

1 | ~~Haematological~~**Hematological** indices of experimental rats fed with rat chow fortified with
2 | processed breadfruits.

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3 |
4 |
5 | **ABSTRACT**

6 | **Background:** The abundance of nutrients, vitamins, and fiber in **breadfruit** has been documented
7 | in many literature studies that can hardly be exhausted and are consumed **majorly** by the **Igbos**
8 | and other southern parts of Nigeria to ameliorate hunger.

9 | **Aim:** This study however ~~aims was aimed~~ at determining the effect of feeds fortified with grilled,
10 | ~~parboiledpreboiled~~, and cooked breadfruit on hematological indices of ~~Wistar-wistar rats~~.

11 | **Methods:** Hematological parameters were determined using an automated hematology analyzer
12 | (Mindray-BC-5300). The parameters ~~analysedanalyzed~~ include Hemoglobin (HGB), Packed Cell
13 | Volume (PCV), Red Blood Cells (RBC), Platelets (PLT), Mean Corpuscular Volume (MCV),
14 | Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC),
15 | White Blood Cells (WBC), Neutrophils (NEUT), Lymphocytes (LYMPH), Monocytes (MON),
16 | Eosinophils (EOS) and Basophils (BAS).

17 | **Results:** The result from the experiment indicated that all fortified groups showed no significant
18 | increase or decrease ($p>0.05$) in their HGB, PCV, RBC, PLT, MCV, MCH and MCHC when
19 | compared with their respective controls. The white blood cell, neutrophil and eosinophil
20 | concentration of the experimental rats significantly increased (~~$p<0.05$~~) compared with the normal
21 | control group. A significant decrease (~~$p<0.05$~~) was observed in the lymphocyte and basophil
22 | concentration. The monocyte levels of the experimental rats showed a non-significant increase or
23 | decrease (~~$p>0.05$~~) in all the groups with respect to the normal control.

Comment [Dbf1]: Once is enough, no need to mention level of significance again and again.

24 | **Conclusion:** It may however be safe to infer that fortification of feed with breadfruit has no
25 | negative effect on the physiological status of the experimental animals as all the hematological
26 | parameters remained within range.

27 |
28 | **Keyword:** Breadfruit, Hemoglobin, Cooked, ~~ParboiledPreboiled~~, Grilled, Platelets, Lymphocyte.

29 |
30 | **1.0 INTRODUCTION**

31 | The popular food crop known as breadfruit (*Treculia ~~Africanaafricana~~*) has been known to
32 | possess enormous potential for domestic and industrial uses and is widely distributed globally.
33 | The commonly known breadfruit does not require much exposition to the science community as
34 | a lot of literature research has been carried out on it [1,2] and these literature reviews can hardly
35 | exhaust the available information on the nutritional and health benefits of *Treculia*
36 | ~~Africanaafricana~~.

37 | Breadfruit is an important source of protein and amino acid that is needed for metabolic well-
38 | being of humans. Roasted breadfruit shows significant high levels of sodium, copper,
39 | magnesium and phosphorus [3]. It has been reported by Umezuruike *et. al.* [4], that *Treculia*
40 | ~~Africanaafricana~~ contains ~~Alaninealanine~~, ~~Isoleucineisoleucine~~, lysine, histidine, phenylalanine,

41 glutamic acid, glycine, proline, threonine, tyrosine, valine, and methionine. These amino acids
42 are found in concentrations that satisfy the RDA for essential amino acids for infants and adults
43 [5].

Comment [Dbf2]: Define this abbreviation

44 This fruit consists of several varieties such as the Africanaafricana, inverse, and mollies [6]
45 which basically differ in the size of the tree fruit head, size and color of seeds, rate of
46 fermentation, and ease of seed extraction [1]. ~~In~~In developing countries, breadfruit plays a major
47 role in amelioration of hunger and malnutrition [7,8, 8] as they can be consumed either by
48 Roasting, parboiling, dehulling, steaming or grilling of the extracted breadfruit seeds [4]. Despite
49 the vast nutritional and health benefit of breadfruit, this study tries to investigate the effect of
50 cooked, ~~parboiledpreboiled~~, and grilled breadfruit on the hematological parameters of Wistar
51 wistar rats.

52 2.0 Methods

53 2.1 ~~Sample Collection~~collection and ~~Identification~~identification

54 The breadfruit used for this study was purchased from Orié market, Abagana in Njikoka Local
55 Government Area, Anambra State, Nigeria. The sample was identified by a taxonomist in the
56 Department of Botany, Nnamdi Azikiwe University, Awka. The voucher number as deposited in
57 the herbarium of Nnamdi Azikiwe University, Awka is NAUH-77B.

58 2.2 Processing of ~~Sample~~sample

60 The breadfruit was properly washed and mashed with water to remove its slippery nature and
61 was then dried under room temperature for seven days. After the drying, the breadfruit was
62 shared into three portions for processing.

63 2.2.1 Cooked ~~Breadfruit~~breadfruit

64 The first portion of the breadfruit was ~~parboiledpreboiled~~ for 45 ~~minutes~~ in a pot containing only
65 water. The pods were then separated from the chaffs with the help of a corona manual grinding
66 machine. The breadfruit was then cooked using cooking stove for a period of 2 ~~hours~~ until it was
67 soft and edible for consumption. Next, the cooked breadfruit was dried under room temperature
68 and pulverized using corona manual grinding machine, and the now powdered cooked breadfruit
69 was stored inside a well labelled airtight plastic container until use.

70 2.2.2 ~~ParboiledPreboiled Breadfruit~~breadfruit

71 The second portion of the breadfruit was ~~parboiledpreboiled~~ by boiling it inside a pot containing
72 water, on a stove for 45 ~~minutes~~, till it was partly cooked. The pods were then separated from the
73 chaffs with the help of a corona manual grinding machine, after which it was dried for one week
74 under room temperature. Next, the pods were pulverized using corona manual grinding machine,

75 | and the now powdered ~~parboiled~~preboiled breadfruit was stored inside a well labelled airtight
76 | plastic container until use.

