweet potato varieties were highly significantly different ($p>0.01$) in all the anti-nutritional factors. These constituents were moderate in all the varieties; this obviously make the varies under study a nutritious food as the concentration of anti-nutrient does not exceed the recommended daily dose. Cooking significantly reduced the levels of the anti-nutritional factors with the average percentage reduction following cooking in Tis-86/0356 for instance 14.97% (Alkaloid), 11.11% (Oxalate), 6.94% (Phytate), 61.91% (Tannin), 61.46% (Hydrogen cyanide) and 36.83% saponin and also to other varieties. Hence consumers of sweet potatoes should cook the potato before consumption to enhance its nutritional benefit.

Keywords: Food crops; Anti-nutritional factor; Food value; Plant food; Root crops; Varieties

INTRODUCTION

Sweet potatoes, scientifically known as *Ipomoea batatas*, are a vital source of nutrition and have been a staple food crop in many parts of the world for centuries. Their versatility in culinary applications and nutritional value make them an essential component of diets in various regions, especially in developing countries. However, sweet potatoes, like many other plant-based foods, contain naturally occurring anti-nutritional compounds, which may affect the bioavailability of essential nutrients and overall nutritional quality.

Anti-nutritional compounds are substances found in various foods, particularly plant-based sources that can interfere with the absorption and utilization of essential nutrients by the human body. These compounds can affect the bioavailability of vitamins, minerals and potentially hinder their health benefits. In the context of sweet potatoes, several anti-nutritional factors have been identified, including oxalates, phytates, tannins, and protease inhibitors. Understanding how these compounds are affected by different cooking methods is significant for optimizing the nutritional value of sweet potatoes and ensuring their contribution to a balanced diet.

The effects of cooking on the nutritional quality of foods are complex and can vary depending on several factors, including the type of food, cooking method, and specific compounds present. Sweet potatoes are no exception to this rule, and the diversity in sweet potato cultivars further adds complexity to the equation. Sweet potato cultivars vary not only in taste and texture but also in their nutritional composition, including the levels of anti-nutritional compounds.

This study aims to investigate how cooking methods influence the levels of anti-nutritional compounds in eight different varieties of sweet potato cultivars. The selection of these eight varieties allows for a comprehensive examination of the potential variability in anti-nutritional composition among sweet potatoes, as well as how cooking can impact these levels.

Cooking methods can significantly alter the nutritional composition of foods. For sweet potatoes, commonly employed cooking methods include boiling, steaming, baking, frying, and microwaving, each of which can affect the levels of anti-nutritional compounds differently. Understanding the changes in these compounds as a result of cooking is significant for making informed dietary choices and promoting sweet potatoes as a nutritious food source.

Furthermore, the impact of anti-nutritional compounds on human

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health is multifaceted. While some anti-nutritional compounds can be detrimental when consumed in excess, others may offer potential health benefits, such as antioxidants. It is important to strike a balance between minimizing the presence of harmful anti-nutritional factors and maximizing the retention of beneficial compounds during cooking.

In conclusion, sweet potatoes are a globally important food source, and understanding the effect of cooking on the levels of anti-nutritional compounds in different sweet potato cultivars is essential for promoting their optimal consumption. This study aims to explain on how various cooking methods may influence the nutritional quality of sweet potatoes, ultimately contributing to more informed dietary recommendations and a better utilization of this nutritious crop.

The sweet potato (*Ipomoea batatas*) is a dicotyledonous perennial plant which belongs to the family Convolvulaceae [1,2]. Both the roots and the leaves of sweet potatoes are edible. It is the seventh most important food crops after wheat, rice, maize and cassava [3], being cultivated in more than 100 countries [4,5], with the world's average productivity of 15 ton/ha. Global production of sweet potato is estimated to be over 105 million metric tons annually [6].

Sweet potato has the advantage of high yield, high resistance to drought and wide adaptability to various climates and farming system [7,8]. Sweet potato has the advantage of high yield, high resistance to drought and wide adaptability to various climates and farming system [9,10]. For this reason, sweet potato is considered as strategic famine-relief food for countries with unreliable rainfall condition like Ethiopia. Moreover, it is also used as a cash crop and hence it is means of income generation for rural households to drive their livelihood.

