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Hematological Comparison Property of *Brysocarpus coccineus*, *Piptadeniastrum africanum*, *Caesalpinia bonduc* and *Crinum jagus* Methanol Extracts

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Abstract: This study evaluated and compared the hematological effects of methanol leaf extracts of *Brysocarpus coccineus*, *Piptadeniastrum africanum*, *Caesalpinia bonduc*, and *Crinum jagus* on mice. Sixty-four male mice (20–30 g) were randomly divided into groups and orally administered 100, 200, or 400 mg/kg of each extract for 14 days, while control mice received normal saline. Blood samples were analyzed for Red Blood Cell (RBC) count, White Blood Cell (WBC) count, Hemoglobin (Hb) concentration, Hematocrit (HCT), count, and differential WBC count (neutrophils, lymphocytes, monocytes, etc.) using an automated hematology analyzer. Results revealed that all extracts were hematologically safe, showing no signs of anemia or leukocytosis. *C. jagus* exhibited the highest packed cell volume (PCV; 46%) and hemoglobin concentration (15.4 g/dL), followed by *C. bonduc* (44%, 14.3 g/dL), and *P. africanum* (43%, 14.3 g/dL). *B. coccineus* produced the lowest but dose-dependent values (PCV 29–39%; Hb 10.1–13.7 g/dL). RBC and platelet counts remained within normal ranges, while leukocyte and differential counts showed mild increases, indicating potential immunostimulation. ANOVA revealed significant differences among treatments for PCV, Hb, and RBC ($p < 0.01$), but not for WBC or platelets ($p > 0.05$). These findings indicate that *C. jagus* and *C. bonduc* possess superior erythropoietic properties, while all extracts maintain hematological balance without toxicity. The study scientifically supports the traditional use of these plants in the management of anemia and related hematological disorders.

Keywords: *Brysocarpus Coccineus, Piptadeniastrum Africanum, Caesalpinia Bonduc, Crinum Jagus*, Hematology, Erythropoiesis.

Research Paper

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INTRODUCTION

Hematology is a field of medicine that studies blood, the organs that produce it, and disorders related to blood. The health of the blood is a key indicator of overall physiological well-being and is commonly utilized to evaluate the safety and therapeutic efficacy of herbal medicines. Blood parameters such as packed cell volume (PCV), hemoglobin (Hb), red blood cell (RBC) count, and white blood cell profiles serve as sensitive indicators of red blood cell production, immune response, and potential toxicity after exposure to foreign substances, including plant extracts (Vågane *et al*., 2022). For centuries, medicinal plants have been used in traditional medicine to treat a variety of health problems. These plants hold a prominent place in ethnopharmacology, particularly within African traditional medicine, where they have been relied upon for centuries to combat conditions such as anemia, blood clotting abnormalities, and immune deficiencies.

Brysocarpus coccineus, known as Amuje wewe or Ado kanti-kanti in Nigeria, is a deciduous climbing plant belonging to the Connaraceae family. It thrives in tropical forests and savannahs, showcasing remarkable adaptability to diverse ecological conditions (Akindele *et al*., 2011). The ethnobotanical significance of this plant is profound, with its leaves, bark, and roots historically employed for their diverse medicinal properties, ranging from gastrointestinal ailments to skin conditions. The plant's therapeutic properties are primarily linked to its bitter constituents, known as cucurbitacins (Ukwade *et al*., 2024).

Caesalpinia bonduc—commonly referred to as Fever Nut, Gray Nicker, or Bonduc Nut, and called *ayóo* in Yoruba—is a spiny, climbing shrub belonging to the Fabaceae family. It is widely distributed throughout tropical and subtropical regions, flourishing in coastal zones, open forests, and scrublands. This robust species demonstrates remarkable ecological adaptability, thriving even in sandy or disturbed soils (Lok *et al*., 2011). Traditionally, nearly all parts of the plant—seeds, roots, leaves, and bark—have been employed in herbal medicine for their diverse pharmacological activities,

including antipyretic, antidiabetic, antimicrobial, antioxidant, anti-inflammatory, and hepatoprotective properties (Singh and Agarwal (2023).

Piptadeniastrum africanum, commonly known as African greenheart, is a large deciduous tree belonging to the Fabaceae family and is indigenous to the humid tropical regions of sub-Saharan Africa, extending from Senegal to Sudan and Angola. It represents the sole species within its genus. Typically found in freshwater swamp areas and extending inland, this species holds significant medicinal value. Among the Baka people of Cameroon, macerated stem bark extracts are traditionally used to relieve abdominal pain. Additionally, leaf extracts serve as tonics and aphrodisiacs, reputed to alleviate back pain and enhance sexual vitality (Ahmadu *et al.,* 2007).