77 | 2.2.3 Grilled ~~Breadfruit~~breadfruit

78 | The third portion of breadfruit was grilled on a frying pan using a stove. The seeds were then
79 | separated from the chaffs of the pods and were pulverized using corona manual grinding
80 | machine. The now powdered grilled breadfruit was stored inside a well labelled airtight plastic
81 | container until use.

82 | 2.3 Composition of the ~~Rat-rat Feed~~feed

83 | The standard feed used was a product of Novum Agric Industries. It was purchased from a Feed
84 | dealer in Awka. The ingredients used in the compounding of the standard feed include grains,
85 | cereals, vegetable, protein meals, vitamins, minerals, essential amino acids, anti-toxins, enzymes.
86 | The composition of the ingredients is as follows: Oil (6%), Protein (16%), ~~Fibre~~Fiber (7%), Ash
87 | (10%), Calcium (0.95%) and Phosphorus (0.65%). The feed was fortified with the processed
88 | grilled, ~~parboiled~~preboiled, and cooked breadfruit in the following percentages: Using an
89 | analytical weighing balance, the feed and respective breadfruits were each measured. To 70g of
90 | feed, 30g of grilled breadfruit was added; to 70g of feed, 30g of ~~parboiled~~preboiled breadfruit
91 | was added; to 70g of feed, 30g of cooked breadfruit was added; also, to 50g of feed, 50g of
92 | grilled breadfruit was added; to 50g of feed, 50g of ~~parboiled~~preboiled breadfruit was added; and
93 | to 50g of feed, 50g of cooked breadfruit was added. These formulations were repeated until
94 | enough feed was prepared which lasted for a period of one month.

95 | 2.4 Study ~~Design~~design

96 | A total of 35 ~~Wistar-wistar~~ rats weighing between 120g to 150g were purchased from Chris
97 | Experimental Animal Farm and Research Laboratory, Awka, Anambra State, and randomized
98 | into seven groups of five rats each and used for the study. They were maintained and housed in
99 | cages under standard environmental conditions (27°C ± 3°C, 12-hour light/dark cycle) in Chris
100 | Experimental Animal Farm and Research Laboratory, Awka. The rats were weighed, marked,
101 | and put into labeled cages. The rats were grouped as follows:

- 102 | Group A – Normal ~~Control~~control
- 103 | Group B – 70% ~~Standard-standard Feed-feed~~ fortified with 30% cooked breadfruit
- 104 | Group C – 70% ~~Standard-standard Feed-feed~~ fortified with 30% ~~parboiled~~preboiled breadfruit
- 105 | Group D – 70% ~~Standard-standard Feed-feed~~ fortified with 30% grilled breadfruit
- 106 | Group E – 50% ~~Standard-standard Feed-feed~~ fortified with 50% cooked breadfruit
- 107 | Group F – 50% ~~Standard-standard Feed-feed~~ fortified with 50% ~~parboiled~~preboiled breadfruit
- 108 | Group G – 50% ~~Standard-standard Feed-feed~~ fortified with 50% grilled breadfruit

110 | 2.4.1 Feeding of the ~~Experimental-experimental Animals~~animals

111

112 The experimental rats were fed accordingly using the feed prepared for each of the groups. The
 113 feeding was done for a period of four weeks after which the rats were fasted and anesthetized
 114 with chloroform before blood collection. Blood was collected by cardiac puncture and put in the
 115 EDTA bottles for hematological analysis. The carcasses were properly disposed of by burying
 116 them.

118 | **2.5 Hematological Analysis**

119 Hematological parameters were determined using automated hematology analyzer (Mindray BC-
 120 5300). The hematological parameters that were analyzed include Hemoglobin (HGB), Packed
 121 Cell Volume (PCV), Red Blood Cells (RBC), Platelets (PLT), Mean Corpuscular Volume
 122 (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration
 123 (MCHC), White Blood Cells (WBC), Neutrophils (NEUT), Lymphocytes (LYMPH), Monocytes
 124 (MON), Eosinophils (EOS), Basophils (BAS).

Comment [Dbf3]: Mention method/procedure with citation how the analysis of each parameter was performed?

Comment [Dbf4]: The whole information has been repeated here as above line no. 11-16.

126 | **2.6 Statistical Analysis**

127 Data obtained from the experiments were analyzed using the Statistical Package for Social
 128 Sciences software for windows version 23 (SPSS Inc., Chicago, Illinois, USA). All the data
 129 collected were expressed as Mean \pm SEM. Statistical analysis of the results obtained were
 130 performed by using ANOVA Tests to determine if a significant difference exists between the
 131 mean of the test and control groups. The limit of significance was set at $p < 0.05$.

132
 133 **3.0 RESULTS**

134 **Table 1:** Effect of feed fortified with cooked, ~~parboiled~~preboiled, and grilled Breadfruit
 135 breadfruit seeds on some of the hematological parameters (HGB, PCV, RBC, PLT, MCV, MCH
 136 and MCHC) on Wistar-wistar rats expressed as mean \pm SEM.

Comment [Dbf5]: The description of results depicted in Table 1 is missing. A detailed description of results given in Table 1 is required.

Comment [Dbf6]: Mention it in footnote of the table not in the title of the table.

