EFFICACY OF THE ANTI-NUTRITIONAL FACTORS IN SOYBEAN ON THE CONTROL OF RODENT INFESTATION IN STORED YAM TUBERS

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Abstract
This study is aimed at evaluating the anti-nutritional factors in soy bean using albino rats. Mature soy bean contains higher percentage anti-nutritional factors in faba beans products include, trypsin Inhibitor, Hemaggluthin, Phenols, Phytic Acid, Vicine and Corvine the presence of anti-nutritional factors in faba beans products could limit their utilization for human consumption. The anti-nutritional factors were isolated using micellization process are phenol, trypsin inhibitors, vicine, phyto -heamaglutinin and phytic acid. Phenol at 600 mg/kg weight caused death of the animal within 12th day of application on the 8th day, while at 800 mg/kg and 1000 mg/kg body weight, death was observed throughout the duration of the trial. With vicine, death was recorded at 30 mg/kg body weight on the 8th day after application. There were no significant differences between that of Dioscorea rotundata and Dioscorea cayanensis in terms of vicine application. The injection of phyto-hemagglutinin at 0.75 mg/kg body weight death occurred by 8th and 10th day for groups fed with Dioscorea cayanensis and Dioscorea rotundata, respectively. Trypsin caused the death of treated rabbits within the 6th day of application, at 600 mg/kg and 1000 mg/kg body weight death occurred on the 4th and 2nd day respectively.

Introduction

For more than a century, pesticides have played an important role in controlling insects, mites, nematodes, fungi, weed and rodents, there-by contributing to the health and well-being of the populace (Robert *et al.,* 1972). Other benefits coming from the use of pesticides includes increasing production and efficiency of food and fiber and improvement of human health and comfort. Today, chemical pesticides are important inputs in agriculture, industrial and public health technology. However pesticides are by nature toxic to one or more forms of life. (Rumker and Harray, 1972). Most chemical pesticides are, unfortunately toxic, not only to the pest against which they were used, but also against other useful organisms. Undesirable side effects from the use of chemical pesticides have become increasing apparent in recent years including damage to non-target organisms, disequilibrating of ecosystems and general environmental contamination by persistence pesticides which tend to accumulate and magnify biological in aquatic and essential food webs (Rumker and Harray, 1972). In addition, an increasing number of pests especially insects and mites , have developed resistance to some of these chemicals and those organisms have constituted themselves into serious problems (Rumker and Harray, 1972) as a result of long term exposure to low levels of pesticides. Pesticides are potent and biological active chemicals which not only produce many benefits when used properly, but also have great potential for causing harm to man himself, non target organisms as well as local and global environments (Rumker and Harray, 1972).. The control of insect pest with chemical insecticides is very popular and potent. However, improper usage or handling has led to toxicity to mammals and insect resistance problems (Mbah *et al.,* 2011). Continued investigations for plant-derived alternatives to synthetic are being intensified to develop less hazardous but effective pest control strategy. The use of plant-derived products, which are cheap, potent, less toxic to mammals, easy to adopt by farmers and environmental-friendly has been investigated (Mbah *et al.,* 2011).

Many legumes contain deleterious, biological active factors such as trypsin inhibitors, hemagglutinins, cyanogenic glucosides, saponins and goiterogens. (Liener, 1962). Higher percentage of these anti-nutritional factors that include, trypsin inhibitor, hemagglutinins, phenols, phytic acid, vicine and corvine have been isolated in soy bean (Arntfield *et al.,* 1985, Enwere 1978). The presence of anti-nutritional factors in soybeans products could limit their utilization for human consumption. Yam is a member of genus *Dioscorea* and produce tubers, bulbils, or rhizomes that are of economic importance, especially as food for man (Lucien, 1993). The yams (*Dioscorea spp*) are important food crop in West Africa with Nigeria producing about 70% of the world total (Hahn, 1995; FAO, 2006). It is usually planted as intercrop and may serve as religious and cultural symbols and as well as symbol of wealth (Enwere, 1998; Kushwah and Polycap, 2001; Ibeawuchi, 2004, 2007; Ibrahim *et al.*, 2011). Most of the yams produced in Africa are stored in barns, on platform and underground. Loss of yam tubers in storage can also occur through insects like termites, scale insect, and especially rodents (Onwuneme, 1978; Fagge *et al.*, 2010). It has been reported that the Nigerian agriculture suffer loss as much as 30% for roots and tubers crops post- harvest practices and poor on-farm storage facilities (FMARD, 2001; Fagge *et al.*, 2010).

