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Research Article

Effect of Cooking on the Nutritional Value of Turkey Berry

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Abstract

The study investigated the effect of cooking on the proximate and mineral composition of turkey berry. The proximate composition of turkey berry was affected by cooking specifically boiling. The moisture content of turkey berry increased significantly when the heat was applied however, the protein, carbohydrates, and fiber content decreased when cooked in relation to the raw sample. Regarding the ash and fats and oil, the parboiled sample had the highest value followed by the raw and then the boiled sample. Concerning how cooking affects the mineral composition of turkey berry, it was demonstrated that cooking significantly affected the mineral composition of turkey berry. The iron, copper and potassium, sodium, calcium, magnesium and phosphorous content in turkey berry decreased significantly when the heat was applied. It was therefore recommended for the attainment of specific nutrients in turkey berry it will be appropriate to prepare it in their raw, parboiled, or boiled state. Again, since, boiling decreased the mineral composition of turkey berry, it will be appropriate to add the water used in boiling in the turkey berry to any food preparation.

Keywords: Turkey Berry; Proximate Composition; Boiled; Parboiled; Mineral Content

Introduction

Turkey Berry is one of the numerous wild fruits and vegetables that is preferentially consumed mainly because of its true nutritional and medicinal values and essential micronutrients. The consumption of turkey berries has increased significantly in recent years [1] in sub-Saharan African countries. Turkey Berry is considered a valuable health vegetable since they have a high level of dietary fiber and other beneficial compounds which are used in addition to staple foods for a balanced diet. Most green leafy vegetables such as turkey berries are good sources of vitamins and minerals and when combined with a variety of foods, help to contribute to optimal body and brain growth, development, and maintenance, as well as overall good health [2].

Turkey berries are also an essential source of bioactive compounds with potential medicinal value. The medicinal use of turkey berry has a very long tradition in Thailand, South America, and India [3] whereas in the West African countries, the study of the bioactive compounds and their health benefits of turkey berry has only recently emerged [1,4]. The medicinal properties of turkey berry have been reported by the scientific community including anti-inflammatory, antioxidant, antiviral, anticancer, antimicrobial, immunomodulators and antidiabetic effects [5-7]. Various extracts from turkey berry are known to be useful in the treatment of colds, hypersensitivity, coughs and other skin diseases. Numerous positive effects have been associated with the presence of irons, which boost the blood levels of individuals and are mostly used for the treatment of anemia Asiedu-Addo, 2014, especially among pregnant women in Ghana. It can therefore be inferred that the nutritional value of turkey berry in our foods cannot be downplayed.

A review of literature points out that, every 100g of fresh turkey berry contains 85.4g of moisture, 10.7g of carbohydrate,

2.4g of protein, 6.1g of fiber, 0.4g of fat and about 0.12g of ash [8]. With respect to the mineral composition of turkey berry [8] opined that every 100g of turkey berry contains 104 mg of Calcium, 4.6 mg of iron, 70 mg of Potassium. Therefore, the addition of turkey berry in a particular local diet being it soup, or stew adds on to the macro and micronutrients in the diet. Literature also points out that, turkey berry like other vegetables may be eaten raw or cooked depending on the type of food being prepared, however, turkey berries are mostly cooked before consumption in Ghana. Food processing techniques such as cooking, and frying have been reported to have inevitable consequences on the nutritional value of foods especially [9]. According to [10] cooking alters the physical look and nutritional content of many foods significantly, especially vegetables. The macro-and micronutrients found in vegetables, such as protein, carbohydrates, fats, vitamins, and minerals, all have varying degrees of stability when processed, cooked, or stored and the degree of stability is largely determined by the type and structure of the food/nutrient, food chemistry, and the severity and duration of cooking [11]. For example, [12] assert that, boiling significantly influences the nutritional value of the final product of certain vegetables. [13] found that cooking has variable effects on micronutrients in indigenous vegetables.