Groups	HGB (g/dl)	PCV (%)	RBC (g/dl)	PLT ($\times 10^9/L$)	MCV (fl)	MCH (Pg)	MCHC (g/dl)
Normal Control	11.95 \pm 0.20	35.78 \pm 0.63	6.47 \pm 0.12	833.25 \pm 46.57	55.28 \pm 0.56	18.48 \pm 0.85	25.93
70% Std Feed + 30% cooked Breadfruit	12.40 \pm 0.65	38.23 \pm 1.44	6.78 \pm 0.19	717.25 \pm 74.45	56.38 \pm 0.97	18.25 \pm 0.45	32.40
70% Std Feed + 30% Parboiled Preboiled Breadfruit	12.28 \pm 0.36	38.20 \pm 1.65	6.68 \pm 0.28	886.25 \pm 143.34	57.28 \pm 1.67	18.43 \pm 0.39	32.20 \pm 0.46
70% + Std Feed + 30% grilled	11.63 \pm 0.24	35.12 \pm 0.79	6.22 \pm 0.35	727.25 \pm 135.70	56.88 \pm 1.98	18.83 \pm 0.68	33.05 \pm 0.06

Comment [Dbf7]: Explain and define units used here in the footnote of the table.

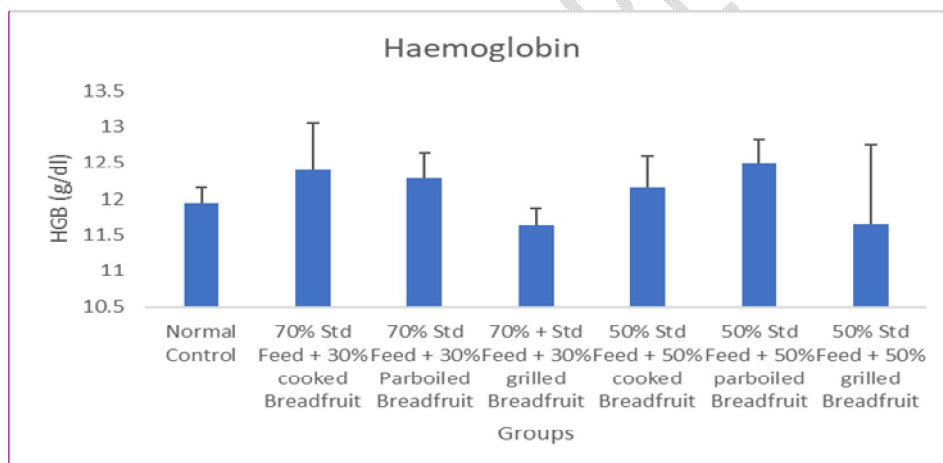
Comment [Dbf8]: Explain and define units used here in the footnote of the table.

Comment [Dbf9]: Explain and define units used here in the footnote of the table.

Breadfruit							
50% Std Feed + 50% cooked Breadfruit	12.15±0.44	37.53±1.51	6.53±0.11	701.25±36.11	57.50±1.45	18.63±0.43	104.83±72.39
50% Std Feed + 50% parboiled preboiled Breadfruit	12.50±0.33	38.30±0.83	6.70±0.30	778.25±74.94	57.30±1.46	18.73±0.38	32.63±0.19
50% Std Feed + 50% grilled Breadfruit	11.65±1.10	35.45±3.90	6.35±0.72	681.75±158.65	55.90±0.58	18.50±0.85	33.10±0.70

137

138



Comment [Dbf10]: Remove title of the figure "Haemoglobin" as it mentioned in figure legend.

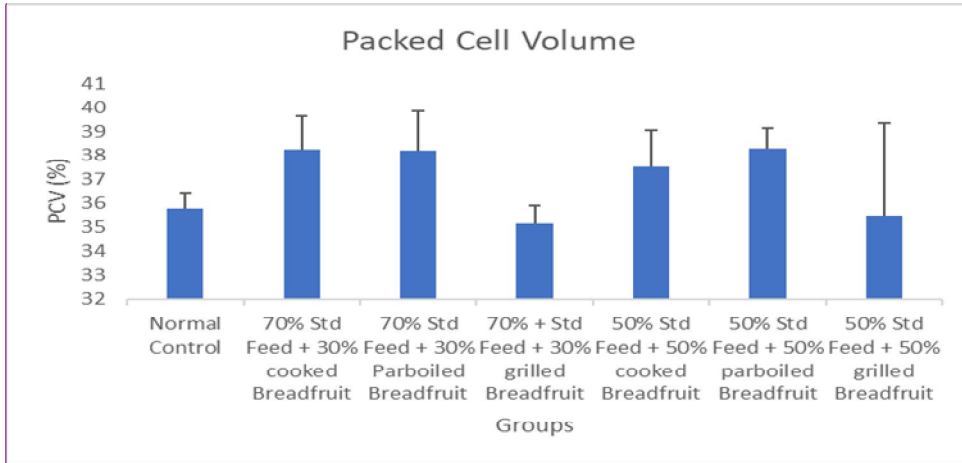
139

140 **Figure 1:** Hemoglobin concentration of normal rats fed with feed fortified with processed
141 breadfruit.

142

143 Figure 1 indicates that all fortified groups showed no significant increase or decrease ($p>0.05$)
144 although these fortified groups showed a slight increase in their haemoglobin concentration when
145 compared to the normal control with the exception to groups fortified with 30% and 50% of
146 grilled breadfruit. The group of rats fortified with 30% and 50% of grilled breadfruit showed a
147 slight decrease ($p>0.05$) in their haemoglobin concentration with respect to the normal control.

Comment [Dbf11]: Level of significance already has mentioned at line number 130. No need to mention it again and again. Please avoid repetitions.

