EFFECT OF STORAGE AND INSECT INFESTATION ON PHYSICO CHEMICAL AND NUTRITIVE VALUES OF SUN DRIED YAM (DIOSCOREA ROTUNDATA)

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Abstract

Effect of storage and insect infestation on physicochemical and nutritive values of sundried yam (*Dioscorea Rotundata*) were studied. The samples were subjected to proximate and elemental analyses. There was a decrease in carbohydrate value of the infested yam compared with the uninfested yam which was also found to be lower than that of the raw yam. Copper, zinc, iron, magnesium, potassium, calcium and sodium were found to be 72.69 mg/100g, 70.58 mg/100g, 78.88 mg/100g, 71.70 mg/100g, 76.60 mg/100g, 60.06 mg/100g and 50.35 mg/100g in uninfested yam while the values of the mineral elements in the infested yam samples were obtained as 76.22 mg/100g, 75.91 mg/100g, 77.02 mg/100g, 76.08 mg/100g, 80.04 mg/100g, 64.55 mg/100g, 52.02 mg/100g compared to the raw yam which gave 74.44 mg/100g, 73.58 mg/100g, 79.99 mg/100g, 75.48 mg/100g, 78.26 mg/100g, 72.98 mg/100g and 51.50 mg/100g respectively. The Results showed that the samples were non-resistant to insect infestation with acute deterioration in food values.

Keywords: *Dioscorea rotundata*, storage, proximate, mineral analysis.

INTRODUCTION

Yam (*Dioscorea* spp) has been classified as important food for millions of people [1]. It is principally a carbohydrate food for energy and mineral supply [2] which also met the requirements of lipids because of their bulk composition. It is a seasonal crop that can be stored for different period of time. Yams are harvested and stored as tuber, dried and flour for sales and consumption [3]. Yam tubers are eaten boiled, roasted, fried and pounded.

Underdeveloped and developing countries are faced with food shortage due to insect attack, drought and other disasters [4]. The crop is attacked by pests during storage which causes not only postharvest losses but also nutrients' quality depletion [5]. Productivity of the crop therefore continues to reduce due to effect of insect such as yam beetles.

Report of studies on effect of storage and insect infestation on physico-chemical and nutritive values of sun-dried yam are scarce in the literature. This study therefore reports the extent of physico-chemical changes and

nutritive values loss due to the effect of storage and insect infestation on sun-dried yam which is very common with local way of storing the product.

Materials and Methods

Sampling

Tubers of yam were purchased from Iberekodo market, Abeokuta, Ogun State, Nigeria. The yams were processed, sun-dried and stored at ambient temperature (20-35 °C) for six months. Those infested during the storage were separated from the uninfested.

Proximate Analysis

Moisture content of the samples was determined according to method in literature [6]. The ash content of each sample (5 g) was determined at 550 °C, crude oil was extracted from 10 g of each sample by using 60-80 °C n-hexane, the crude protein was determined by using Nessler's modified Kjeldahl method of protein analysis while the crude fiber was determined by the trichloroacetic acid method [7]. Each milled

sample (2 g) was digested till the green solution formed disappeared. The digest was distilled and the solution titrated. The total carbohydrate was determined by subtracting the sum of the fractions of moisture, crude fiber, oil, ash and crude protein from the total content of the yam sample.

Elemental Analysis

The mineral elements of the infested and uninfested yam samples were determined through ashing at 550 °C and later treated with a mixture of concentrated nitric and hydrochloric acid (3:1) according to literature method [8]. Copper, Zinc, Iron, Magnesium, Potassium, Calcium and Sodium were determined from the infested and uninfested sun-dried yams by using Pye Unicam Atomic Absorption Spectrophotometer.

Results and Discussion

Analyses of the samples were carried out in duplicates and 5 percent deviation was allowed. The results for the proximate composition are as shown in Table 1 for the infested and uninfested sun-dried yams.

Moisture content of the infested was 10.96 % while the uninfested 8.75 %. This result agreed with 10.00 % of the infested grain crop reported by Sylvester et al. (2003) [9].

The ash content gave 3.24 % for the infested yam while the uninfested yam was 2.90 %. The values are comparable with 4.01 % and 2.98 % in earlier work reported by Omonigho and Ikenbomeh (2000) [1]. The crude fibre content of the infested sample 4.65 % agreed with 4.92 % of similar infested crop earlier reported by Sylvester et al. (2003) [9]. The crude fibre content of the uninfested yam sample was 4.55 % compared with the 4.11 % reported for *faidherbia albida* chew pods (Acacia) samples in literature.

