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Biochemical Analysis of Beanweevil Infested Cowpea Flour

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Abstract

Beanweevil (*Callosobruchus maculatus*) was reared and allowed to damage cowpea severely, while the heavily infested cowpea was then processed into flour. The nutritional composition of heavily infested cowpea flour and *Callosobruchus maculatus* were investigated using Association of Official Analytical Chemists (AOAC). The result showed that, infested cowpea flour has; 15.50% of Protein, 226 µg/100g of Vitamin A, 17.39 mg/100g of Vitamin C, 1.67 mg/100g of Vitamin B, as for Minerals; 200 mg/Kg of Calcium, 650 mg/100g of Phosphorus, 528 mg/100g of Iron and 110 mg/Kg of Magnesium. It was concluded that, there was high depreciation in the nutritional composition of infested cowpea when compared to non-infested cowpea, which was due to the weevil infestation.

Keywords: *Callosobruchus maculatus*, Cowpea flour, Nutritional composition

1. Introduction

Though people are aware of the weevil infestations on the cowpea, yet they accidentally eat it along with their meal, not minding the side effect this could have. In Nigeria for example, heavily infested cowpeas are used to make cowpea flour, by dehulling, drying it in the sun and then milling it using milling machine. This cowpea flour could be used to prepare *akara* or steamed to prepare *moin-moin*, which they consume without considering its side effect to the human system. Cowpea contains more protein, vitamins and some elements and so good for human consumption.

Cowpea can be consumed as dried, fresh grain, and long stored dried grain, which is cooked; they are also dehulled to remove the seed testa, then ground to obtain flour. The flour obtained can be used to make various dishes or as an ingredient in recipes (FAO ^[1]). Cowpea is the most important source of vegetable protein in the daily diets of the rural and urban masses in the dry savannas of West and Central Africa and parts of East and Southern Africa (Singh *et al.* ^[2]). Because of its high protein, vitamins and mineral contents in daily diets, it impacts positively on the health of women and children (Mcwatters ^[3]). The addition of even a small amount of cowpea ensures nutritional balance of the diet and enhances the protein quality by the synergistic effect of high protein, high lysine from cowpea, high methionine and high energy from the starchy foods (Singh and Jackai ^[4]).

Cowpea grains, as well as the vegetative parts, make major nutritional contributions to diets. The mature grain contains 23-25% protein, B vitamins such as folic acid which is important in preventing birth defects and essential micronutrients such as Iron, Calcium and Zinc. Although a significant amount of cowpea is commercialized, it plays a critical subsistence role in the diets of many households in Africa, Latin America and Asia, providing nutrients that are deficient in cereals (Bingen *et al.* ¹⁵). Boiled whole grains are sometimes eaten with oil and seasonings, but more common uses of whole grains are mixture of cowpea and cereal, and as ingredient in soups and stews. The most common use of milled cowpea in West Africa is, fried cowpea ball "Akara" and steamed cowpea cakes "Moin-moin" in Yoruba land South-West Nigeria (Langer and Hill ¹⁶). In Nigeria, the cowpea bean is highly utilized. It is boiled with condiments, or boiled alone and eaten with stew. It is also used in the preparation of Akara balls (a fried dish) and moin-moin a steamed dish (Frank-Peterside *et al.* ¹⁷).

The study was conducted to investigate the nutritional composition of heavily infested cowpea flour and *Callosobruchus maculatus* and their side effect on man.

2. Materials and Method

2.1. Source of Cowpea

Ife brown, one of the best varieties free of weevil was bought from Ago-Iwoye market where the survey was carried out. The town lies within the tropical rain forest belt, between longitudes 6° 55' and 6° 56' and latitudes 3° 54' and 3° 55'.

