

Hematology and blood serum chemistry of Albino rat fed variously processed false yam (*Icacina trichantha*) root tuber at varying replacement level for Maize.

Abstract

The experiment was conducted at the Animal science laboratory, Teaching and Research Farm, Ambrose Alli University to evaluate the effect of feeding differently processed false yam tuber meal on the hematology and blood serum chemistry of Albino rats. Fresh tubers of *Icacina trichantha* were collected from Ekpoma environ. The tubers were washed then chopped and were differently processed by oven drying, sun drying as well as parboiling and sun drying. All processed tubers were then milled and an aliquot was collected and labeled before taken to the laboratory. 36 unsexed albino rats of an average age of 6 weeks were randomly allotted to four treatment namely: Corn starch-egg mixture as the control while diet 2, 3 and 4 were Oven dried, Sun dried and parboiled-sun dried *Icacina trichantha* in a completely Randomized Design with three replicates. The result on the hematology showed that Hb and PCV were higher ($P<0.05$) among rats fed oven dried false yam. WBC was higher ($P<0.05$) among rats fed parboiled sundried false yam comparable to control. MCH, MCHC, and RDW were higher ($P<0.05$) in that fed oven dried false yam. Platelet value was higher ($P<0.05$) in those fed sun-dried false yam. MPV, PWD, and neutrophil values were higher ($P<0.05$) among rats fed parboiled sundried false yam. lymphocyte was higher among those fed diet 3. Serum chemistry showed that globulin, urea, and creatinine were significantly affected. It is concluded therefore that the inclusion of oven dried false yam meal as the substitute for maize in the diet enhances the blood quality of Albino rats.

Key words: Haematology, Serum chemistry, Albino rats, False yam, Maize

Introduction

False yam is seldom cultivated and grows in the forest and most common under palm plantation all over Nigeria. It remains freshly green all year with no pests and diseases reported (Kay, 1987). It is not grazed by cattle or any other ruminant animal even when no other green plant is available and is yet to gain recognition and popularly as a food crop like cocoyam, potato or cassava. Its root resembles turnip or beet but can grow to giant size sometimes in two or three connecting tubers, weighing more than 30 kg. The words “false yam” confer a sense of illegitimacy and much better educated consider it as a creeping plant or even a starchy weed. The roots are difficult to lift from the soil unlike cocoyam, potato or cassava and their preparation are tough. It is renowned for its enormous tuber and penetrating root for destroying not only shovels and plows but people's patience. Despite the need for processing first, since it contains hydrocyanic acid, phytic acid, and oxalic acid the same bitter principals as cassava, a global staple (Antai and Akwelang, 1999) and sometimes as slightly bitter flavor icacina flour is commonly used to make pastes or porridges in local communities of some West African countries. Composed mainly of starch, the flour nonetheless can contain up to 10% protein, Okosun *et al.*, (2017) reported 10.21 and 10.04 % for sundried and oven dried respectively; while Kay, (1987) reported a protein value for false yam tuber flour 10.3% a remarkable amount for a root crop five times that in cassava flour and twice that in potato, for example. It can be stored until needed Okosun *et al.*, (2017). Earlier nutritionist have reported work on false yam (*Icacina oliviformis*) leaf meal (Ansah and Aboagye, 2011); false yam seeds (*Icacina oliviformis*) on growth performance of Albino rat (Salifu *et al.*, 2015) while Umoh and Iwe, (2014) carried out study on effects of processing on nutrition composition of false yam (*Icacina trichantha*) flour. There has been a dearth of information on false yam incorporation in the diet of livestock. This study, from the nutritionist point of view, is designed to evaluate the hematology and blood serum chemistry of Albino rat fed variously processed false yam (*Icacina trichantha*) root tuber at varying replacement level for maize in livestock diet.

53 **Materials and method**

54 **Location and duration of the study**

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56 The experiment was carried out at the Animal science laboratory, Ambrose Alli University, Ekpoma for a
57 period of 28 days.