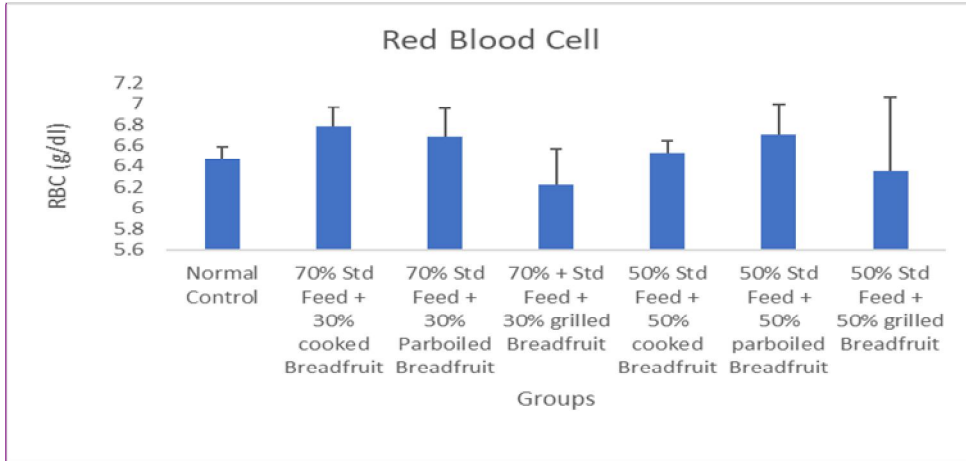


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148
 149 | **Figure 2:** Packed cCell yVolume concentration of normal rats fed with feed fortified with
 150 processed breadfruit.
 151

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152 | Figure 2 shows that all fortified groups indicated no significant increase or decrease ($p>0.05$) in
 153 | their packed cell volume concentration when compared to the normal control with the exception
 154 | of groups fortified with 30% and 50% of grilled breadfruit. The group of rats fortified with 30%
 155 | and 50% of grilled breadfruit however showed insignificant decrease ($p>0.05$) in their packed
 156 | cell volume concentration with respect to the normal control.



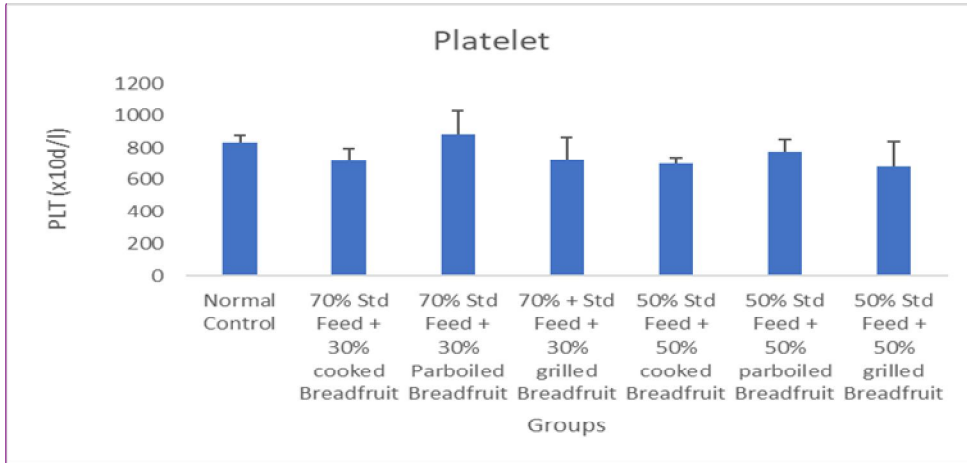
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157 | **Figure 3:** Red blood cell concentration of normal rats fed with feed fortified with processed
 158 | breadfruit.
 159 |

160 | The red blood cell concentration of all fortified groups as seen in figure 3 showed a slight but
 161 | insignificant ($p>0.05$) increase in the red blood cell concentration when compared to the normal
 162 | control with the exception to groups fortified with 30% and 50% of grilled breadfruit. The
 163 | groups of rats fortified with 30% and 50% of grilled breadfruit showed a non-statistical decrease
 164 | ($p>0.05$) in their red blood cell concentration with respect to the normal control.
 165 |

166 |

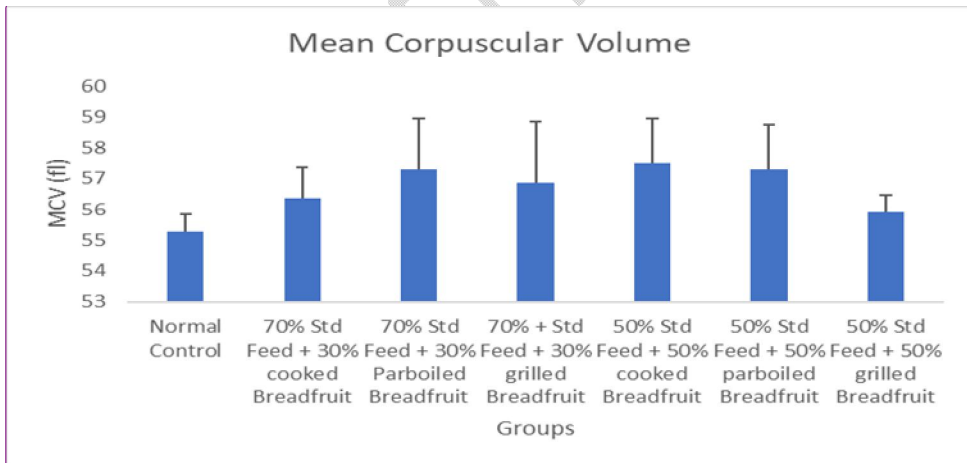
167 |



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168
169 **Figure 4:** Platelet concentration of normal rats fed with feed fortified with processed breadfruit.

170
171 Statistical analysis revealed that only the group of rats fortified with 30% Parboiled
172 Breadfruit indicated an non-significant increase ($p > 0.05$) in its platelet
173 concentration. All other groups were slightly but non-statistically decreased
174 ($p > 0.05$) when compared with the normal control (figure-Figure 4).