Materials and Methods

The following materials were used to conduct the trial they include, crushed soybean, salt, centrifuge, yam and albino rats are used to test for the anti-nutritional factors. Some quantities of the soybean were analyzed to determine the anti-nutritional factors. To achieve this, the soybean was crushed and analyzed for the factors. The process of protein isolation

using micellization technique were used in determining the available supernatant and protein isolate (Protein micelle mass) (Pmm) the isolation of protein from the soybean concentrate was done using the procedure outlined by Murray et al., (1978). To determine phenol, the follin ciocatean (Ciocatean reagent) spectrophotometer method was used, while in the aspect of the phytic acid, it was by the supernatant differences method of Ealy de Furk (1982). To determine vicine, the method of Arntified *et al.*, (1985) was used (Micro nutrition). Also for that of trypsin inhibitor the same process of Antifield *et al.*, (1985) was used to determine it.

A protein concentrate of 30g was mixed with 0.3 NaCl and allowed to stand for 30 minutes at 37^{0c}. The protein slurry was centrifuge at 10,000Rpm for 15 minutes to separate the residue from the high salt protein extract (HSPE). This was diluted at 1:3 ratio with cold tap water and after 30 minutes the decant supernatant was developed from the isolate protein (micelle mass). From the supernatant the anti-nutritional factors were isolated from each other at different pH levels. The method of ultra titration was used to separate each anti-nutritional factor in the supernatant at different pH level through fractional distillation and the reception factors were collected. The method of Arntfield *et al.,* (1985) was employed in the recovery of the anti- nutritional factors. Trypsin inhibitor was precipitated at pH 8.5 while phyto-heamagglutinin was precipitated at pH 7.0, phenols and phytic acid were precipitated at pH 9.0 and 5.5 respectively and vicine precipitated at pH 5.0.

Preparation of Bait

Bait were prepared separately with the same concentration of the individual factors of the anti-nutritional from soybean. The factors were separately embodied into a "Carrier Dust" made of acid washed river sand (Particle size ≤ 106 mm). Before the mixture the carrier was obtained by collection of river sand and sieved through a 106 mm. what was collected was treated with HCL solution over-night. The next day, the acid treated soil was washed with several changes of distilled water and spread in a laboratory tray before drying in a carbolite electronic oven at 105^0C. When totally dried, the fine sand was stored in a dessicator with well charged dessicant (silical gel). This became the carrier dust unto which the different anti-nutritional factors from soybean were separately incorporated at different concentrations. Two hundred and forty (240) albino rats weighing between 48 and 62 grammes were randomly selected and grouped into, six groups of six rats each labeled A,B,C,D,E and F for the various treatments of control, phenol, phytic acid, vicine, phyto-haemagglutinin and trypsin inhibitor respectively. Each group was replicated five (5) times.

A – Control, B – Phenol, C – Phytic acid, D – Vicine (HCN), E – Phyto-heamagglutinin and F – Trypsin Inhibitor.

Each of the toxic or the anti-nutritional factors was added each to the two selected varieties of yam being fed to the rats. The treated yams were administered to the rats. After an overnight starvation to ensure that the entire bait were consumed by the animals. Different concentrations of the factors were maintained in each group as sub-group. They were divided in five different groups of 200,400,600,800 and 1000 mg/kg body weight rats respectively. The treatment applications were monitored for a period of 14 days and the records were taken every other day. The rats were housed in a cage as grouped base on the replication.

Results and Discussion

Effect of feeding rat with Dioscorea rotundata and Dioscora cayanenso treated with phenol.