Crinum jagus, a member of the Amaryllidaceae family and commonly called the bush lily, is widely recognized under various local names across regions. Native to West Africa, it plays a central role in traditional African medicine due to its extensive therapeutic applications. The bulb and leaves are particularly valued for treating fevers, wounds, and respiratory infections, making *C. jagus* an essential component of indigenous healing practices. Moreover, several species within the *Crinum* genus contain alkaloids with notable pharmacological potential (Sallihu *et al*., 2022).

This study investigated the hematopoietic property of *B. coccineus, P. africanum, C. bonduc,* and *C. jagus* methanol extracts in mice.

Materials and Methods

Preparation of Plant Extract

Fresh leaves of *B. coccineus*, *P. africanum*, *C. bonduc*, and *C. jagus* were collected, air-dried, and ground into fine powder. Each powdered sample was macerated in methanol for seven days with continuous agitation. The mixtures were then filtered, and the filtrates were concentrated to dryness at room temperature. The resulting dried extracts were stored in tightly sealed containers until further use in the experiment.

Experimental Animals

A total of sixty-four (64) healthy male mice weighing between 20 and 30 g were obtained from Ibadan, Oyo State, Nigeria. The animals were housed in the Animal House of the Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria, under controlled environmental conditions (12-hour light/dark cycle, temperature 22–25°C). They were allowed to acclimatize for one week before the commencement of the experiment and were provided with standard feed and water *ad libitum*. All experimental procedures followed the institutional guidelines for the care and use of laboratory animals.

Experimental Design

Sixteen (16) mice were used for the assay of each plant extract and were randomly assigned into five groups, with four mice per group. The treatment groups received oral doses of the plant extracts at concentrations of 100, 200, and 400 mg/kg, while the negative control group received normal saline (2 mL/kg). All treatments were administered orally once daily for a period of 14 days.

Blood Sample Collection and Hematological Analysis

At the end of the treatment period, blood samples were collected via cardiac puncture under light anesthesia, isoflurane. Samples were placed in ethylenediaminetetraacetic acid (EDTA) bottles for hematological analysis. Hematological parameters measured included: Red Blood Cell (RBC) count**,** White Blood Cell (WBC) count**,** Hemoglobin (Hb) concentration**,** Hematocrit (HCT)**,** count**,** and differential WBC count (neutrophils, lymphocytes, monocytes, etc.)**.** These were determined using an automated hematology analyzer and standard laboratory protocols.

Statistical Analysis

All data are expressed as mean ± standard deviation (SD). Statistical differences between treatment groups were analyzed by one-way ANOVA, followed by Tukey's post-hoc test at $p < 0.05$.

Results

Results of the Hematological Analysis

The hematological results of mice treated with methanol extracts of *B. coccineus*, *P. africanum*, *C. bonduc*, and *C. jagus* at varying doses of 100, 200, and 400 mg/kg are summarized in Table 1 while statistical summary of hematological parameters is shown in Table 2.

Packed Cell Volume (PCV) and Hemoglobin (Hb)

The normal control group recorded a PCV of 43% and Hb of 14.6 g/dL. Among the extracts, *C. jagus* (D1–D4) exhibited the highest PCV (42–46%) and Hb (14.2–15.4 g/dL), values slightly exceeding the control, indicating enhanced erythropoietic activity. *C. bonduc* (C1–C4) followed closely with PCV (38–44%) and Hb (11.9–14.3 g/dL). *P. africanum* (B1–B4) also maintained relatively high PCV (38–43%) and Hb (12.5–14.3 g/dL), whereas *B. coccineus* (A1–A4) showed the lowest PCV and Hb values (29–39% and 10.1–13.7 g/dL, respectively), suggesting a milder hematinic potential.

Red Blood Cells (RBC) and Erythrocyte Indices

RBC counts varied across the extracts, with *C. jagus* (D4: 8.5 $\times 10^{12}$/L) and *C. bonduc* (C4: 8.3 $\times 10^{12}$/L) showing the highest levels compared to control (8.1

$\times 10^{12}$/L). *P. africanum* ranged from 7.3–8.1 $\times 10^{12}$/L, while *B. coccineus* remained the lowest (5.4–7.6 $\times 10^{12}$/L). The mean corpuscular volume (MCV) across treatments ranged from 50.65–54.12 fL, mean corpuscular hemoglobin (MCH) from 16.3–18.64 pg, and mean corpuscular hemoglobin concentration (MCHC) from 31.32–35.48 g/dL, all within normal physiological limits, indicating normocytic, normochromic erythrocytes across all groups.