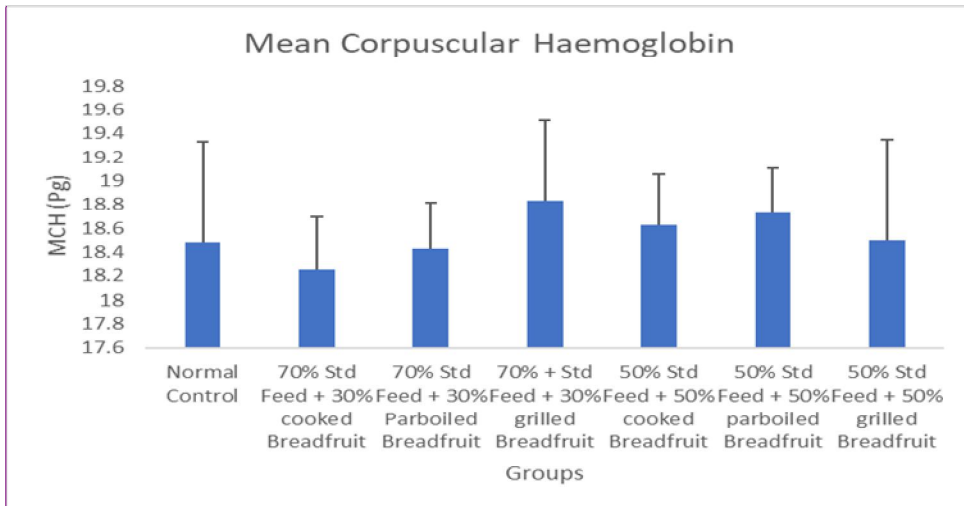


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176
177 **Figure 5:** Mean Corpuscular Volume concentration of normal rats fed with
178 feed fortified with processed breadfruit.

179 The Mean-mean Corpuscular Volume concentration of the rats showed a
180 non-significant increase ($p > 0.05$) in all groups with respect to the normal control
181 group (figure-Figure 5).

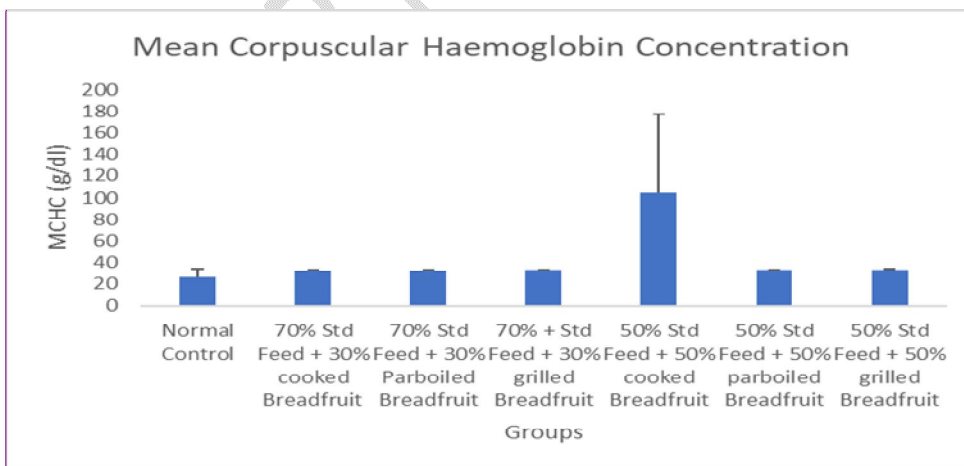
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Figure 6: Mean ~~Corpuscular-corpuscular Hemoglobin-hemoglobin~~ of normal rats fed with feed fortified with processed breadfruit. The Mean ~~Corpuscular-corpuscular~~ hemoglobin of the rats showed a ~~non-in~~significant increase ($p > 0.05$) in most groups with respect to the normal control group except for groups fortified with 30% cooked ~~Breadfruit-breadfruit~~ and 30% ~~parboiled-preboiled Breadfruit-breadfruit~~ which showed a slight but insignificant decrease ($p > 0.05$) when compared with the normal control (~~figure-Figure~~ 6).



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196

Figure 7: Mean ~~Corpuscular-corpuscular Haemoglobin-haemoglobin~~ concentration of normal rats fed with feed fortified with processed breadfruit.

197
198
199 The Mean ~~Corpuscular~~ corpuscular hemoglobin concentration of the rats showed a non-
200 significant increase ($p > 0.05$) in all groups with respect to the normal control group as seen in
201 ~~figure~~ Figure 7.

202
203 **Table 2:** Effect of feed fortified with cooked, ~~parboiled~~ preboiled and grilled Breadfruit seeds on
204 some of the white blood cells and its differentials (Neut, Lymph, Mon, Eos and Bas) on ~~Wistar~~
205 wistar rats expressed as mean ± SEM.

Comment [Dbf18]: Mention in footnote, not in title of the table.

Groups	WBC (x10 ⁶ /dL)	NEUT (%)	LYMPH (%)	MON (%)	EOS (%)	BAS (%)
Normal Control	7.40±0.81	22.78±1.97	74.60±2.54	1.78±1.11	1.15±0.43	1.95±1.06
70% Std Feed + 30% cooked Breadfruit <u>breadfruit</u>	13.48±2.22 ^a	38.88±8.12 ^a	59.13±8.18 ^b	0.88±0.21	3.90±2.17	0.60±0.12
70% Std Feed + 30% Parboiled <u>Preboiled</u> Breadfruit <u>breadfruit</u>	14.49±3.14 ^a	18.28±1.47	78.30±2.53	2.00±1.39	0.93±0.36	0.50±0.11 ^b
70% + Std Feed + 30% grilled Breadfruit <u>breadfruit</u>	10.48±1.69	21.50±1.83	76.53±2.12	0.83±0.40	0.40±0.41	0.75±0.12
50% Std Feed + 50% cooked Breadfruit <u>breadfruit</u>	15.21±0.97 ^a	29.75±4.10	67.88±4.13	0.98±0.10	2.05±1.34	0.70±0.29
50% Std Feed + 50% parboiled <u>preboiled</u> Breadfruit <u>breadfruit</u>	13.18±0.79 ^a	28.60±2.38	68.28±2.43	1.35±0.31	1.08±0.21	0.70±0.18
50% Std Feed +	10.04±2.66	26.23±3.06	70.48±2.54	1.58±0.39	0.55±0.24	1.18±0.45

