Original Research Article

The effects of methanolic plant extract on the haematological indices of induced preeclamptic Wistar rats

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ABSTRACT

Aims: Preeclampsia can have a deleterious impact on hematological parameters of pregnant women. Management of this medical condition is critical for improving mother and fetal outcomes. Alternative phytomedicinal intervention is becoming more popular in prenatal care. The current study looked into the effects of methanolic extracts of Jatropha curcas, Alchonnea cordifolia, and Secamone afzelii on haematological markers in preeclamptic Wistar rats.

Study design: The study was a trial using an animal model

Place and Duration of Study: The study was conducted in the University of Benin, Nigeria in July 2019.

Methodology: Age-matched (3 days) female Wistar rats weighing 220 to 256 g were used in the study (mean, 237 g). The Adriamycin Model was utilized in Wistar rats to induce preeclampsia. Methanolic extracts of Jatropha curcas, Alchonnea cordifolia, and Secamone afzelii were given to the rats in doses of 50, 100, and 200 mg/kg. The animals were anaesthetized with chloroform and humanely slaughtered twenty-four (24) hours after the last dosage of the standard medicine and various treatment extracts were administered to the relevant groups. Blood samples were drawn from the aorta and transferred to tubes containing the anticoagulant EDTA before being evaluated for the various parameters on an Auto Haematology Analyzer Model XrHA640.

Results: White cell count was $6.77x10^3$ in the control group, but when preeclampsia was developed, WBC plummeted to $5.8x10^3$. However, when preeclamptic rats were given 100mg/kg of Secamone afzeli extracts, their WBC increased to $9.75x10^3$. A similar increase in hematological differentials was observed in lymphocytes when preeclampsia dramatically reduced lymphocyte volume to 1.1% against 1.17 % in the control. The mean corpuscular volume in the control group was 71.6fL, but when preeclampsia was induced, it dropped to 67.0fL. This improved to 78.6fL when the normal medication was supplied, and 81.6fL when 50mg of Alchonnea cordifolia extracts were administered.

Conclusion: According to the findings, extracts of several plants generated increases in PCV to varying degrees, and hence might be utilized to treat anemia. Their ability to improve platelet counts at various levels showed that they could be used in the treatment of thrombocytopenia. The extracts can help improve immune responses by increasing white cell numbers.

Keywords: Jatropha curcas, Alchonnea cordifolia, Secamone afzelii, preeclamsia, haematological indices

1. INTRODUCTION

The incidence of preeclampsia can negatively affect the blood work or hematological parameters of pregnant women. Many pregnant women with preeclampsia have low platelet counts, hemolysis, red blood count, and plasma volumes. Preeclampsia (PE) is a pregnancy related disorder that affects 6–8% of pregnancies worldwide (Han et al.,2014). This ailment is characterized by hypertension (blood pressure ≧140/90 mmHg), proteinuria (≧0.3 g/d), edema and other symptoms and begins as early as the 20th gestational week and last for 6 weeks after delivery [1]. Preeclampsia can lead to eclampsia, a serious condition that can have health risks for mom and baby and, in rare cases, cause death. If your preeclampsia leads to **seizures**, you have eclampsia. The arteries delivering blood to the placenta are affected by preeclampsia. The infant may obtain insufficient blood and oxygen, as well as fewer nutrients, if the placenta does not receive enough blood. This can result in fetal growth restriction, or sluggish growth. Preeclampsia can progress to the HELLP syndrome (Hemolysis, Raised Liver Enzymes, Low Platelets), which includes general hemolysis, elevated liver enzymes, low platelet counts, and elevated levels of free adult hemoglobin (Hb) [2].

Pregnancy usually causes a number of physiologic changes that have an impact on hematologic indices, either directly or indirectly. The harmful influence of preeclampsia on pregnancies thus becomes a significant concern that must be treated at all costs. Conventional preeclampsia management has been associated with a number of difficulties. Antihypertensive therapy may enhance maternal outcomes, but it has the potential to harm the fetus. In many circumstances, even though the foetus is underdeveloped, quick delivery is recommended to preserve the mother's life. Many foetuses have been diagnosed with Neonatal Respiratory Distress Syndrome. Alternative methods of intervention, such as the use of plant extracts, have been suggested [3, 4].