Table 2 and 3 show the weight of rats when phenol was administered as the antinutritional factor. There were significant physical changes in the rats until 8^{th} day when loss of appetite and weight, reduced the rats activities and eventual death of the rats at higher concentrations of 800mg/kg body weight and above. By the 12^{th} day under 600mg/kg weight, death had occurred with both yams as bait. The results shown in table 2 indicate a reduction in body weight of animals fed with the yam sample, *Dioscorea rotundata and* treated with phenol. The weight of treated reduced from 48.20gm to 46.1gm at concentration of 200mg/kg body weight. The loss of weight of the rat was mostly at 400mg/kg body weight when Dioscorea rotundata was used (table 3) samples of rats treated with phenol using dioscorea cayanensis also indicated loss in boy weight. The weight of the animals continued to depreciate as the concentration of phenol increased suggesting that the anti-nutritional factor, phenol after 600mg/kg body weight becomes lethal dose kept accumulating in the body of the rats.

Effect of feeding rat with dioscorea rotundata and dioscorea cayanansis treated with phytic acid.

Table 4 and 5 show that phytic acid did not reduce body weight of the rats in the five sub-groups tested 200 mg/kg to 1000 mg/kg body weight. From the analysis of the result, the treated albino rats continued to increased in all the concentrations. This shows that phytic acid within the range of 200 mg/kg to 1000 mg/kg body weight could not kill the rats rather their body increased and as the concentrations of phytic acid increased.

There was increased in the body weight of the rats irrespective of the yam species used and concentration of the phytic acid. The same experience was observed in both *Dioscorea rotundata* and *Dioscorea cayanensis* treated with phytic acid respectively. The results suggests that the application of the phytic acid at 200 mg/kg body weight to 1000 mg/kg was not enough to inhibit physiological activities or kill or lethal to the rats. There was also an increase from the initial body weight of the rat suggesting that the factor had a positive impact in the body of the rat that led to weight appreciation.

Effect of feeding the animals with Dioscorea rotundata and Dioscorea cayanensis treated with vicine

The result indicated that between 10 to 20 mg/kg body weight, there was no death, but at higher concentration of 30, 40 and 50 mg/kg body weight deaths were recorded on the 14^{th}, 10^{th} and 6^{th} days respectively for *Dioscorea rotundata* (Table 6) and 12^{th}, 10^{th} and 6^{th} days respectively for *Dioscorea cayanensis* (Table 7). However, there was no visible manifestation in terms of weight loss and physical activity on the rats before death. Also, there was no significant difference for both *Dioscorea rotundata and Dioscorea cayanensis* being used as bait for vicine. Death occurred on the 6^{th} day of treatment with group 5 that received 50 mg/kg vicine and on the 10^{th} day for those fed at 40 mg/kg vicine for both *Dioscorea rotundata* and *Dioscorea cayanensis*.Death of rat however recorded on the 12^{th} day of application when *Dioscorea cayanensis* was used instead of the 14^{th} day as recorded with *Dioscorea rotundata*. The reason for this variation could be attributed to the higher content of the vicine in *Dioscorea cayanensis.*The growth of the rats in the control experiment as compared with these resultant effect of the fed with phytic acid suggests that there was unattributed growth and increase in weight of the animal irrespective of the treatment indicating that the treatment did not adversely affect the animal as there was no retardation in growth, rather there was appreciably improvement in the growth rate of the animals. However in group 3, (800 mg/kg body weight) the animals weight appreciated more than the weight of those in the control experiment in both the *Dioscorea rotundata* and *Dioscorea cayanensis.* As indicated in table 5 it shows that there was a moderate resistant, since the severity ranged between 10 mg/kg to 400 mg/kg and a mean weight between 35.0 gm to 47.0 gm. It also represents that any concentration between 80 mg/kg weight remains lethal and a body weight of 22.0 gm. The mean weight ranges was between 21.90 gm to 47.09 gm. The result shows that in body weight of 50 mg/kg there was variation in weight of the animals 58.2 to 21.90 gm. It shows that at 50 gm/kg body weight, the concentration becomes lethal to the animal.