2.2. Materials for rearing / rearing habitat

The materials used for rearing *Callosobruchus maculatus* included; a 7 litres plastic container that has cover, muslin net, cellophane tape. The plastic container was cleaned, and properly dried. While the cover was drilled in the center to make a round hole. The net was cut according to the size of the hole on the cover. Super glue gum was applied round the edge of the hole to gum the net to the hole. This was allowed to dry, so that air could be allowed in and out of the container. 4 Kg of cowpea was transferred into the container, covered up while the paper tape was used to seal it round. The experiment was conducted at room temperature $\pm 37^{\circ}\text{C}$. After three weeks the eggs were noticed on the cowpea seeds which took about 16 days to hatch under normal room temperature of $\pm 37^{\circ}\text{C}$,

holes were noticed on the beans. Having given it 15 days, the adult weevils have emerged and could be seen through the perforated part of the cover. After an additional 10 days of adult emergence, the container (containing the infested beans) was taken into the refrigerator, where it spent 5 days. When brought out, all the weevils were dead and so were harvested. The weevils were slightly dried in the sun, packed and sealed in a nylon satchet for analysis.

2.3. Preparation of cowpea flour

4 Kg each of the heavily infested cowpea and non-infested cowpea were soaked separately in water for about 1 hour respectively, and were dehulled by rubbing between palms. This exercise was repeatedly done until the coats were completely removed from the cowpeas. The cowpea was repeatedly rinsed with water until the coats were completely washed away leaving behind the dehulled cowpea. The dehulled cowpea was dried in the sun, this was repeatedly done for four consecutive days. After which, it was taken to the local milling machine which then milled it into flour. The cowpea flour was then sieved to make it fine in terms of texture.

40 g of cowpea flour from both infested and non-infested cowpea were collected in a labeled specimen bottles and were sent to the laboratory for chemical analysis.

2.4. Chemical Analysis

Proximate analysis of the infested cowpea flour was carried out using, the Association of Official Analytical Chemist (A.O.A.C.) 2005 procedure, to determine the: Protein content, Vitamin content and mineral salts.

3. Results

As shown on the table, the proximate composition of cowpea flour showed that infested cowpea flour has 15.50% of protein far lesser than non-infested cowpea flour which has 22.00%. Vitamin A has 248.54 mg in non-infested cowpea, higher than infested cowpea. Vitamin B 1.67 mg, slightly reduced in infested cowpea flour when compared to non-infested cowpea flour, Vitamin C has 17.39 mg in infested cowpea flour compared to non-infested cowpea flour which was higher. The analysis of other nutritional value according to the Table showed that, infested cowpea flour has lower mineral contents compared to non-infested cowpea flour.

Table: Chemical Analysis of Bean flour and *Callosobruchus maculatus*

Parameters	Infested Cowpea flour	Non-infested flour	<i>Callosobruchus maculatus</i>
Protein (%)	15.50	22.00	16.30
Vitamin A (µg/100g)	226.47	248.54	374.24
Vitamin C (mg/100g)	17.39	19.44	6.15
Vitamin B (mg/100g)	1.67	1.75	1.05
Calcium (mg/Kg)	200	320	310
Phosphorus (mg/100g)	650	850	455
Iron (mg/100g)	528	588	605
Magnesium (mg/Kg)	110	150	90

4. Discussions

The result of this study showed that, *C. maculatus* infestation of cowpea had effects on cowpea, as this leads to weight loss and cowpea damage. This is similar to the Arnarson *et al.*, (1994) that reported variation in the damage to some infested grains.

The reduction in protein contents of infested cowpea was due to the weevil infestation, as they also needed protein in their diet. This was corroborated by the findings of Dobie and Kilminster^[8], which reported protein as an important nutrient in the diet of insect pest. The protein content of damaged cowpea suggests that protein is one of the nutrients affected by the insect feeding.

This study also recorded depletion of vitamins and other mineral salts in infested cowpea as against non-infested cowpea, which was used as control and found to be rich in vitamin and mineral salts. The depletion in vitamins and mineral salts was caused by the weevil infestation of cowpea.

The findings of this study shows the need for routine check of cowpea during storage and in market places to avoid any damage which might arise from weevil infestation to reduce loss in quantity and quality.

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