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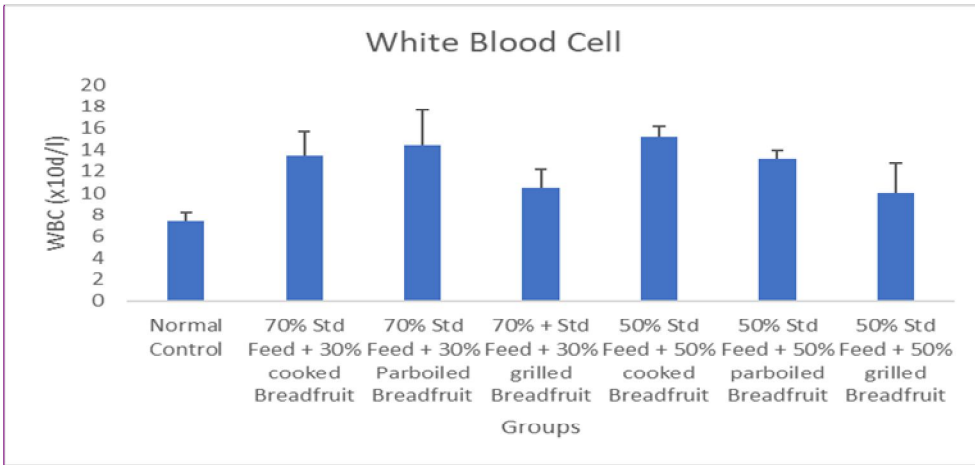
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50%	grilled					
Breadfruit	breadfruit					

206 ^aSignificant increase with respect to normal control; ^bSignificant decrease with respect to normal
 207 control.

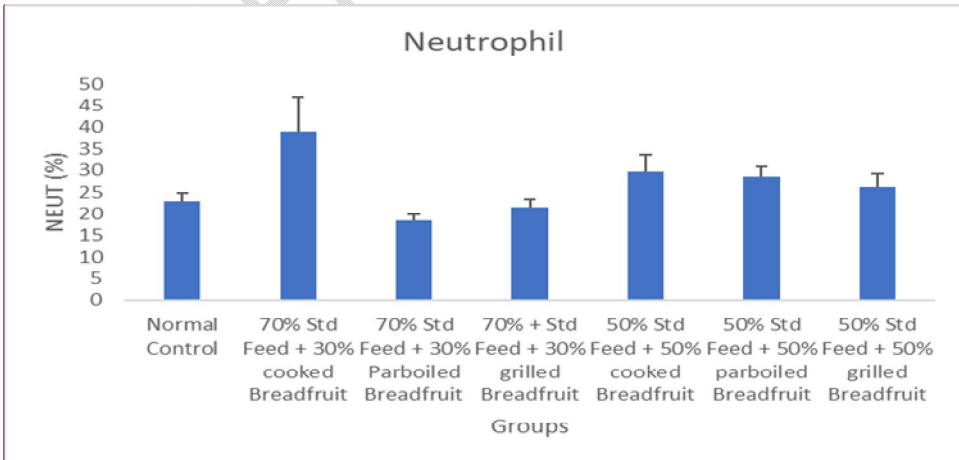
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209 **Figure 8:** White blood cell concentration of normal rats fed with feed fortified with processed
 210 breadfruit.
 211

212 The white blood cell count of the experimental rats showed significant increase ($p < 0.05$) in all
 213 groups except for the groups fortified with 30% and 50% grilled ~~Breadfruit~~ ~~breadfruit~~
 214 respectively compared with the normal control (figure-Figure 8).
 215
 216
 217

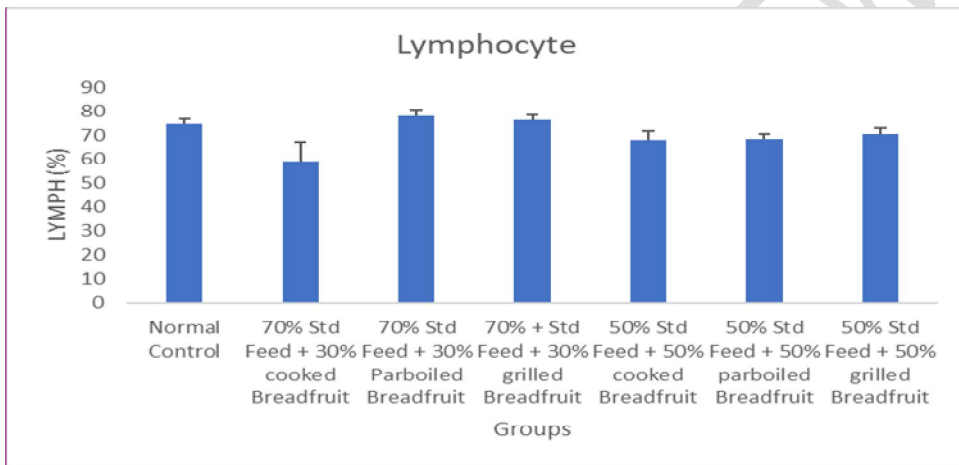


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219 **Figure 9:** Neutrophil concentration of normal rats fed with feed fortified with processed
220 breadfruit.
221

222 Throughout the period of the experiment, only the group fortified with 30% cooked Breadfruit
223 showed a significant increase ($p < 0.05$) with respect to the normal control group (figure Figure 9).
224 The Neutrophil concentration of rats fortified with 30% Parboiledpreboiled Breadfruit
225 breadfruit and 30% grilled Breadfruit-breadfruit showed some level of reduction when compared
226 to the normal control, although this reduction was not statistically significant ($p > 0.05$). All the
227 groups that were fortified with 50% of either-cookedeither cooked, parboiledpreboiled or grilled
228 Breadfruit-breadfruit showed levels of increase in their neutrophil concentration with respect to
229 the normal control group, but this increase was not statistically significant ($p > 0.05$).
230