Effects of phyto-heamagglutinin on rat weight using dioscorea rotundata and dioscorea cayanensis.

The albino rats used to obtained results in tables 8 and 9 were divided into five sub-groups and fed with yam baits treated with phyto-heamagglutinin at different levels of concentration; 0.01, 0.025, 0.075, and 1.00 mg/kg per body weight. The results obtained indicated loss of weight in the rats for each treatment as well as reduction in physical activities. Deaths were recorded after the 12^{th} day throughout when the rats were fed with baits at 0.075 mg/kg weight.

Effects of feeding rats with Dioscorea rotundata and Dioscorea cayanesis treated with trypsin inhibitor

The rats were fed with different concentrations of trypsin per body weight of rat 200,400,6000,800 and 1000 mg/kg. The rats were monitored for the 14 days and results were collected (Tables 10 and 11). There was initial acceptability of the treated yams that tend to increase the body weight of the rats until at the 600 mg/kg concentration when the systems of the rats broke down and death was recorded at the 6^{th} day of application for both *Dioscorea rotundata* and *Dioscorea cayanensis*. More deaths were recorded at the 6^{th} day as the concentration increased to 600 mg/kg to 1000 mg/kg body weight thus suggesting 600 mg/kg body weight as the lethal dose for trypsin inhibitor. At 600 mg/kg body weight the average weight of the albino rats in *Dioscorea rotundata* was higher than that of the *Dioscorea cayanensis* which shows that even though there was death as the same 6^{th} day of application, the weight of the rats fed with *Dioscorea cayanensis* as bait. (Table 11).

Table 10 shows initial appreciation in the growth of the rats when *Dioscorea rotundata* was treated with trypsin inhibitor. There was an increase in the body weight of the albino rats between 200 mg/kg and 400 mg/kg body weight. From 600 mg/kg body weight there was decrease in the weight of the albino rats indicating reduction in physiological activities and loss in weight and subsequent death of the rats as the concentration of trypsin inhibitor increases.

A similar trend was observed when *Dioscorea cayanensis* was used as bait for the trypsin inhibitor Table 11. The death of the albino rats started to show from the concentration of 600 mg/kg body weight after 6^{th} day (table 11). This observation collaborates the dramatic decrease in the weight of the rats from the initial weight of 58.39 to a mean weight of 20.55 and at a concentration of 400 mg/kg and 600 mg/kg respectively. The weight of 20.55 gm could have occurred at the 6^{th} day which calumniated into emaciation and death of the rats.

Conclusion

There was total increase in the body weight of the animals as observed in the control. The animals continued to add weight. This can be attributed to non interference since no anti-nutritional factor was added in the control experiment.

In the application of the phenol, it was effective and potent since at 800mg/kg body weight it was able to kill the animals. In the phytic acid application. It was not potent-enough to kill the animal rather. Since it was not lethal at the level of application. It can only be useful for fattening of the animal. In the aspect of the vicine. It was potent, good for protection and preservation of yam since it was able to kill the animals within the level of application. In the phyto-haemagglutinm, it was useful since it was potent at some level of application, it was protective and preserving. The trypsin was also useful and potent, it retard the level of growth and sub-sequently killed the animal.

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Table 1: Method of Extraction.