White Blood Cells (WBC) and Differential Counts

WBC counts across treatment groups were slightly elevated compared to control (12.5 $\times 10^3$/µL), ranging from 11.4 $\times 10^3$/µL (*P. africanum* at 100 mg/kg) to 14.6 $\times 10^3$/µL (*C. bonduc* at 400 mg/kg). Neutrophils (43–47%) and lymphocytes (45–49%) remained relatively stable, suggesting balanced innate and adaptive immune responses. Monocyte (5–8%), eosinophil (0–2%), and basophil (1–2%) counts were within physiological ranges, indicating no allergic or inflammatory reactions.

Platelets (Thrombocytes)

Platelet counts ranged from 6.4–8.4 $\times 10^9$/L, comparable to control (7.1 $\times 10^9$/L). *P. africanum* and *C. bonduc* exhibited the highest thrombocyte counts (8.4 $\times 10^9$/L), implying mild thrombopoietic stimulation.

Table 1: Hematological Results of *B. coccineus, P. africanum, C. bonduc,* and *C. jagus* methanol extracts on mice

SN	CODE	PCV%	WBC X 10^3µL	NEUT%	LYMPH %	MONO %	EOS%	BASO%	THROM X 10^9	RBC x10^{12}L	HB g/dL	MCHC g/dL	MCV fl	MCH pg
1	N	43	12.5	43	48	5	2	2	7.1	8.1	14.6	33.95	53.09	18.02
5	A1	29	12.8	43	46	7	2	2	5.4	5.6	10.1	34.83	51.79	18.04
6	A2	31	14.2	47	45	5	1	2	7.2	5.9	11	35.48	52.54	18.64
8	A4	39	13.3	45	48	6	0	1	6.6	7.6	13.7	35.13	51.32	18.03
12	B1	38	11.4	43	49	6	1	1	8.4	7.3	12.5	32.89	52.05	17.12
13	B2	39	11.8	44	48	6	1	1	6.7	7.7	13.2	33.85	50.65	17.14
15	B4	43	13.9	45	48	6	0	1	7.9	8.1	14.3	33.26	53.09	17.65
17	C1	38	12.4	43	48	7	1	1	8.3	7.3	11.9	31.32	52.05	16.30
18	C2	42	13.3	44	47	6	1	2	7.4	7.9	14.1	33.57	53.16	17.85
19	C4	44	14.6	45	46	8	0	1	6.4	8.3	14.3	32.50	53.01	17.23
25	D1	42	12.6	44	48	5	1	2	7.4	7.9	14.2	33.81	53.16	17.97
26	D2	43	13.4	44	47	6	2	1	6.7	8.4	14.6	33.95	51.19	17.38
29	D4	46	12.4	43	48	5	2	2	6.4	8.5	15.4	33.48	54.12	18.12

Note: N= Normal control, A= *B. coccineus* extract, B= *P. africanum* extract, C= *C. bonduc* extract and D= *C. jagus* extract. 1= 100 mg/kg, 2= 200 mg/kg and 4= 400 mg/kg

Table 2: Statistical Summary of Hematological Parameters

Parameter	Control (N)	*B. coccineus*	*P. africanum*	*C. bonduc*	*C. jagus*	F-value	p-value
PCV (%)	43.00 ± 0.00^{a}	33.00 ± 5.29^{c}	40.00 ± 2.65^{b}	41.33 ± 3.21^{ab}	43.67 ± 2.08^{a}	7.214	0.004 **
Hb (g/dL)	14.60 ± 0.00^{a}	11.60 ± 1.86^{c}	13.33 ± 0.90^{b}	13.43 ± 1.23^{b}	14.73 ± 0.61^{a}	9.126	0.002 **
RBC ($\times 10^{12}$/L)	8.10 ± 0.00^{a}	6.30 ± 0.96^{c}	7.63 ± 0.88^{b}	7.53 ± 0.97^{b}	8.27 ± 0.46^{a}	6.448	0.006 **
WBC ($\times 10^3$/µL)	12.50 ± 0.00^{ab}	13.43 ± 0.72^{a}	12.37 ± 1.27^{ab}	13.43 ± 1.14^{a}	12.80 ± 0.51^{ab}	1.243	0.345 ns
Platelets ($\times 10^9$/L)	7.10 ± 0.00^{a}	6.40 ± 0.92^{ab}	7.67 ± 0.88^{a}	7.37 ± 0.96^{a}	7.17 ± 0.96^{a}	0.986	0.448 ns
MCV (fL)	53.09 ± 0.00^{ab}	51.88 ± 0.60^{b}	51.93 ± 1.23^{b}	52.74 ± 0.65^{ab}	52.82 ± 1.52^{a}	1.871	0.184 ns
MCH (pg)	18.02 ± 0.00^{ab}	18.24 ± 0.33^{a}	17.30 ± 0.27^{b}	17.13 ± 0.79^{b}	17.82 ± 0.38^{ab}	2.972	0.081 ns
MCHC (g/dL)	33.95 ± 0.00^{ab}	35.15 ± 0.35^{a}	33.33 ± 0.49^{ab}	32.46 ± 0.54^{b}	33.75 ± 0.22^{ab}	3.682	0.048 *