58 **Sourcing and Processing of Raw materials**

59 Fresh tubers of *Icacina trichantha* were collected from Ekpoma environ in Esan West Local government
60 area of Edo state, Nigeria. The tubers were washed, chopped into small pieces and were differently
61 processed by oven drying (OD), sun drying (SD) as well parboiling and sun drying (PBSD). For the oven,
62 dried sample *Icacina trichantha* was chopped and placed in the oven for optimum drying at 60°C to
63 constant weight as described by Okaka and Okaka, (2005). For a sun-dried sample, the test material was
64 equally chopped and spread on the polythene mat then placed in the sun for optimum drying as described
65 by Umoh, (2013). For parboiled-sun dried samples, *Icacina trichantha* after slicing were boiled for about
66 30mins and subsequently dried in the sun as described by Umoh, (2013). All the chopped, processed
67 tubers were then milled into a fine powder to pass through a 2mm mesh sieve, and an aliquot was
68 collected from the differently processed false yam and was well labeled then were taken to the laboratory
69 for proximate analysis. The image below (fig 1 and 2) shows the root and leaves of false yam (*Icacina*
70 *trochanter*)



73

74 Fig 1: Root of false yam

Fig 2: Leaves and root of false yam

75 **Proximate analysis of the differently processed Raw Materials**

76 The moisture content, ash, crude fiber and crude fat, were determined using the method described by
77 AOAC (1990). The crude protein was also be determined by the Kjeldahl method. The energy value was
78 determined using an Adiabatic Oxygen Bomb calorimeter (12149 Adiabatic calorimeters, PARR
79 instrument Co. Illinois USA as reflected in Table 1.

80 **Table 1: Proximate composition of differently processed false yam meal and corn starch-**
81 **Eggwhite mixture.**

Parameters (%)	CSEWM	ODFYM	SDFYM	PSFYM
Dry Matter	5.73	10.79	9.49	7.61
Crude protein	21.03	5.32	6.03	5.38
Crude fiber	0.47	1.27	1.31	1.32
Ether extract	3.24	2.04	1.77	2.63
Crude Ash	1.46	2.23	2.34	2.26
NFE	68.07	78.35	79.06	80.80
Carbohydrate	81.66	87.27	87.53	88.39

82

83 **CSEWM: Corn starch- Egg white mixture, ODFYM: Oven-dried false yam meal, SDFYM: Sundried**
84 **false yam meal, PSFYM: Parboiled sundried false yam meal.**

85 **Experimental Animals, management, and design**

86 A total of thirty-six white rats of same average weight were purchased from the animal house unit of
87 College of Medicine, Ambrose Alli University Ekpoma, Edo State, for the experiment. The rats were kept
88 under a standard temperature (25°C), relative humidity (45%-55%), dark/light cycle (12 hours), and were
89 fed with the diet containing (oven dry, parboiled /sun-dried and sun-dried of *Icacina tricantha* meal) and

rain water *ad libitum*. The rats were placed on 10days acclimatization period before the commencement of the experiment, while giving free access to water. The thirty-six mixed sexed rats of an average age of 6 weeks that were obtained from the College of Medicine Ambrose Alli University, Ekpoma, Edo State for the experiment and were randomly allotted to four dietary treatment namely: Corn starch-egg mixture (CSEM) as the control diet while diet 2, 3 and 4 were Oven dried *Icacina tricantha* (OD), Sun dried *Icacina tricantha* (SD) and parboiled-sun dried *Icacina tricantha* (PBSD) in a Completely Randomized Design with 3 replicates of nine rats per treatment.

Hematology and serum chemistry study

At the 28th day of the feeding trial, two sets of fresh blood samples of 1ml each were collected via neck slit from one (1) rat selected from each of the replicates into 2 bottles per rat, one of the bottles contained ethylene diamine tetraacetic acid (EDTA) to prevent clotting, while the other bottle was without EDTA for the serum biochemistry study. The haematological parameters such as packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC), white blood cell (WBC), platelets, neutrophils, lymphocyte, etc. were determined using improved Neubauer's haematometer after dilution and cyanmethemoglobin method as described by Dacie and Lewis (1991); while mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), were calculated according to Jain (1986). Serum biochemistry parameters such as total protein, albumin, and serum glucose were determined by the method of Hyduke (1975) while globulin values were estimated by the subtraction of albumin value from serum protein value (Dacie and Lewis, 1991).

Statistical Analysis

All the data collected were subjected to analysis of variance (ANOVA) and the difference between means and treatments were determined using Duncan's multiple range test (DMRT) at 5% level of probability. All statistical procedures were according to Steel and Torrie, (1990) using SAS (2006) package.