This stands to reason that, cooking can increase or decrease the micronutrients of many indigenous vegetables such as turkey berry. [14] indicated in a study that cooking and blanching decreased certain micronutrients such as phosphorus in a leafy vegetable. [15] also described that cooking greatly affects the nutritional value of certain vegetables and legumes. However, [15] continued to recommend that, vegetables should be cooked in 7.5mins to maintain the nutritional profile. Similarly, [16] pointed out in their study that heating time is very crucial in the reduction of certain vitamin content in vegetables. It was further highlighted that an increase in heating time increases vitamin C reduction in certain vegetables. This means that, cooking is crucial in maintaining the nutritional content of many foods and since turkey berries are mostly cooked before consumption it is possible that their nutritional value could be altered. However, there is no evidence of how the nutritional content of turkey berries changes after cooking. As a result, this study, therefore, sought to investigate the effect of cooking on the nutritional value of turkey berry in Ghana.

Materials and Methods

Fresh turkey berries were purchased from Abura market, one of the principal market centers in the Cape Coast Metropolis in the Central Region of Ghana. After obtaining fresh turkey berry samples, all the experiments and further analysis were conducted at the School of Agriculture Food and Technology Laboratory at the University of Cape Coast. Firstly, four hundred and fifty grams (450 g) of washed fresh turkey berry were used for the experiment. The turkey berry was divided into three portions (150g each). The first portion of 150 g of turkey berry remained uncooked or raw. The second portion also of 150 g was parboiled for 1 minute and the third portion of the 150 g sample was boiled for 10 minutes under normal cooking temperature. After boiling, all portions were homogenized with a Philips blender into a semi-smooth paste and placed in a clean plain plastic bag (Ziploc), labelled and stored in a laboratory refrigerator for further experiment.

Chemical Composition of Turkey Berry

A proximate analysis procedure described by AOAC (1990) [17] was used in determining the proximate composition of turkey berry: moisture, ash, protein, fats and oil, carbohydrate and fiber. Data collected were presented in percentage protein, minerals, moisture content and percent complex carbohydrate (which represents fiber). The moisture content was determined by heating 10g of fresh turkey berry in a clean oven-dried crucible and then calculated as the percentage water loss by the sample. The ash content was determined by burning a sample of 2 g in a furnace at 600 °C for 2 hours Midkiff et al., 1984. The protein content of turkey berry was determined by the Kjeldahl method. Fats and oil were determined by the Soxhlet apparatus method of extraction using ether as described by A.O.A.C. (2005) [18]. The carbohydrate content was determined by the use of the colorimetric method specifically the anthrone method. Lastly, the fiber content was determined by using sodium hydroxide and sulphuric acid reagents.

Statistical Analysis

Mean values were derived for the chemical compositions of the berry samples in triplicate. One-way Analysis of variance and Duncan's multiple range tests were used to establish the significance of differences among food samples at the $P \leq 0.05$ level. ANOVA was employed to determine the Statistical difference in the effect of cooking on the mineral compositions of raw, parboiled and boiled turkey berry. Thus, to explore whether any difference exists in the mineral composition (iron, copper, zinc, potassium, calcium, magnesium and phosphorous) of raw, parboiled and boiled turkey berry samples.

Results and Discussions

Proximate Composition

Results from the statistical difference in the proximate composition of turkey berry is presented in Table 1. Proximate composition of protein, fat and ash of turkey berry was varied in all the forms, that is, raw, parboiled and boiled. Significantly, the boiled turkey berry sample had the highest moisture content of 97.11±.13% followed by a parboiled sample with a value of 96.46±.19%. The raw turkey berry sample had the lowest moisture content of 81.82±.34%. The ash content was significantly higher ($P<0.05$) in the parboiled sample (1.44±.01%) than in the raw (1.24±.02%) and the boiled sample (1.23±.00%). The raw sample of turkey berry had the highest protein content (15.3 ± .17%) followed by the parboiled sample (14.72 ± .15%). The boiled sample had the lowest protein content (14.26 ±.21%). This means that cooking significantly reduced the protein content in turkey berry. With respect to the fats and oil content, the parboiled sample had the highest fats and oil content (5.52 ± .01%). This was followed by the