Currently, different varieties of sweet potato cultivars are cultivated and consumed. These cultivars contain different skin color example pink, green, orange and white, and flesh colors example white, cream, orange and yellow. As with all crops the nutritional status of sweet potato cultivars vary from place to place depending on the climate, soil type, the crop variety and other factors [11]. Depending on the variety sweet potatoes are rich in nutrients [12]. However, with all its desirable traits, sweet potatoes also contain potential plant toxins and anti-nutritional factors such as phytate, oxalate and tannin [13], which affect the nutrient utilization in the body. This study was conducted with the aim of knowing the effect of cooking on the antinutrient content of sweet potato cultivars currently cultivated and consumed.

MATERIALS AND METHODS

Plant materials

The materials used for this research project were four varieties of sweet potatoes (*Ipomoea batata*). They include: TIS-86/0356, TIS-8441, CPI-Tazanian, and Wagabalise.

Processing of plant materials

Before analysis, pre-processing of the samples was done as follows: The samples were peeled, washed and 50.0 g of each sample were weighed with weighing balance. Then these were crushed into slurry form prior to the analysis.

Method of analysis

Method of AOAC (1990) were used to determine saponin, alkaloid and oxalate while tannin and phytate were determined using FAO, (1985) and cyanogenic glycoside was determined by Bradbury et al., (1999).

Statistical analysis

The data obtained were subjected to inferential studies using Statistical Analysis for Sciences, SAS (Figures 1-4).

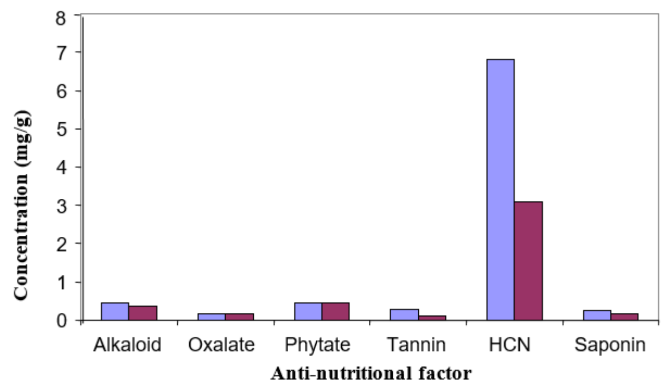

Figure 1: Level of antinutritional content in uncooked and cooked samples of 86/0356 of sweet potato **Note:** ( ) Uncooked ( ) Cooked

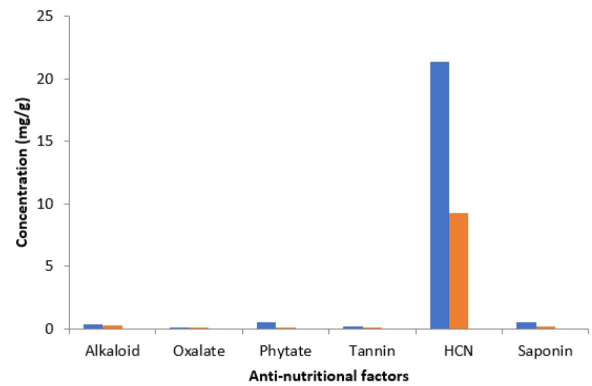

Figure 2: Level of antinutritional content in uncooked and cooked samples of TIS-8441 of sweet potato **Note:** ( ) Uncooked ( ) Cooked

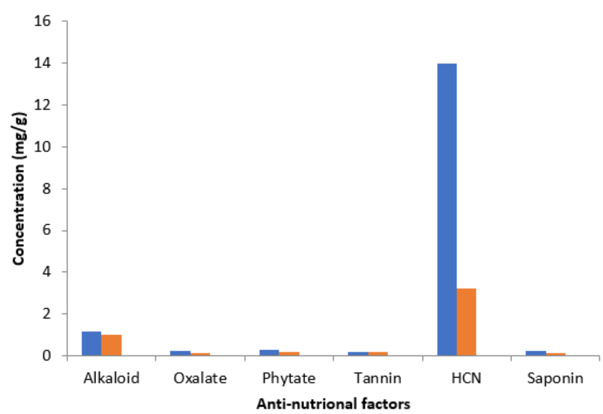

Figure 3: Level of antinutritional content in uncooked and cooked samples of Wagabalise of sweet potato. **Note:** ( ) Uncooked; ( ) Cooked