Results

Hematological indices of albino rats fed the dietary treatments

Hematological indices of albino rat fed treatment diets shows that hemoglobin, red blood cell, white blood cell, mean corpuscular haemoglobin concentration, red blood distance with, platelet, mean platelet volume, platelet distance with, neutrophil and lymphocyte were all significantly influenced ($P<0.05$) by the differently processed dietary treatments. However, packed cell volume and mean corpuscular volume were not significantly affected ($P>0.05$) by the dietary treatments. Haemoglobin was highest ($P<0.05$) with value of 13.40g/dl in rats fed diet 2(Oven dried false yam) followed by similar values (11.50 and 11.57g/dl) recorded in rats fed the control diet and diet 4(Parboiled and sun-dried false yam) respectively and least numerical value 10.50g/dl was recorded in rats on a diet 3(Sundried false yam.) Packed cell volume was however similar ($P>0.05$) among rats fed the treatment diets with the highest value of 37.36% from those fed diet 2 and lowest value of 35.00% was recorded in rats fed diet 4. Red blood cell was significantly highest ($P<0.05$) in diet 2 ($6.81 \times 10^6 \mu\text{c}$) followed by ($6.33 \times 10^6 \mu\text{c}$) in diet 4 and least ($5.32 \times 10^6 \mu\text{c}$) in diet 3. White blood cell values were significantly highest ($P<0.05$) in rats fed diet 4 (parboiled and sun-dried false yam) ($13.71 \times 10^3 \mu\text{c}$) comparable to ($13.62 \times 10^3 \mu\text{c}$) recorded in rats fed the control diet and lowest ($8.31 \times 10^3 \mu\text{c}$) in diet 3 (sundried false yam). Mean corpuscular volume had similar ($P>0.05$) values of 57.97, 57.45, 59.24 and 55.77 recorded in rats that ate treatment diets 1,2,3 and four respectively. Mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration were significantly highest ($P<0.05$) in rats fed diet 2 (oven dried false yam) (19.61pg and 35.25g/dl), followed by (19.46pg and 34.70g/dl) in rats fed the control diets and lowest in those fed diet 4. Red blood distance width was significantly highest ($P>0.05$) in diet 4 (18.09%) followed by similar values of (17.50%) recorded in diet 1 and 2 and lowest in diet 3 (16.79%). Platelet value was highest ($P<0.05$) in rats placed on diet 3 ($5.06 \times 10^3 \mu\text{c}$), similar to ($4.84 \times 10^3 \mu\text{c}$) recorded in diet 4 and least value ($3.47 \times 10^3 \mu\text{c}$) in diet 2. Mean platelet volume and platelet distribution width were significantly influenced ($P<0.05$) by the treatment diets with highest mean values (6.62fl and 9.02% in diet 3 and lowest values (5.72fl and 6.63%) were recorded in rats fed diets 2. The neutrophil value was also significantly highest ($P<0.05$) in rats fed diet 4 (19.10%) followed by similar values 17.37 and 17.34% recorded in rats fed diets 1 and two while the least numerical value of 15.71% was recorded in rats on a diet 3. Lymphocyte also showed significant variation ($P<0.05$) among rats fed dietary treatments with the highest value of 78.84% recorded in diet 3, followed by statically similar values 76.30 and 75.71% recorded in rats that ate the control diet and diet four while least value of 73.12% was recorded in menu 2.

Table 2: Hematological indices of albino rats fed treatment diets (differently processed false yam)

Differently processed false yam meal					
	CSEWM	ODFYM	SDFYM	PSDFYM	
Parameters	1	2	3	4	SEM±
Haemoglobin (g/dl),	11.50 ^b	13.40 ^a	10.50 ^c	11.57 ^b	0.12*
Packed cell volume (%)	34.80	37.36	36.60	35.00	0.94 ^{NS}
Red blood cell (x10 ⁶ µc)	6.50 ^b	6.81 ^a	5.32 ^c	6.33 ^{ab}	0.18*
White blood cell (x 10 ³ µc)	13.62 ^a	12.37 ^b	8.31 ^c	13.71 ^a	0.25*
MCV (fl)	57.97	57.45	59.24	55.77	1.86 ^{NS}
MCH (pg)	19.46 ^{ab}	19.61 ^a	19.25 ^b	18.55 ^c	0.21*
MCHC (g/dl)	34.70 ^{ab}	35.25 ^a	31.80 ^b	32.73 ^b	0.66*
RDW (%)	17.40 ^a	17.50 ^a	16.79 ^b	18.09 ^a	0.18*
Platelet (x 10 ⁵ /mm ³)	4.36 ^b	3.47 ^c	5.06 ^a	4.84 ^b	0.10*
MPV	5.85 ^c	5.72 ^c	6.23 ^b	6.62 ^a	0.10*
PDW	7.99 ^b	6.63 ^c	9.02 ^{ab}	12.95 ^a	0.22*
Neutrophil (%)	17.37 ^b	17.34 ^b	15.71 ^c	19.01 ^a	0.22*
Lymphocyte (%)	76.30 ^b	73.12 ^c	78.84 ^a	75.71 ^b	0.26*

NS: No significant difference (P>0.05). *: significantly different (P<0.05) a,b,c: mean along the same row with different superscripts are significantly different (P<0.05),µl: international unity per liter, g/dl: gram per deciliter, Fl: (picolitre) = fraction of one. A millionth of a liter pg: (pictograms) – one – trill out of a gram SEM± standard error of means, MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration. RDW: red blood distance width; MPV: mean platelet volume PDW: platelet distance width, CSEW: cornstarch-egg with mixture; OVD: oven-dried false yam SUD: sun-dried false yam; PBSD: parboiled and sun-dried false yam.