Traditional herbal treatments are generally safe when used as directed, with just a few cases of life-threatening complications. Inappropriate use of herbs, or interactions between these herbs and prescription medicines, might have unanticipated consequences in pregnancy or create significant problems in the fetus. Herbal drugs do not have rigorous restrictions like contemporary pharmaceuticals, and with their use on the rise, the use of these items, particularly during pregnancy, is a cause for worry. Although there is little research on the use of specific herbs in the therapy of preeclampsia, there is a potential that herbs exist that control the problems of preeclampsia, such as high blood pressure and proteinurea. Herbs are used by Nigerians to treat various health problems in pregnant women. A number of plant extracts have been implicated in the management of some of the complications of preeclampsia including *Jatropha curcas, Alchonnea cordifolia,* and *Secamone afzelii* [5]. The aim of this study therefore was to find out if these plant extracts can be used to improve the haematological status of preeclamptic Wistar rats.

2. MATERIAL AND METHODS

2.1 Collection and preparation of plant samples

Plant samples were collected from First Generation Farms in Iguosula, Uhunmwonde Local Government Area, Edo State, and delivered to the Phytomedicine Unit for identification, but the Herbarium Unit at the University of Benin, Benin City, authenticated and assigned voucher specimen numbers. Specimen numbers UBH-J404, UBH-A560, and UBHS566 were allocated to *Jatropha curcas*, Alchornea cordifolia, and Secamone afzelii, respectively. The samples were rinsed with distilled water several times before being air-dried for two weeks and pulverized into powder with a Panasonic® medium kitchen blender, model MX-

GX1021WTZ. After macerating 100g of each powder sample in 200 mL of methanol for 12 hours, the extracts were filtered through Whatman Filter Paper No 42. (125 mm).

2.2 Study design

The study used age-matched (±3 days) female Wistar rats weighing 220 to 256 g (mean, 237 g). The animals were housed in the Animal House at the Department of Biochemistry, University of Benin, Benin City, in a well-ventilated tropical rain forest setting with diurnal change of light and darkness during the month of May, 2019. The animals were fed a normal diet (0.35 g NaCl, 20 g protein, and 1.17 g arginine per 100 g chow) and given free access to tap water (pH range 6.8 – 7.2). They were given a one-week acclimation period before the trial began.

The rats were randomly separated into fifteen (15) groups, each with six (10) rats. Group 1 was the positive control, while Groups 2, 3, and 4 were the negative controls. Other groups are listed below (Table 1);

Table 1: Designation of experimental groups

Group	Description
Group 1	Control
Group 2	Administered with Ext-JC (No induced Preeclampsia)
Group 3	Administered with Ext-AC (No induced Preeclampsia)
Group 4	Administered with Ext-SA (No induced Preeclampsia)
Group 5	Induced Preeclampsia, no treatment provided
Group 6	Induced Preeclampsia + 100 mg/kg Standard drug
Group 7	Induced Preeclampsia + 50 mg/kg Ext-JC
Group 8	Induced Preeclampsia + 100 mg/kg Ext-JC
Group 9	Induced Preeclampsia + 200 mg/kg Ext-JC
Group 10	Induced Preeclampsia + 50 mg/kg Ext-AC
Group 11	Induced Preeclampsia + 100 mg/kg Ext-AC
Group 12	Induced Preeclampsia + 200 mg/kg Ext-AC
Group 13	Induced Preeclampsia + 50 mg/kg Ext-SA
Group 14	Induced Preeclampsia + 100 mg/kg Ext-SA
Group 15	Induced Preeclampsia + 200 mg/kg Ext-SA

Ext-JC, Metholic leaf extract of *Jatrophacacus;* Ext-AC, Metholic leaf extract of *Alchonneacordifolia;* Ext-SA, Metholic leaf extract of *Secamoneafzelii.*Standard drug was methyl DOPA (Aldomet®)