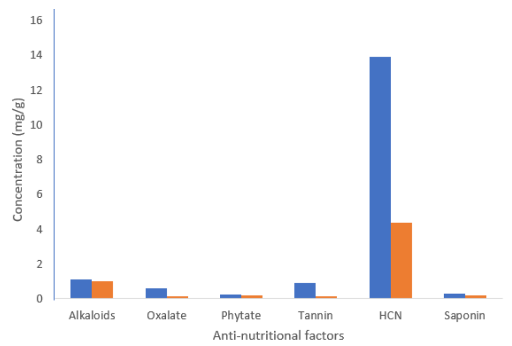

Figure 4: Level of antinutritional content in uncooked and cooked samples of CPI-Tanzania of sweet potato. **Note:** (■) Uncooked; (■) Cooked

RESULTS AND DISCUSSION

The results of anti-nutritional factors in the cooked and uncooked sweet potato varieties were presented in Figures 1 to 4. From the result it reveals that the values of hydrogen cyanide had the highest value in TIS-8441 (21.4 ± 0.02 mg/g) while TIS-86/0356 had the least value 7.8 ± 0.01 mg/g and these values were reduced to 9.30 ± 0.02 mg/g and 6.95 ± 0.03 mg/g respectively after cooking, therefore their percentage reduction is 56.54% and 10.89% respectively. The values are far below lethal dose for Hydrogen Cyanide (HCN) in man (50 mg/kg-60 mg/kg) body weight as reported by Gernah, et al (2007) [14]. This implies that the varieties of potato under studies are within the acceptable limit for human consumption and cooking help to reduce the concentration of the antinutrient to its minimal level. The phytate levels were 0.53 ± 0.02 and 0.26 ± 0.03 mg/g for TIS-8441 and CPI-Tanzanian respectively for uncooked sample, but for cooked sample the values are 0.12 ± 0.03 and 0.20 ± 0.04 mg/g respectively. From the result obtained, the phytate content in this studied is low when compared to the value 1.44 ± 0.01 mg/100 g obtained by Antia, et al (2006) [15], using sweet potato. The moderate level of phytate in sweet potato cultivars suggest that it will not render several mineral especially iron and zinc biologically unavailable to animals and human that feed on the potato in the study areas [16]. Also, moderate level of this phytate in the varieties has the advantages of reducing oxidative stress in the body as they act as antioxidant, hence reducing the chances of getting diseases such as cancer and cardiovascular disease [17]. TIS-8441 had the highest saponin concentration with a value of 0.54 ± 0.019 mg/g for uncooked sample but for cooked sample the concentration reduced to 0.22 ± 0.02 mg/g and is low when compared with the value 17.80 mg/g obtained by Anita, et al (2006) [18], which were considered to be safe for human consumption. CPI-Tanzanian had the highest tannin concentration with a value of 0.41 ± 0.012 mg/g for uncooked sample and 0.12 ± 0.03 mg/g for cooked sample and the value is moderate when compared to the value 0.21 ± 0.02 mg/100 g obtained by Antia, et al (2006) using sweet potatoes which were considered to be safe for human consumption.

CONCLUSION

From the foregoing discussions, it can be concluded that all the varieties of sweet potatoes examined contained moderate levels of anti-nutritional factors, including oxalate, tannin, phytate, saponin, alkaloid, and hydrogen cyanide. This suggests that these sweet potato varieties can still be considered a nutritious food, as the concentrations of these anti-nutrients do not surpass the recommended daily limits. These varieties when cooked the concentration of the anti-nutritional factors were significantly reducing to safer level and also ensures high bioavailability of nutrients. Therefore, cooking or processing of sweet potatoes is important if the sweet potatoes is for human consumption. Future research could delve deeper into the specific health implications of anti-nutritional compounds in sweet potatoes and explore innovative cooking techniques that can enhance both the reduction of harmful compounds and the retention of beneficial ones. As we continue to strive for a better understanding of the relationship between cooking and nutrition, sweet potatoes stand as a valuable and versatile food source with the potential to contribute significantly to global food security and health.

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