Serum chemistry study

The serological studies of albino rats fed dietary treatment (Table 3) revealed that total protein and albumin were not significantly influenced (P>0.05) by the dietary treatments but globulin, urea and creatinine showed a significant (P<0.05) variation among rats fed the treatment diets. The total protein had similar (P>0.05) values of 4.53, 4.43, 4.51 and 4.42g/dl among rats fed diets 1, 2,3 and four respectively. Albumin followed the same trend having a statistically similar values (P>0.05) of 2.60, 2.43, 2.50 and 2.53g/dc in rats fed diet 1, 2, 3 and four respectively. Globulin, on the contrary, was significantly highest (P<0.05) in rats fed diet 3 (Sun dried false yam) (2.01g/dl) followed by the comparable value of 2.00g/dl in diet 2, and lowest value of 1.89g/dl was recorded in rat fed diet 4. Urea was also significantly highest (P<0.05) in rats placed on diet 2 (4.17mg/dl), followed by those on control diet (3.60mg/dl) and lowest (3.50mg/dl) in diet 3, Creatinine was also significantly influenced (P<0.05) by the dietary treatment with highest (0.81mg/dl) value recorded in rats fed diet 2, followed by similar values of 0.71 and 0.70mg/dl in rats fed diet 3 and the control while least numerical value of 0.63mg/dl was recorded in rats fed diet 4.

Tab-3 Serum chemistry of albino rats fed treatment diets (false yam meal)

Differently processed false yam meal					
	CSEWM	ODFYM	SDFYM	PSDFYM	
Parameters	1	2	3	4	SEM±
Total protein (g/dl),	4.53	4.43	4.51	4.42	0.03 ^{NS}
Albumin (g/dl)	2.60	2.43	2.50	2.53	0.08 ^{NS}
Globulin (g/dl)	1.93 ^{ab}	2.00 ^a	2.01 ^a	1.89 ^b	0.08*
Urea (mg/dl)	3.60 ^b	3.70 ^b	3.50 ^b	4.17 ^a	0.13*
Creatinine (mg/dl)	0.70 ^b	0.81 ^a	0.71 ^b	0.63 ^c	0.02*

NS: Not significant (P>0.05); *: Significantly different (P<0.05) abc: Means along the same row with different superscripts are significantly different (P<0.05) g/dl: gram per decilitre mg/de: Milligram per decilitre, CSEW: cornstarch-egg with mixture; OVD: oven-dried false yam, SUD: Sun-dried false yam; PBSD: Parboiled – sun-dried false yam.