2.3 Induction of preeclampsia

To induce preeclampsia, The Adriamycin Model. was used. According to Podjarny et al. [6], Adriamycin (Adriablastin) was given to rats under light ether anesthesia at a dose of 3.5 mg/kg IV into the femoral vein. For four days, the rats were partnered with a reproductive male. On the first day of pregnancy, the presence of spermatozoa in the vaginal smear was documented. Elevated blood pressure and substantial proteinuria confirmed preeclampsia (Table 2). The blood pressure of the Wistar rat was measured using the CODA® High Throughput System with 2 Activated Channels (CODA-HT2) by Kent Scientific Corporation, USA, as described by Feng and DiPetrillo [7]. The rats were gently held in the CODA System restrainer, and the back hatch was replaced to keep the rat within. After placing all of the Wistar rats to be tested on the identical CODA system in their restrainers, the rats were given 5 minutes to adjust before the blood pressure measurement process began. This allows the Wistar rats to relax and warm up, which allows blood to flow to the tail. After a 5-

minute acclimatization period, the blood pressure testing procedure begins. The proteinuria was determined using the dipstick (combi2) method.

Table 2: Confirmation of preeclampsia

Treatments	Parameter	Control	Induced
Blood pressure			
Third trimester	Systolic (mmHg)	124	177
	Diastolic (mmHg)	98	121
Post-partum	Systolic (mmHg)	121	160
	Diastolic (mmHg)	96	125
Proteinuria			
Third trimester	Proteinuria	Negative	+++
Post-partum	Proteinuria	Negative	+

2.4 Determination of Haematology parameters

Twenty four (24) hours after administration of the last dose of the standard drug and various treatment extracts to the respective groups, the animals were anaesthetized with chloroform and humanely sacrificed. Blood samples were collected from the aorta and transferred to tubes containing anticoagulant EDTA, and thereafter analyzed for the various parameters using Auto Haematology Analyzer Model XrHA640.

2.5 Statistical analysis

Data collected were analyzed using SPSS version 20. Results were presented in Tables and Quantitative variables were expressed as mean $\pm$ standard deviation

3. RESULTS AND DISCUSSION

The effects of the selected plant extracts on haematological parameters of preeclamptic Wistar rats have been investigated in the present study. Table 3 shows white cell count as well as hematological differentials in preeclampticWistar rats.White cell count (WBC) was 6.77×10^3 in the control but when preeclampsia was induced WBC dropped to 5.8×10^3. However when preeclamptic rat were administered 100mg/kg of *Secamone afzeli* extracts, WBC improved to 9.75×10^3. Similar enhancement in hematological differentials was reported in lymphocytes (LYM) when the incident of preeclampsia significantly reduced lymphocytes volume to 1.1% as against 1.17% in the control. Although there were differences in lymphocytic volume as concentration of plant extract varied as well as the types of the plant extract. The highest lymphocytes volume obtained was 2.53%when preeclamptic rat were administered with 59mg/kg of *Alchonnea cordifolia* extracts, another high lymphocyte volume obtained (2.41) was when preeclamptic rat was administered with 50g/Kg of *Jatropha curcas* extracts. Both incidence occurred in the third trimester of the pregnant Webster rats (Table 3).

Table 3: Total white cell count and differentials

Group	WBC $x10^3$	LYM (%)	MID (%)	GRAN (%)	LYM $x10^3$	MID 10v3	GRAH $x10^3$
	3rd trimester						
Control	6.77	1.17	2.89	10.84	56.45	9.78	24.09
Only Ext-A (No induced PreEc)	8.58	1.03	2.08	11.69	7.96	7.96	16.05
Only Ext-B (No induced PreEc)	9.84	2.32	0.99	13.16	15.93	15.93	6.82
Only Ext-C (No induced PreEc)	4.2	0.64	1.08	5.88	9.85	9.85	18.29
Induced PreEc, no treatment provided	5.78	1.11	2.63	9.33	10.75	10.75	25.94
Induced PreEc + 100 mg/kg StdD	9.01	1.45	3.25	11.92	10.95	10.95	25.56
Induced PreEc + 50 mg/kg Ext-A	8.13	2.41	2.39	11.35	19.18	19.18	19.74
Induced PreEc + 100 mg/kg Ext-A	6.05	0.63	1.34	6.86	8.42	8.32	18.28