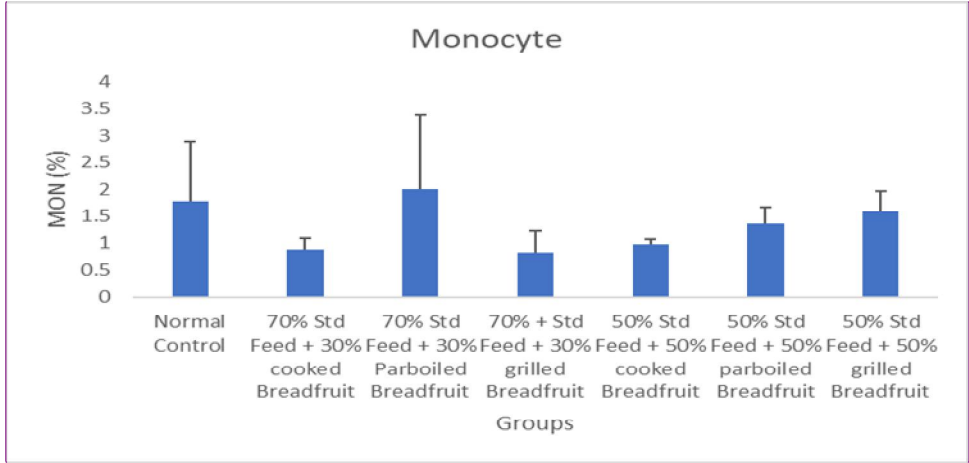


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231 **Figure 10:** Lymphocyte concentration of normal rats fed with feed fortified with processed
232 breadfruit.
233

234 A significant decrease ($p < 0.05$) in the lymphocyte concentration was observed in the group
235 fortified with 30% cooked Breadfruit-breadfruit when compared with the normal control (figure
236 Figure 10). All the groups that were fortified with 50% of either-cookedcooked,
237 parboiledpreboiled or grilled Breadfruit-breadfruit showed levels of decrease in their lymphocyte
238 concentration when compared with the normal control group, but this decrease was not
239 statistically significant ($p > 0.05$). The groups that were fortified with 30% parboiledpreboiled
240 Breadfruit-breadfruit and 30% grilled Breadfruit-breadfruit both showed an increase in
241 Lymphocyte-lymphocyte level, however, this increase was also not statistically significant ($p >$
242 0.05).
243

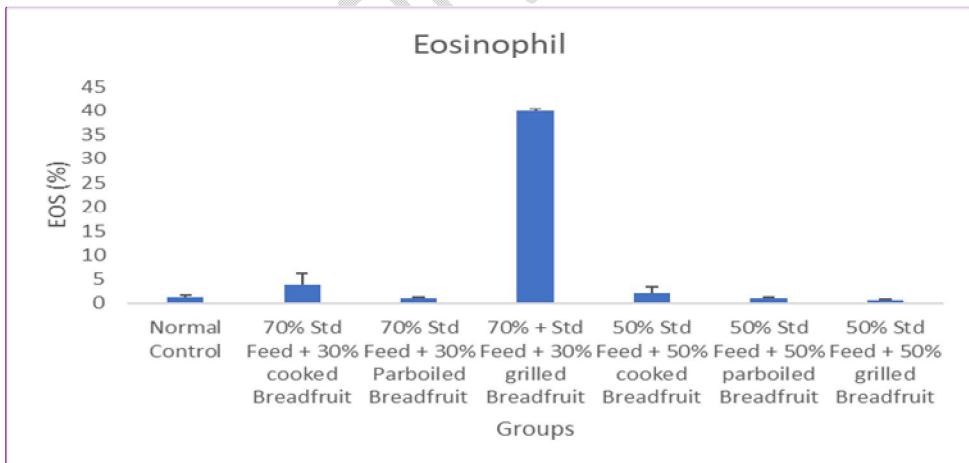
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248 **Figure 11:** Monocyte concentration of normal rats fed with feed fortified with processed
 249 breadfruit.
 250

251
 252 Figure 11 revealed that the monocyte levels of the experimental rats decreased in all groups with
 253 respect to the normal control except for the group of rats fortified with 30% ~~Parboiled~~Preboiled
 254 ~~Breadfruit~~breadfruit which indicated an increase in its monocyte level when compared to the
 255 normal control group. Both the increase and decrease observed were not statistically significant
 256 ($p > 0.05$).
 257
 258

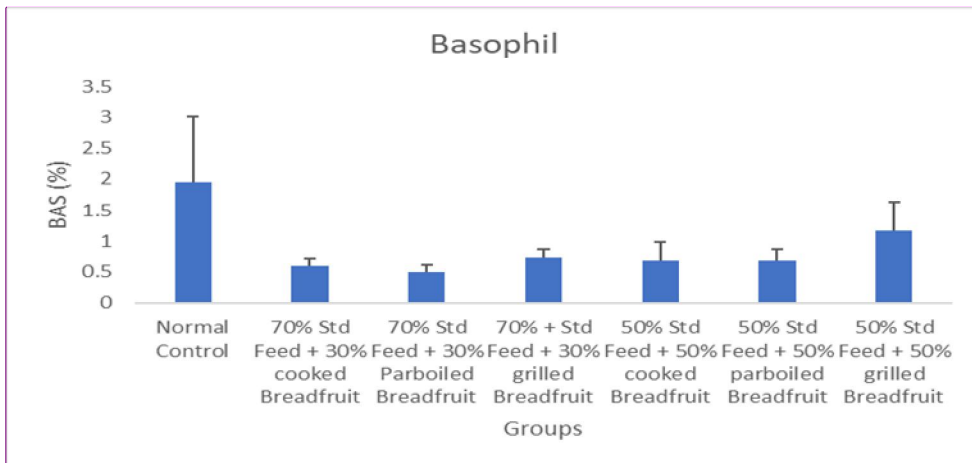


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259 **Figure 12:** Eosinophil concentration of normal rats fed with feed fortified with processed
 260 breadfruit.
 261