Superscripts with different letters (a, b, c) within each row indicate statistically significant differences at $p < 0.05$. ns = not significant; * = significant ($p < 0.05$); ** = highly significant ($p < 0.01$).

DISCUSSION

The comparative analysis of hematological parameters reveals that all four plant extracts possess varied but generally positive hematopoietic and immunomodulatory potentials in mice.

Erythropoietic Effects

Among the extracts, *C. jagus* exhibited the strongest erythropoietic effect, evident in its significantly higher PCV, Hb, and RBC counts. This aligns with earlier findings that *C. jagus* bulbs contain alkaloids, saponins, and glycosides known to stimulate erythropoiesis and enhance oxygen transport (Nwachukwu *et al*., 2023; Idu & Ovuakporaye, 2021).

The extract's ability to maintain high MCV and MCH values further suggests the production of normocytic and normochromic red cells, signifying no anemic or cytotoxic effect.

C. bonduc ranked second in hematinic activity, showing a marked increase in PCV and Hb close to *C. jagus*. This agrees with Uchegbu *et al*. (2020), who reported that *C. bonducella* seed extract enhances hemoglobin synthesis and protects erythrocytes from oxidative hemolysis due to its rich phenolic and iron contents.

P. africanum maintained moderate erythropoietic potential with hematological parameters comparable to control, corroborating reports that its stem bark extract promotes red cell regeneration and possesses antioxidant effects (Ezeonwumelu *et al*., 2022).

Conversely, *B. coccineus* showed the lowest PCV and Hb across doses, though still within physiological limits. This may be due to its lower concentration of iron and hematopoietic phytoconstituents compared to the other extracts. However, the gradual dose-dependent improvement from 29% (A1) to 39% (A4) in PCV and from 10.1 to 13.7 g/dL in Hb suggests mild but positive hematinic activity. Olorunnisola *et al*. (2012) attributed similar effects in *Bauhinia tomentosa* to the presence of flavonoids and terpenoids that enhance erythropoiesis by reducing oxidative stress on red cells.

Leukocyte and Immune Responses

The stable neutrophil and lymphocyte ratios across extracts suggest that none of the treatments elicited leukocytosis or immunosuppression. The mild elevation in total WBC count, particularly in *C. bonduc* and *C. jagus*, indicates mild immunostimulation, consistent with their reported antimicrobial and immunomodulatory properties (Oladele *et al.,* 2019; Adesegun *et al*., 2016). This implies that these extracts may enhance immune surveillance and response efficiency without provoking inflammation.

Platelet Regulation

All extracts maintained platelet counts within normal range, implying no disruption in thrombopoiesis. The slightly higher platelet values in *P. africanum* and *C. bonduc* suggest possible support for platelet production, as previously observed in *Piliostigma thonningii* and related legumes (Okonkwo *et al*., 2021).

CONCLUSION

The comparative hematological analysis of *B. coccineus*, *P. africanum*, *C. bonduc*, and *C. jagus* methanol extracts reveals that all four plants are hematologically safe and exhibit dose-dependent erythropoietic and immunomodulatory effects in mice. Among them, *C. jagus* demonstrated the most potent hematopoietic activity, followed by *C. bonduc* and *P. africanum*, while *B. coccineus* showed mild but consistent effects. The observed increases in PCV, Hb, and RBC counts indicate enhanced erythropoiesis, while stable leukocyte and platelet counts confirm hematological safety and immune balance.

These findings scientifically substantiate the ethnomedicinal use of these plants in treating anemia, immune disorders, and oxidative blood pathologies, suggesting their potential as natural hematinic agents. Further studies should isolate and characterize the bioactive compounds responsible for their hematopoietic properties.

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