/Induced PreEc + 200 mg/kg Ext-A	8.9	1.24	2.77	11.17	10.12	10	23.26
Induced PreEc + 50 mg/kg Ext-B	7.04	2.53	5.78	14.09	16.41	16.21	37.05
Induced PreEc + 100 mg/kg Ext-B	9.3	1.02	1.99	12.31	7.58	7.49	14.58
Induced PreEc + 200 mg/kg Ext-B	5.87	0.75	1.08	7.7	8.9	8.79	12.71
Induced PreEc + 50 mg/kg Ext-C	7.86	1.43	2.8	12.08	10.67	10.67	20.93
Induced PreEc + 100 mg/kg Ext-C	9.75	0.87	1.17	11.8	6.64	6.64	8.99
Induced PreEc + 200 mg/kg Ext-C	8.22	0.87	1.99	11.07	7.07	7.07	16.21
F-test	1.139	2.019	1.928	3.665	0.886	1.133	2.016
LSD(0.05)	3.5	0.52	1.01	2.03	3.25	3.28	4.82
p-value	0.368	0.052	0.064	0.001	0.581	0.372	0.053
	Post-partum						
Control	7.41	1.17	1.17	9.75	10.83	10.87	10.87
Only Ext-A (No induced PreEc)	6.86	0.99	0.9	8.67	10.3	10.35	8.47
Only Ext-B (No induced PreEc)	5.32	0.63	0.76	6.05	9.4	9.44	9.44
Only Ext-C (No induced PreEc)	6.42	0.72	0.98	7.32	8.88	8.92	10.04
Induced PreEc, no treatment provided	6.12	0.99	1.85	8.04	11.12	11.16	17.25
Induced PreEc + 100 mg/kg StdD	2.21	0.27	0.54	2.8	9.03	9.03	15.05
Induced PreEc + 50 mg/kg Ext-A	7.02	0.81	0.87	8.12	9.34	9.34	8.31
Induced PreEc + 100 mg/kg Ext-A	5.62	0.36	0.54	6.16	5.47	5.47	8.21
Induced PreEc + 200 mg/kg Ext-A	5.42	0.54	0.54	6.72	7.53	7.53	7.53
Induced PreEc + 50 mg/kg Ext-B	9.12	1.45	1.1	11.94	11.29	11.29	7.76
Induced PreEc + 100 mg/kg Ext-B	8.31	1.45	2.4	12.32	10.95	10.95	16.42
Induced PreEc + 200 mg/kg Ext-B	4.15	0.72	1.3	6.05	10.78	10.78	17.52
Induced PreEc + 50 mg/kg Ext-C	8.58	0.9	0.9	10.3	7.92	7.92	7.13
Induced PreEc + 100 mg/kg Ext-C	5.87	0.9	1.72	8.49	9.61	9.61	18.26
Induced PreEc + 200 mg/kg Ext-C	7.04	1.17	0.81	9.03	11.74	11.74	8.13
F-test	0.991	1.012	1.021	0.817	1.091	0.744	1.195
LSD(0.05)	3.3	0.76	0.82	3.44	2.48	2.04	3.05
p-value	0.485	0.467	0.46	0.646	0.403	0.716	0.328

Extract (a) *Jatropha curcas*
Extract (b) *Alchonnea cordifolia*
Extract (c) *Secamone afzelii*
Std D is the standard drug (Aldomet)
WBC……Total white cell count
LYM (%)……Percentage of Lymphocyte in the total white cell
MID (%)……..Percentage of Monocyte in the total white cell
GRAN(%)……Percentage of Granulocyte in the total white cell
LYM $x10^3$…… Absolute lymphocyte count in the total white cell
MID $x10^3$…… Absolute Monocyte count in the total white cell
GRAN $x10^3$…… Absolute Granulocyte count in the total white cell

During post-partum lymphocytes volume was 1.17% in the control but significantly reduced to 0.99% in preeclamptic rats, however the administration of standard drug as well as *Jatropha curcas* extracts (*Jatropha curcas*) further reduced lymphocytes volume to as low as 0.36% compare to 0.99 in the non-treated preeclamptic rat. Also, percentage MID was 1.17% in the control and 1.85 in preeclamptic Wistar rats. The MID in preeclamptic rat reduced to 0.87%, and 0.54% when different concentrations of *Jatropha curcas* extracts was administered. The highest MID was obtained (2.4%) when 100mg/kg of *Alchonnea cordifolia* extracts was administered.