raw sample (4.54 ± .03%) and then the boiled sample (4.15±.03%). The total carbohydrates present in turkey berry was highest in the raw sample (11.57 ±.16). the boiled sample followed with a value of 8.57±.23%. the parboiled sample had the lowest carbohydrate content with a value of 8.36±.20%. Lastly, the fibre content of turkey berry in the raw sample was relatively higher with 5.01±.06% than the parboiled and boiled samples. The parboiled and boiled sample relatively had similar moisture content with a value of 4.85±.06% and 4.82±.17% respectively. It can, therefore, be concluded that cooking generally increased the moisture content significantly (P<0.05) while decreasing the ash, protein, carbohydrates and fiber content of turkey berry.

Table 1: Proximate Composition of Turkey Berry.

Compositions	Raw (g)	Parboiled (g)	Boiled (g)
Moisture	81.82±.34	96.46±.19	97.11±.13
Ash	1.24±.02	1.44±.01	1.23±.00
Protein	15.3 ± 0.17	14.72± 0.15	14.26 ±.21
Fats and Oil	4.54 ± .03	5.52 ± .01	4.15±.03
Carbohydrates	11.57 ±.16	8.36±.20	8.57±.23
Fiber	5.01±.06	4.85±.06	4.82±.17

The result of the effect of cooking on the mineral composition is shown in Table 2. The study tested minerals such as iron, copper, zinc, potassium, sodium, calcium, magnesium and phosphorous. Table 2 showed that, turkey berries are good sources of elements such as Fe, Cu, Zn, K, Na, Ca, Mg and P. However, there were significant changes ($p < 0.05$) in all the mineral components tested in Turkey Berry, thus cooking caused significant changes ($p < 0.05$) in all the mineral elements tested as revealed in Table 2. The mineral content of raw, parboiled and samples investigated was presented in Table 2. Specifically, the level of iron in raw turkey berry was significantly (P<0.05) higher (18.30±.00 a mg/100g) followed by the boiled turkey berry (17.40±.00 mg/150g) and the parboiled sample (17.07±.00 a mg/150g). There was a statistically significant difference in the copper content of raw, parboiled and boiled turkey berries (p=0.00) with the raw sample having the highest value of 2.77±.00 a mg/150g followed by the parboiled sample (1.97±.00 a mg/150g) and boiled sample (1.43±.00 a mg/150g). This means that, cooking generally decreased the copper content in turkey berry. A similar result was observed in Zinc content. Zinc content in the raw sample (2.87±.00 ab, p=0.00) was significantly higher than the zinc content in the parboiled and boiled sample with a value of 2.10±.00 a mg/150g and 1.93±.00 b mg/150g respectively. The potassium, sodium, calcium, magnesium and phosphorous content significantly decreased when the heat was applied (p=0.00). In other words, the potassium, sodium, calcium, magnesium and phosphorous content was high in the raw samples and decreased when cooked.

Table 2: Mineral Composition of Turkey Berry.

Component	Raw (mg/150g)	Parboiled (mg/150g)	Boiled (mg/150g)	sig
Iron	18.30±.00^{a}	17.07±.00^{a}	17.40±.00	0.03
Copper	2.77±.00^{a}	1.97±.00^{a}	1.43±.00^{a}	0.0
Zinc	2.87±.00^{ab}	2.10±.00^{a}	1.93±.00^{b}	0.0
Potassium	1673.67±.01^{ab}	1572.07±.04^{a}	1527.87±.02^{b}	0.0
Sodium	601.50±.02^{ab}	516.00±.01^{a}	498.20±.00^{b}	0.0
Calcium	378.17±.03^{ab}	333.83±.01^{a}	303.90±.01^{b}	0.0
Magnesium	61.13±.00^{ab}	55.73±.00^{a}	54.80±.00a^{b}	0.0
Phosphorous	406.10±.00^{ab}	280.10±.01^{a}	288.87±.00^{b}	0.0