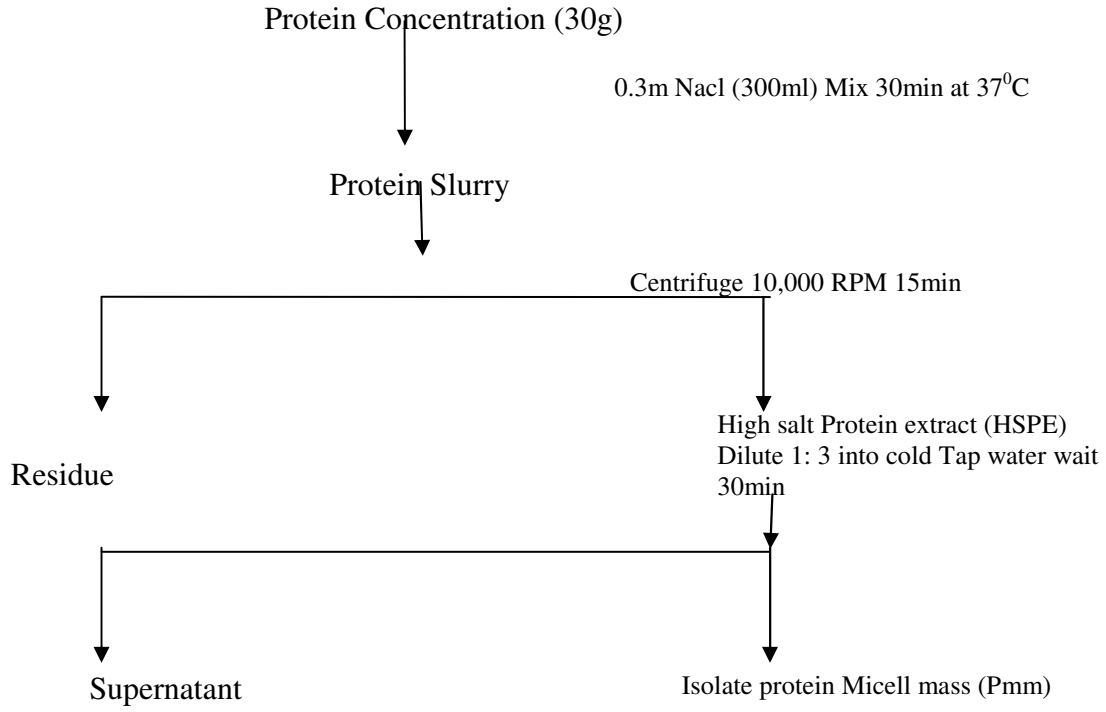

Table 2: Effect of Phenol Treatment on Rat weight using *Dioscorea rotundata*

Treatment group (Mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
200	RB_1	48.2	48.6	48.8	46.2	44.3	44.3	44.2	44.2	46.10	-4.10
	A	43.6	44.2	45.0	44.6	45.6	49.0	52.0	52.6	47.75	-4.15
400	RB_2	44.4	44.6	45.3	42.4	41.8	41.8	41.4	41.6	21.43	-23.97
	A	50.6	51.3	52.7	53.5	34.0	56.0	54.5	55.9	53.58	+ 2.98
600	RB_3	50.6	51.4	51.4	50.8	48.6	48.4	Death	Death	37.65	-12.95
	A	40.5	41.7	40.7	42.5	44.0	44.8	47.0	47.0	43.52	+ 3.02
800	RB_4	43.4	44.3	44.5	42.4	Death	Death	Death	Death	21.83	-21.57
	A	54.7	55.6	55.4	57.0	58.5	64.0	65.7	65.5	92.62	+4.92
1000	RB_5	42.6	43.0	43.4	42.4	Death	Death	Death	Death	21.43	-21.00
	A	55.2	55.9	57.5	60.0	60.0	59.6	62.8	62.5	59.19	+3.99

RB_1 – RB_5- Effect of phenol at different concentration of 200, 400, 600, 800, 1000mg/kg,
A – control at different application
weight gain weight lost – initial weight minus mean weight.

Table 3: Effect of phenol treatment on rat with *Dioscorea cayanensis*

Treatment Group 4 (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Phenol Mean weight	Wt/gain/wt lost
200	CB_1	49.2	49.6	47.8	47.2	45.3	45.3	41.2	41.2	45.85	-3.35
	A	44.6	44.6	45.2	45.1	46.4	48.5	53.4	52.6	47.35	+2.95
400	CB_2	45.4	45.6	44.3	43.4	42.8	41.6	40.4	40.6	43.01	-2.39
	A	51.2	51.1	53.7	53.8	53.6	55.7	55.4	55.6	53.68	+2.48
600	CB_3	54.6	52.4	52.4	49.8	49.6	47.4	45.9	45.5	37.65	-2.37
	A	40.8	41.3	41.2	43.1	43.6	45.0	46.6	46.8	43.55	+2.75
800	CB_4	42.4	45.3	45.5	43.4	42.6	42.6	Death	Death	21.83	-9.67
	A	55.2	556.1	55.7	56.8	59.4	64.3	66.2	66.0	59.96	+4.76
1000	CB_5	43.6	42.0	42.4	41.4	Death	Death	Death	Death	21.43	-22.42
	A	55.4	56.4	58.0	59.9	60.4	60.1	63.1	63.0	59.53	+4.13