Table 4: Haemoglobin count and red cell indices

Group	RBC $x10^6$	HGB (g/dl)	PCV (%)	MCV (fL)	MCH (pg)	MCHC (g/dl)	RDW SD (%)	RDW CV (%)
Control	5.51	17.95	45.79	71.6	27.2	37.4	38.5	17
Only Ext-A (No induced PreEc)	4.06	14.55	36.58	91.2	28.7	30.8	85.1	26.4
Only Ext-B (No induced PreEc)	5.33	16.38	41.19	73	29.5	38.6	51.6	20
Only Ext-C (No induced PreEc)	4.79	17.35	43.46	83.2	28.7	32.5	45	18.3
Induced PreEc, no treatment provided	5.95	12.07	30.23	67	21.9	33.3	39	17.5
Induced PreEc + 100 mg/kg StdD	5.23	17.57	44	78.6	27.8	37.6	40.4	17.6
Induced PreEc + 50 mg/kg Ext-A	5.32	16.06	40.22	84	26.8	33.5	45.1	17.2
Induced PreEc + 100 mg/kg Ext-A	6.49	15.95	39.95	72.1	21	29.7	49.4	20.4
Induced PreEc + 200 mg/kg Ext-A	6.13	12.78	38.06	80.7	21.3	27.4	56.8	21.7
Induced PreEc + 50 mg/kg Ext-B	5.59	12.78	38.21	81.6	24.3	31.1	69.9	25.1

Induced PreEc + 100 mg/kg Ext-B	6.88	13.19	39.56	75.6	26.8	30.5	48	20
Induced PreEc + 200 mg/kg Ext-B	4.79	11.92	35.77	79.3	23.8	29.9	55.5	22
Induced PreEc + 50 mg/kg Ext-C	6.23	12.37	37.12	73.9	20.4	28.4	59.1	24.4
Induced PreEc + 100 mg/kg Ext-C	6.41	13.1	39.29	74.1	21	29.2	46.2	19.3
Induced PreEc + 200 mg/kg Ext-C	6.05	12.55	37.66	71.4	20.8	29	48.3	19.4
F-test	1.314	0.602	0.624	0.97	0.974	2.914	0.994	1.173
LSD(0.05)	2.11	3.33	6.23	12	8.3	5.5	9.3	5.1
p-value	0.257	0.842	0.824	0.504	0.501	0.007	0.483	0.344
Control	5.78	13.82	41.46	78.4	22.9	29.9	55.6	23
Only Ext-A (No induced PreEc)	6.5	12.28	36.85	59.6	19	32.5	39.7	19.8
Only Ext-B (No induced PreEc)	4.97	13.37	40.1	86	29.4	33.9	54.8	21.4
Only Ext-C (No induced PreEc)	5.24	13.82	41.46	67.9	21.9	30.2	45.6	18.8
Induced PreEc, no treatment provided	4.34	11.11	33.33	78.3	27.9	32.6	46.6	18.9
Induced PreEc + 100 mg/kg StdD	2.71	12.92	38.75	93.9	39.6	43.4	41.2	16.2
Induced PreEc + 50 mg/kg Ext-A	4.34	12.19	36.58	65.3	24.6	37.4	46.4	21.5
Induced PreEc + 100 mg/kg Ext-A	5.51	14.27	42.81	77.5	26.8	35.8	45.7	20.3
Induced PreEc + 200 mg/kg Ext-A	4.61	13.73	41.19	65.3	27.6	38.2	30	14.7
Induced PreEc + 50 mg/kg Ext-B	6.14	13.28	39.83	70.9	23	33.7	43.2	20.2
Induced PreEc + 100 mg/kg Ext-B	5.96	13.1	39.29	77.3	23.2	30.7	51.1	21.5
Induced PreEc + 200 mg/kg Ext-B	5.78	13.64	40.91	60.8	21.7	33.2	38.6	18.2
Induced PreEc + 50 mg/kg Ext-C	4.7	12.83	38.48	75	28.5	35.1	37.7	16
Induced PreEc + 100 mg/kg Ext-C	4.52	13.91	41.73	83.3	31.4	34.9	41.7	16.8
Induced PreEc + 200 mg/kg Ext-C	5.96	14.81	44.44	75.8	26.4	36.3	40.4	18.5
F-test	0.888	0.404	0.659	0.78	1.361	1.558	0.715	1.008
LSD(0.05)	1.13	3.92	7.31	11.3	7.4	8.3	5.9	6.4
p-value	0.579	0.962	0.794	0.682	0.232	0.15	0.743	0.471