175 **Discussion**

176 **Hematological indices of Albino rats fed treatment diets**

177 The health status of all experimental animal used in the various trial is expedient, and one of the
178 ways of assessing it is to evaluate its blood quality. (Oyebiyi *et al.*, 2007). Hemoglobin value of the
179 rats as reflected in Table 3 was significantly ($P<0.05$) influenced by the treatment diets. The
180 lower hemoglobin value recorded in this study could be as a result of the residual anti-nutritional
181 factor present in *Icacina trichantha* (false yam) which had a greater affinity for metals such as iron
182 and copper and make them unavailable thereby reducing the hemoglobin count and hence effective
183 oxygen transportation. This is in tandem with the findings of Tewe, (1999) who reported 40% whole
184 cassava root meal feed to cockerel resulted in significantly lower hemoglobin value at the finisher
185 phase. The values obtained are within the recommended range by Jain (1993). The similarities observed
186 in packed cell volume is a pointer to the fact that these dietary treatments have good nutritional qualities
187 and rats maintained on them had low susceptibility to infections. Red blood cell was significantly
188 highest in rat fed oven dried false yam; this shows that there was a significant reduction in the anti-
189 nutritional factor in false yam when oven dried and this brings about nutrient availability in the test diet.
190 The significant ($P<0.05$) variation and the similar value recorded in rat fed the control diet, parboiled
191 and sun-dried false yam could be related to the nutritional adequacy of the test diet and its safety for
192 consumption. This is in agreement with the report of Olabamiyi *et al.*, (2007). The mean value recorded
193 for white blood cell of albino rat fed treatment diet are within the range of hematological value reported
194 by Islam *et al.*, (2004). The similarities in the values of mean corpuscular volume in this study could also
195 be related to the nutritional adequacy and safety of the processing methods used for the test diets. MCV
196 is an important trait which determines the cell size of the erythrocyte and thus an important factor in
197 determining the ability of the rat to withstand oxygen starvation for a long time (Mitruka and Rawnsley,
198 1997). Mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration and red blood cell
199 distance width were of better quality in rats that ate oven dried false yam and this could be adduced to
200 the nutritional adequacy and safety of the test diet which also is in corroboration with the report of
201 (Olabaniyi *et al.*, 2007) Platelet, mean platelet volume and platelet distance width was significantly
202 ($P<0.05$) influenced in rats fed parboiled and sun dried false yam, This implies that the rat fed this diet
203 had low susceptibility to infection compared to other test diets since platelets are carriers of antibodies
204 that help fight against foreign bodies in farm animals. The value recorded is within the range
205 recommended by (Wikivet, 2013). This significant ($P<0.05$) variation observed in rats fed the treatment
206 diets with the highest value recorded in rats fed parboiled and sundried false yam concerning neutrophil
207 shows that the anti-nutritional factor present in false yam was reduced to the bearest minimum that gave
208 a higher neutrophil value in rats fed diet 4. The value falls within the recommended range established by
209 (Maxwell *et al.*, 1990; Mitruka and Rawnsley, 1997 and Mohammed *et al.*, 2008). The significant
210 variation in lymphocyte value with highest value recorded in rat fed sun-dried false yam (diet 3) is a
211 pointer to the fact that the rats placed on this diet has higher immunity and low susceptibility to
212 infection and diseases and higher lymphocyte is associated with the ability of animals to perform well
213 under a very stressful condition. The value also fell within the recommended range established by
214 Maxwell *et al.*, (1990); Mohammed *et al.*, (2008). Feeding the rats with the different diets did not
215 significantly affect the pack cell volume and mean corpuscular volume values of the experimental
216 rats when compared to the control groups and suggested that the consumption of false yam is safe
217 and has no potential blood toxicity effect. Blood toxicity is usually accompanied with significant
218 changes in the values of hematological parameters including fall in values of RBC, Hb and PVC
219 due to possible suppression of erythropoietic processes of hemolysis of the available RBC and
220 resulting in liver necrosis and anemia with changes in blood biochemical parameters
221 (Uhrmacher *et al.*, 2010). The results of these blood parameters show very low standard mean
222 error (SEM $\pm$) and thus support their findings.

223 **Serum chemistry Study of Albino Rats fed treatment diets**

224 Serum biochemistry profile of the experimental rats showed similarities ($P>0.05$) in the values of
225 total protein and Albumin while significant variation ($P<0.05$) were observed in the value of
226 globulin, urea and creatinine Serum total protein, albumin and globulin synthesis is related to the
227 availability of protein and micro-nutrient (Hofferberg *et al.*, 1996). The similarities observed in
228 total protein could be due to the high level of protein present in *Icacina trichantha* (false yam)

(Okosun *et al.*,2017). It is also known to contain some vitamins and mineral which makes it a renounced unconventional protein source in animal or mini-livestock feeding Albumin and Globulin values recorded fell within the recommended range by Jain (1993) and Wikivet,(2013). Serum Urea is known to be a function of the protein quality ingested by the animal, energy deficiency and decrease condition which impair protein utilization. When diet is deficient in essential amino acid, the amino acid present will be deaminated resulting in an increase in urea excretion (Ranch on. 2001). In this present study, highest urea value was recorded in diet 4, followed by comparable urea values in diet 1, 2 and three respectively. This indicates that the diets were adequate in amino acid building blocks. Eggum (1970) reported that creatinine is an indirect measure of protein utilization in poultry. The significant difference observed in the creatinine value with least creatinine value recorded in diet 4 suggest optimum protein utilization. It is of note that high level of creatinine could lead to tissue wastage while low creatinine enhances tissue build up in farm animals.

Conclusion

It is concluded therefore that the inclusion of oven dried false yam meal as substitute for maize in the diet enhances the blood quality of Albino rats and this preliminary study can be extended to further feeding trail using other livestock such as Rabbits, poultry, pigs, and ruminants so as to build data base of *Icacina trichantha* as possible feed stuff.

Ethical Disclaimer:

As per international standard or university standard, written ethical approval has been collected and preserved by the author(s).

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