CB_1 – CB5- Effect of phenol at different concentration using *D. Cayanensis* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 4: Effect of Phytic Acid Treatment using *Dioscorea rotundata*

Treatment Group 4 (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Phytic acid Mean weight	Wt/gain/wt lost
200	RB_1	60.4	44.2	61.0	62.4	64.7	44.3	66.1	66.8	63.39	+2.99
	A	43.6	56.1	43.0	44.6	45.6	49.0	52.0	52.6	47.75	+4.15
400	RB_2	55.7	51.5	56.1	58.4	60.3	41.8	64.1	64.0	59.38	+3.68
	A	50.6	50.3	52.7	53.3	54.0	56.0	54.5	55.9	53.58	+2.98
600	RB_3	49.2	41.7	53.2	53.4	56.8	48.4	56.8	56.7	54.10	+4.90
	A	40.5	57.1	40.7	42.5	44.0	44.8	47.0	47.0	43.52	+3.02
800	RB_4	56.8	55.6	57.0	58.2	58.3	59.4	59.4	59.3	58.19	+1.32
	A	54.7	61.4	55.4	57.0	58.5	64.0	65.7	65.5	59.62	+4.92
1000	RB_5	61.1	55.6	63.2	64.1	65.3	65.3	65.8	66.3	64.06	-2.96
	A	55.2	57.1	57.5	60.0	60.0	59.6	62.8	62.5	59.19	+3.99

RB_1 –RB5- Effect of phytic acid at different concentrations using *D. rotundata* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 5: Effect of Treatment with Phytic Acid using *Dioscorea cayanensis*

Treatment Group 5 (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
200	CB_1	61.4	62.0	62.0	64.3	63.3	66.7	68.0	69.1	64.73	+3.33
	A_1	44.6	44.6	45.2	45.1	46.4	48.5	53.4	52.6	47.35	+2.95
400	CB_2	54.7	55.5	55.1	57.4	59.3	59.3	61.1	61.0	57.88	+3.18
	A_2	51.6	51.1	53.0	53.8	53.6	55.7	55.4	55.6	53.68	+2.48
600	CB_3	48.2	59.3	52.2	52.4	55.8	55.4	55.8	55.7	53.10	+4.90
	A_3	40.8	41.3	41.2	43.1	43.6	45.8	46.6	46.8	43.55	+2.75
800	CB_4	57.8	58.1	58.0	59.2	59.3	60.4	60.4	60.3	59.19	+1.39
	A_4	55.7	656.1	55.7	56.8	69.4	64.3	66.2	66.0	59.96	+4.72
1000	CB_5	60.1	60.4	62.2	63.1	64.4	64.3	64.8	65.3	63.06	+.69
	A_5	55.4	56.4	58.0	59.9	60.4	60.1	63.1	63.0	59.53	+4.13

CB_1 – CB_5 – Effect of phytic acid at different concentration using *D. cayanensis* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight

Table 6: Effect of Treatment with Vicine on rat using *Dioscorea rotundata*

Treatment 5 Group (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
10	RD_1	42.6	43.1	43.2	43.6	43.5	43.8	44.1	41.3	43.40	+1.20
	A_1	43.6	44.2	45.0	44.6	45.6	49.0	52.0	52.6	47.75	+4.15
20	RD_2	44.8	45.2	45.2	46.5	46.8	46.8	46.6	46.4	46.00	+1.20
	A	50.6	51.5	52.7	53.5	54.0	56.0	54.5	55.9	53.58	+2.98
30	RD_3	53.8	52.9	53.6	54.1	54.3	54.8	55.1	Death	47.00	-6.80
	A	40.5	41.7	40.7	42.5	44.0	44.8	47.0	47.0	43.52	+3.02
40	RD_4	55.4	55.6	56.3	56.3	56.2	Death	Death	Death	35.00	+19.40
	A	54.7	55.6	55.4	57.0	58.3	64.0	65.7	65.5	59.62	+4.92
50	RD_5	57.2	57.4	57.6	Death	Death	Death	Death	Death	22.00	-35.20
	A	55.2	55.9	57.5	60.0	60.0	59.6	62.8	62.5	59.19	+3.99

RD_1 – RD5 – Effect of vicine at different concentration using *D. rotundata* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 7: Body weight of rat treated with vicine using *Dioscorea cayanensis*

Treatment Group 5 (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
10	CD_1	41.6	42.1	42.2	42.6	42.5	42.8	43.1	40.3	38.63	-2.97
	A	44.6	44.6	45.2	45.1	46.4	48.5	53.4	52.6	47.35	-12.95
20	CD_2	45.8	46.2	46.2	47.5	47.8	47.8	47.6	47.3	47.04	+1.24
	A	51.2	51.1	53.0	53.8	53.6	55.7	55.4	55.6	53.68	+2.48
30	CD_3	52.8	51.9	52.6	54.1	54.8	55.1	Death	Death	47.09	-5.71
	A	40.8	41.3	41.2	43.1	43.6	45.0	46.6	46.8	43.55	+2.75
40	CD_4	55.4	55.8	56.7	56.7	56.1	Death	Death	Death	35.09	-20.31
	A	55.2	56.1	55.7	56.8	59.4	64.3	66.2	66.0	59.96	+ 4.76
50	CD_5	58.2	58.4	58.6	Death	Death	Death	Death	Death	21.90	- 36.30
	A	55.4	58.4	58.0	59.9	60.4	60.1	63.1	63.0	59.53	+ 4.13

RD_1 – RD5 – Effect of vicine at different concentration using *D. cayanensis* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 8: Body weight of rats fed with *Dioscorea rotundata* with Phyto-heamgglutinin

Treatment Group 5 (mg/kg)		Days of Feeding 0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
0.01	RE_1	43.1	46.3	40.2	38.6	38.6	37.8	37.8	37.6	39.63	-2.47
	A	43.6	44.2	45.0	44.6	45.6	49.0	52.0	52.6	47.75	+4.15
0.025	RE_2	58.2	58.6	55.9	53.7	51.8	51.8	51.2	51.2	54.08	-4.12
	A	50.8	51.5	52.7	53.5	54.0	56.0	54.5	55.9	53.58	+2.98
0.05	RE_3	62.0	62.0	58.4	54.9	52.6	53.3	51.9	51.9	55.71	-6.29
	A	40.5	41.6	40.7	42.5	44.0	44.0	47.0	47.0	43.52	+3.02
0.075	RE_4	61.4	61.6	58.8	55.3	55.3	55.3	Death	Death	43.41	-17.99
	A	54.7	55.6	55.4	57.0	58.5	58.5	65.7	65.5	59.62	+4.92
1.00	RE_5	55.5	55.8	53.4	51.6	Death	Death	Death	Death	27.01	-28.49
	A	55.2	55.9	57.5	60.0	60.0	60.0	62.8	62.5	59.19	+3.99

RE_1 – RE5 – Effect of Phyto-heamgglutinin at different concentration using *D. rotundata* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application,
Weight gain weight lost – Initial weight minus mean weight.