RBC……..Red Blood Cell
HGB…….Haemoglobin
PCV……Packed cell volume
MCV…….mean corpuscular volume
MCHC……mean corpuscular hemoglobin concentration
MCH……. Mean ***cell*** hemoglobin
RDW (SD)……. Red cell distribution width standarddeviaton
RDW (CV)……. Red cell distribution width coefficient of variation

Table 4 shows the haemoglobin count and red cell indices in preeclampticWistar rats. Red blood cell (RBC) was 5.51×10^6 in the control but when preeclampsia was induced it increased by 0.44×10^6 (5.95×10^6). When *Jatropha curcas* extracts was administered it increased to as much as 6.49×10^3 and to as much 6.88×10^3 when 100mg/kg of *Alchonnea cordifolia* extracts was administered.
Mean corpuscular volume (MCV) was just 71.6fL in the control but when preeclampsia was induced it reduced to 67fL and increased to 78.6fL when conventional drug was administered and increased to as high as 81.6fL when 50mg of *Alchonnea cordifolia* extracts was administered.Wistar Rats with no induced preeclampsia when administered with *Alchonnea cordifolia* extracts had MCV of 91.2 %. During postpartum mean corpuscular hemoglobin concentration (MCHC) was 29.9 in the control, and also 32.5, 33.9, 30.2 x 10^6 in non-preeclampstic rat administered with *Jatropha curcas, Alchonnea cordifolia* and *Secamone afzeli* extracts respectively (Table 4). The highest MCHC in preeclampticWistar rats was in rats treated with *Jatropha curcas* extracts. Table 5 shows the platelet counts in preeclamptic rats. Mean platelet volume (MPV) was 8.4fL in the control but there was a significant increment in preeclamptic rats treated with conventional drugs (10fL) and in preeclamptic rats treated with *Alchonnea cordifolia* extracts (9.2fL).

Table 5: Platelet counts

Group	PLT x10^3	MPV (fL)	PDW (%)	PCT (%)	P LCR (fL)
Control	600.7	8.4	8.2	0.32	21.9
Only Ext-A (No induced PreEc)	445.6	7.6	10.1	0.35	14.9
Only Ext-B (No induced PreEc)	743	9.2	15.7	0.68	21.5
Only Ext-C (No induced PreEc)	397.9	7.2	8.2	0.31	10.4
Induced PreEc, no treatment provided	349.1	9.4	9.4	0.51	14
Induced PreEc + 100 mg/kg StdD	455.3	10	10	0.44	15.2
Induced PreEc + 50 mg/kg Ext-A	523.2	9.2	10.5	0.45	12.8
Induced PreEc + 100 mg/kg Ext-A	551.1	7.3	11.2	0.42	4.3
Induced PreEc + 200 mg/kg Ext-A	464.4	7.6	8.8	0.35	2
Induced PreEc + 50 mg/kg Ext-B	543.8	8.6	12.4	0.46	13.9
Induced PreEc + 100 mg/kg Ext-B	561.5	8	11.2	0.46	14

Induced PreEc + 200 mg/kg Ext-B	659.6	7.8	11.5	0.52	10.9
Induced PreEc + 50 mg/kg Ext-C	720.4	8.9	14	0.63	14.9
Induced PreEc + 100 mg/kg Ext-C	491	8.9	12.6	0.41	13.6
Induced PreEc + 200 mg/kg Ext-C	563.6	7.7	11.2	0.44	7.5
F-test	1.225	1.448	0.954	1.13	1.051
LSD(0.05)	112.9	3.1	3.3	0.11	3.9
p-value	0.031	0.194	0.518	0.376	0.436
Control	549.5	9	14.4	0.6	16.9
Only Ext-A (No induced PreEc)	600.1	9.8	20.5	0.6	26.1
Only Ext-B (No induced PreEc)	354.8	8.6	13.4	0.5	15
Only Ext-C (No induced PreEc)	644.6	8	13.7	0.6	18.3
Induced PreEc, no treatment provided	361.2	8.1	12.6	0.5	14.5
Induced PreEc + 100 mg/kg StdD	498.2	7.8	9	0.2	4.1
Induced PreEc + 50 mg/kg Ext-A	530.3	8.6	16	0.3	15.2
Induced PreEc + 100 mg/kg Ext-A	572.5	9.1	13.3	0.6	14.5
Induced PreEc + 200 mg/kg Ext-A	560.4	8.6	12.4	0.5	15.9
Induced PreEc + 50 mg/kg Ext-B	445.2	9.3	14.8	0.6	18.9
Induced PreEc + 100 mg/kg Ext-B	660.5	9.2	14.4	0.5	19.5
Induced PreEc + 200 mg/kg Ext-B	754.3	8.2	14.6	0.7	17.1
Induced PreEc + 50 mg/kg Ext-C	514	6.8	8.6	0.2	4.1
Induced PreEc + 100 mg/kg Ext-C	446.7	6.7	7.3	0.2	0
Induced PreEc + 200 mg/kg Ext-C	546.1	8.9	14.6	0.5	14.5
F-test	0.803	1.454	1.1	1.127	1.372
LSD(0.05)	125.3	2.2	2.5	0.2	11.5
p-value	0.022	0.189	0.396	0.376	0.226