Discussion

It is shown from Table 1 that, there was high moisture content in all the samples under study, thus raw, parboiled and boiled samples. However, the moisture content of turkey berry significantly increased when the sample was cooked (97.11±.13) as compared to the raw sample (81.82±.34). The high moisture content of turkey berry in the boiled and parboiled sample may be due to the absorption of water used for the boiling into the turkey berry. Foods with high moisture content have a shorter shelf-life than foods with low moisture content. Therefore, parboiled and boiled turkey berry may deteriorate faster than raw berries. This is because the high moisture content will increase the activities

of water-soluble enzymes which are responsible for metabolic activities that result in food spoilage. Since the value obtained for the moisture content of raw turkey berry in this study is lower than the average moisture content for cabbage (92.00 ±.12), lettuce (93.80±.20) and tomatoes (93.50±.21) [19] it gives turkey berry a storage advantage over lettuce, cabbage and tomatoes. The finding of high moisture content (81.82) disagrees with the assertion [7] who opined that, there is about 85.4% of moisture in raw turkey berry. High moisture content in the boiled and parboiled sample in relation to the raw sample corroborates with the findings of Ramırez-Anaya et al., (2019) [20] who reported that boiled vegetables had a relatively high moisture content than uncooked vegetables.

The protein content in turkey berry reduced when heat was applied. it can be explained that heat changes the protein composition in food as reported by Henry et al, (1998) [21,22]. The high protein content in the raw, parboiled and boiled samples disagreed with the report of Cuda et al., (2002) who posited that, 100g of turkey berry has 2.4g of protein. The difference in the protein content may be due to the difference in samples (150g) used for the study. The protein content was relatively higher than garden eggs (7.80 ±.21) which suggests that turkey berry can serve as a secondary source of protein in a diet. Regarding the carbohydrates content of the three samples, the boiled (8.57±.23) and parboiled (8.36±.20) turkey berries showed a significant reduction compared with the raw sample (11.57 ±.16). The carbohydrates content range of 8.36±.20-11.57 ±.16 is closer to onions with a value of 11.60 g. However, since carbohydrate is a major source of energy for the body, turkey berries cannot be dependent as a major source of carbohydrates for the body (Weiner, 2010). The fibre content was relatively similar across the three samples: raw (5.01±.06), parboiled (4.85±.06) and boiled (4.82±.17).

The ash content in parboiled was relatively higher than in the raw and boiled sample. The ash content in the samples indicates the inorganic content in the sample where minerals could be obtained It was observed in Table 2 that turkey berry is a good source of vital micronutrients such as iron, copper, zinc, potassium, sodium, calcium, magnesium and phosphorous. Most of these nutrients play an essential role in the development of young children and infants. For example, calcium is essential for teeth and bone development. Iron is essential for treating anemia. Magnesium is required for the release of parathyroid hormone, as well as its function in the backbone, kidney, and gut and the processes involved in the conversion of vitamin D to its active form. The nutritional value levels of raw, parboiled and boiled turkey berry samples changed significantly when the heat was applied with the raw sample having the higher value in all the nutrients under study (as iron, copper, zinc, potassium, sodium, calcium, magnesium and phosphorous). This means that, cooking generally alters the mineral composition of turkey berry. Therefore, how turkey berry is prepared is a crucial factor in maintaining its nutritional value.

Conclusion

This study assessed the effects of cooking on the proximate and mineral composition of turkey berry. The study assessed how cooking affected the iron, copper, zinc, potassium, sodium, calcium, magnesium and phosphorous content in turkey berry. The results show an increase in moisture content when cooked and show a decrease in protein, carbohydrates and fibre content when cooked. With respect to the ash and fats and oil, the parboiled sample had the highest content, followed by the raw sample and then the boiled sample. Cooking caused a reduction in iron, copper and potassium, sodium, calcium, magnesium and phosphorous content in turkey berry. This decrease in nutrient composition could be due to the leaching of nutrients from the turkey berry into the cooking water during prolonged exposure to water and heat. In light of these findings, it can therefore be concluded that cooking clearly affects the proximate composition and the nutritional value of turkey berry. Hence the method of preparation of turkey berry is a key factor to maintaining the nutritional profile of this nutritious and medicinal vegetable.

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