Protein contents for the infested and uninfested sun-dried yams are 10.47 and 8.05 % respectively. These agreed with the

10.95 and 10.00 % reported in grain sorghum, a similar work reported by Pant and Susheela (1977) [5]. The total carbohydrate contents of the infested yam and uninfested yam samples gave 71.05 % and 78.55 which are closed to 69.86 % and 77.64 % reported in similar work on *faidherbia* (Acacia) *albida* by Lale and Igweburke (2002) [3]

The infested sun-dried yam gave 80.04 mg/100 g of potassium while the uninfested yam gave 76.60 mg/100 g (Table 2). These values agreed with 81.16 mg/100 g and 76.09 mg/100 g of potassium in infested and uninfested yams reported earlier in literature by Hahn et al. (1995) [2]. The iron contents of the infested yam and uninfested yam are 77.02 mg/100 g and 78.88 mg/100 g which are close to 82.12 mg/100 g and 75.98 mg/100 g reported on lipids of cereal grains by Nirmala and Kakilavani (1980) [10], Kibon and Maino (1993) [11]. The iron values are also comparable with 82.11 mg/100 g in infested yam and 77.08 mg/100 g in uninfested yam as reported in similar work on acacia sonegal by Molta et al. (1998) [12]. Copper, zinc and magnesium range between 72.20 mg/100 g and 76.08 mg/100 g in the infested sun-dried yam while the range is from 70.58 mg/100 g to 72.69 mg/100 g in uninfested sample (Table 2). The copper, zinc and magnesium are comparable with 74.99 mg/100 g and 76.44 mg/100 g in infested yam sample while there is also an agreement in uninfested yam values of 71.92 mg/100 g-72.02mg/100 g reported by Sylvester et al. (2003) [9]. The infested and uninfested sun-dried yams gave 52.02 mg/100 g and 50.35 mg/100 g of sodium contents. The infested yam sample was higher in calcium than uninfested yam by 4.49 mg/100 g. This agreed with 3.46 mg/100 g higher calcium in infested than uninfested sample reported earlier by Benzinger and Long 2000), Cakmak et al. (2002) and Maziya et al. (2002) [13-15]

Table 1: Proximate composition of raw, un-infested and infested yam

Sample	Moisture (%)	Ash (%)	Crude fibre (%)	Crude Protein (%)	Oil (%)	Carbohydrate (%)
Infested yam	10.96 ± 0.02	3.24 ± 0.03	4.65 ± 0.04	10.47 ± 0.03	1.28 ± 0.05	71.05 ± 0.03
Un-infested yam	8.75 ± 0.04	2.90 ± 0.01	4.55 ± 0.02	8.05 ± 0.03	0.98 ± 0.03	72.55 ± 0.02
Raw yam	13.28 ± 0.06	4.12 ± 0.08	4.99 ± 0.01	8.84 ± 0.04	1.18 ± 0.08	72.98 ± 0.06

Table 2: Mineral composition of infested and uninfested sun-dried yam

Sample	Cu(mg/100g)	Zn(mg/100g)	Fe(mg/100g)	Mg(mg/100g)	K(mg/100g)	Ca(mg/100g)	Na(mg/100g)
Infested yam	76.22 ± 0.0	75.91 ± 0.02	77.02 ± 0.01	76.08 ± 0.01	80.04 ± 0.01	64.55 ± 0.02	52.02 ± 0.03
Un-infested yam	72.69 ± 0.01	70.58 ± 0.01	78.88 ± 0.03	71.70 ± 0.03	76.60 ± 0.01	60.06 ± 0.02	50.35 ± 0.02
Raw yam	74.44 ± 0.02	73.58 ± 0.08	79.99 ± 0.01	75.48 ± 0.04	78.26 ± 0.08	72.98 ± 0.01	51.50 ± 0.06

Discussion

Increase in moisture content of the infested sample could be due to the presence of insect in the sample and also defecation of the pest which could promote spoilage. The higher oil content of 1.28% in the infested yam than the raw yam of 1.18% could be attributed to the presence of insect in the infested yam compared with the lower result of 0.09% than the raw yam obtained for the uninfested sun-dried yam which could be related to storage effect in agreement with 1.19% of the infested reported by Matilda et al. (1993) [4]. The higher crude fibre content obtained for the infested yam than the uninfested yam could be due to the effect of the insects on the infested yam while the lower values of both the infested yam and uninfested yam than the raw yam of 4.99% suggests the effect of storage. The difference between the protein contents for the infested

and uninfested sun-dried yams could be due to the presence of the insects in the infested sample. The high protein content of the infested yam sample may not imply its usage as protein supplement due to possible side effects which could be due to the presence of proteineous insect in the infested yam. The results suggest depletion in the carbohydrate value of the infested sample. The availability of the mineral elements might be due to their absorption and accumulation from the environment and effect of the presence of the insects in the infested yam while their availability in the raw yam and the uninfested yam could be as a result of absorption and accumulation from environmental effect. The elemental accumulation in the yam samples could also be due to environmental leachate that could be as a result of water movement from one place to another.

Conclusion

This study reports the extent of physicochemical changes and nutritive values loss due to the effect of storage and insect infestation on sun-dried yam which is very common with local way of storing the product. There was evidence of increase in oil content of the infested yam as related to the oil values of the raw yam and uninfested yam which could be attributed to the insect infestation effect that could lead to spoilage. Increase in moisture content of the infested sample could also be due to the presence of insect and their defecation which could promote spoilage. The difference between the protein contents of the infested and uninfested sun-dried yams could also be due

to the presence of insects in the infested sample which may not imply its usage as protein supplement due to possible side effects. The elemental accumulation in the samples could be due to environmental leachate attributed to movement of mineral elements from one place to another through underground water. The result revealed marked depletion in carbohydrate value which is the highest content of yam. Other factors marginally vary, but could affect the taste of the infested yam and quality in making different yam products.

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