Table 9: Body weight of rats fed with phytoheamgglutinin *acid using Dioscorea cayenensis*

Treatment Group 5 (mg/kg)		Days of Feeding									
		0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
0.01	CE_1	42.1	42.3	39.2	37.6	34.6	36.8	36.8	36.6	38.63	-3.47
	A	44.6	44.6	45.2	45.1	46.4	48.5	53.4	52.6	47.35	+2.95
0.025	CE_2	59.2	59.6	52.8	52.8	52.8	52.8	52.2	52.4	55.08	-4.12
	A	51.2	51.2	53.0	53.8	53.6	55.7	55.4	55.6	53.68	+2.48
0.05	CE_3	63.0	63.0	59.4	53.6	53.3	53.3	52.9	52.6	56.71	-6.29
	A	40.8	41.3	41.2	43.1	43.6	45.0	46.06	46.8	43.55	+2.75
0.075	CE_4	60.4	60.6	57.8	54.3	54.3	54.9	Death	Death	42.79	-17.61
	A	55.2	56.1	55.7	56.8	59.4	64.3	66.2	66.0	59.96	+4.76
1.00	CE_5	54.3	56.8	54.4	52.6	Death	Death	Death	Death	27.51	-28.79
	A	55.4	56.4	58.0	59.9	60.4	60.1	63.1	63.0	59.53	+4.13

RE_1 – RE5 – Effect of Phyto-heamgglutinin at different concentration using *D. cayenensis* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 10: Effects of trypsin inhibitor on rat weight using *Dioscorea rotundata* as bait

Treatment Group 5 (mg/kg)		Days of Feeding									
		0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
200	RF_1	48.2	48.2	49.8	49.8	51.6	51.8	55.2	55.2	51.00	+2.80
	A	43.6	44.2	45.0	44.6	45.6	49.0	52.0	52.6	47.75	+4.15
400	RF_2	55.6	55.4	56.3	56.4	56.8	59.4	59.4	59.6	57.00	+ 1.40
	A	50.6	51.3	52.7	53.5	54.0	56.0	54.5	55.9	53.58	+2.98
600	RF_3	55.4	55.8	56.2	Death	Death	Death	Death	Death	21.00	- 34.40
	A	40.5	41.7	40.7	42.5	44.0	44.8	47.0	47.0	43.52	+3.02
800	RF_4	59.4	50.4	Death	Death	Death	Death	Death	Death	12.00	-37.40
	A	54.7	55.6	55.4	57.0	58.5	64.0	65.7	65.5	59.62	+4.92
1000	RF_5	49.8	Death	Death	Death	Death	Death	Death	Death	6.00	- 43.80
	A	55.2	55.9	57.5	60.0	60.0	59.6	62.8	62.5	59.19	+ 3.99

RF_1 – RF5 – Effect of trypsin inhibitor at different concentration using *D. rotundata* as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.

Table 11: Effects of Tripsin inhibitor on rat weight using *Dioscorea cayanensis*

Treatment Group 5 (mg/kg)		Days of Feeding									
		0	2	4	6	8	10	12	14	Mean weight	Wt/gain/wt lost
200	CF_1	44.6	44.5	45.1	45.2	46.3	48.5	53.2	52.7	49.48	+8.28
	A	44.6	44.6	45.2	45.1	46.4	48.5	53.4	52.6	47.35	+2.95
400	CF_2	52.1	51.0	53.2	53.5	53.5	55.7	55.3	55.8	58.39	+1.99
	A	51.2	51.1	53.0	53.8	53.6	55.7	55.4	55.6	53.68	+2.48
600	CF_3	40.7	41.2	41.1	Death	Death	Death	Death	death	20.55	-33.85
	A	40.8	41.3	41.2	43.1	43.6	45.0	46.06	46.8	43.55	+2.75
800	CF_4	55.1	56.0	Death	Death	Death	Death	Death	Death	12.37	-38.03
	A	55.2	56.1	55.7	56.8	59.4	64.3	66.2	66.0	59.96	+4.76
1000	CF_5	55.3	Death	42.2	Death	Death	Death	Death	Death	6.10	-42.70
	A	55.4	58.4	58.0	59.9	60.4	60.1	63.1	63.0	59.53	+4.13

CF_1 – CF5 – Effect of trypsin inhibitor at different concentration using *D. cayanensis*as bait at; 200,400, 600, 800, 1000mg/kg
A –Control at different application
Weight gain weight lost – Initial weight minus mean weight.