262
 263 ~~From figure Figure 12 depicted,~~ an increase in eosinophil concentration ~~was observed~~ in the
 264 groups of rats fortified with 50% cooked ~~Breadfruit~~breadfruit, 30% cooked ~~Breadfruit~~breadfruit

265 | and 30% grilled Breadfruitbreadfruit. However, a significant increase ($p < 0.05$) was only
 266 | observed in the group fortified with 30% grilled Breadfruitbreadfruit when compared to the
 267 | normal control.
 268 |
 269 |



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270 |
 271 | **Figure 13:** Basophil concentration of normal rats fed with feed fortified with processed
 272 | breadfruit.
 273 |

274 | All the groups of experimental rats used showed a decrease in their Basophilbasophil
 275 | concentration, with significant decrease ($p < 0.05$) seen in the group of rats fortified with 30%
 276 | Parboiledpreboiled Breadfruitbreadfruit when compared with the normal control group (figure
 277 | Figure 13).
 278 |

279 |
 280 | **DiscussionDISCUSSION**

281 | Hematological parameters give an insight into the physiological status of animals [9]. These
 282 | parameters are of great interest because they help to understand the relation of blood
 283 | characteristics to the environment and help in the diagnosis and monitoring of diseases [10].
 284 | Hemoglobin plays the physiological role of transporting oxygen to tissues of the animal for
 285 | oxidation of consumed food in order to release the needed energy for the effective functioning of
 286 | other body parts and also for the transport of carbon dioxide out of the body of animals [11,12,13,
 287 | 12, 13]. The slight increase in the haemoglobin concentration observed from the result may result
 288 | in a higher amount of oxygen transported to tissues.

Comment [Dbf25]: All headings should be on same format

289 | The red blood cell is involved in the transportation of oxygen and carbon dioxide in the body.
 290 | Thus, a decrease in the red blood cell count indicates a reduction in the level of oxygen that
 291 | would be carried to the tissues as well as the level of carbon dioxide returned to the lungs [11,14,
 292 | 14]. The result showed a slight but non-significant decrease in the red blood cell count of feed

293 fortified with 30% and 50% of grilled breadfruit. It could however be safe to infer that the red
294 blood cell count was not affected by the fortification of the feed with processed breadfruit.

295 The platelet concentration showed a slight but ~~non-in~~statistically decreased (~~$p > 0.05$~~) in all groups
296 except in the group of rats fortified with 30% ~~Parboiled~~preboiled Breadfruit when compared
297 with the normal control. This could result in low platelet concentration when consumed over a
298 long period of time as ~~Platelet-platelet~~ concentrations are implicated in blood clotting, as
299 research has shown that low platelet concentration indicates that the path to clot-formation
300 (blood clotting) will be prolonged leading to excessive loss of blood in the case of injury [15].

301 It has been reported that circulatory erythrocytes and diagnosis of anemia are evaluated by some
302 major indices such as ~~Packed-packed Cell-cell Volume~~volume, hemoglobin, and mean
303 corpuscular hemoglobin [16]. The packed cell volume concentration of the fortified rats showed
304 a nonsignificant increase (~~$p > 0.05$~~) when compared to the normal control with the exception of
305 groups fortified with 30% and 50% of grilled breadfruit. Although the increase was insignificant
306 but may be an indication of either an increase in the number of ~~Red-red Blood-blood Cells-cells~~
307 (~~RBCs~~) or a reduction in circulating plasma volume as reported by [17].

Comment [Dbf26]: Mention name of author with et al.

308 The ~~Mean-mean~~ corpuscular volume, mean corpuscular hemoglobin and mean corpuscular
309 hemoglobin concentration indicate blood level conditions and a low level is an indication of
310 anemia [18]. The research result however indicates no negative effect as the slight increase and
311 decrease observed in the mean corpuscular volume, mean corpuscular hemoglobin and mean
312 corpuscular hemoglobin concentration were statistically insignificant. Some medicinal plants are
313 capable of improving the ~~haematologica~~hematological parameters of ~~Wistar-wistar~~ rats
314 [19,~~20,21, 20, 21~~].

315 White blood cell and its differentials function majorly as the body's defense against infections
316 through phagocytosis against attacks by foreign organisms and through the production,
317 transportation and distribution of antibodies in immune response [22,~~14, 14~~]. The significant
318 increase (~~$p < 0.05$~~) observed in the white blood cell count, neutrophil and eosinophil
319 concentration may indicate higher generation of antibodies and high degree of resistance to
320 diseases which agrees with the findings of Soetan *et al.* [13].

321 The lymphocyte and basophil concentrations indicated significant decrease (~~$p < 0.05$~~) in groups
322 fed with 70% Standard Feed + 30% cooked ~~Breadfruit-breadfruit~~ and 70% ~~Standard-standard~~
323 ~~Feed~~feed + 30% ~~Parboiled~~preboiled ~~Breadfruit-breadfruit~~, respectively. This reduction may
324 however expose the animal to high risk of disease infection [13].

325

326 CONCLUSION

327

328 The results of the experiment carried out on the effect of feed fortified with different quantities
329 of processed breadfruit revealed that processing does not have any toxic effect on the
330 ~~haematologica~~hematological parameters of ~~Wistar-wistar~~ rats. It may be inferred that the

331 fortification of feed with processed breadfruit has no negative effect on the physiological status
332 of the experimental animals.

333

334 **ETHICAL APPROVAL**

335 All experiments were supervised and approved by the Nnamdi Azikiwe University Animal
336 Research Ethics Committee (NAU-AREC) in line with the principles of Animal Care and Use in
337 Research, Education and Testing. The ethical approval number as issued by the NAU-AREC is
338 NAU/AREC/2021/00040.

339

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