MPV…..Mean platelet volume
PCT…….. Plateletcrit
PDW…….Platelet distribution width
PLCR……. ***Platelet***-large cell ratio
PLT……Platelet count

According to Chandra et al. [8] the white blood cell count is elevated during pregnancy, with the lower limit of the reference range being around 6,000 cells per µl and the upper limit around 17,000 cells per µl. This rise is because of the stress imposed on the body through pregnancy also there's an increase during post-partum the white blood cell count range can be anywhere between 9,000 and 25,000 white blood cells per µl of blood. According to our study there was a decrease in white blood cell count when preeclampsia was introduced, this means preeclampsia eventually makes the body less immune to diseases since the white blood cell aids immunity against diseases. However many research papers do not agree with the fact preeclampsia affects white blood cell count. T. Ceyhan et al stated that there was no significant reduction in the white blood count in preeclampsia rat neither was there any significant difference between the control and the preeclampsia rat.

Lymphocytes are a type of white blood cells (WBCs), which are a part of our body's immune system. The antibodies generated by the lymphocytes help the body fight against different types of viruses as well as cells that can turn out to be tumorous. During conception the normal lymphocytes levels reduces. When conception occurs, and the embryo is awaiting implantation into the uterus, the body makes adjustments within itself to allow this to happen. The embryo created within the pregnant woman is recognize by the body as an intruder, so the body naturally has a suppressed immune system by reducing the count of lymphocytes in the body thislead to the successful implantation and growth of the fetus in the body. There was no significant differences in the lymphocytes count when preeclampsia was induced this is consistent with the study carried out by Hafeez et al. [9].

Jatropha carcus increased the WBC and lymphocytes count even though the increase varied according to the amount of the extract that was administered, this findings is consistent with Ebe et al. [10], Aladodo et al. [11], and Nwaka et al. [12]. Therefore *Jatropha curcas* can be used for the elevation of WBC and lymphocytes count in pregnant women, thereby increasing immunity responses.

According to David et al. [13] *Alchornea cordifolia* has the ability to stimulate the immune enzymes. The research shows that the herb can help increase the White blood cell count and lymphocytes count in rats. This is consistent with our findings.

In the present study RDW was found to have little or no significant change when preeclampsia was induced in the rats. Abdullahi et al. [14] studied 65 patients with preeclampsia and 65 in control groups and found that RDW levels were not associated with the presence of preeclampsia, this study agrees with our findings while Kurt et al. [15] determined higher levels of RDW in preeclampsia.
RBC increases when preeclampsia is induced compared to literature where RBC is unchanged or has no insignificant difference.1 0out of 3 of the concentration of *Alchonnea cordifolia* extracts used for the preeclamptic rats increased the RBC, the other were lower than the preeclamptic rats. According to literature *Alchonnea cordifolia* extracts doesn't increase or reduce RBC normally [13]. In this study, *Alchonnea cordifolia* extracts increase the MCV and MCH in the preeclamptic rats when it was administered. According to literature Secamone afezeli extracts normally increases MCV, MCH and MCHC [16]. In this research all the extracts increased platelet count both in the third trimester and post-partum. PLCR had varying changes to the extract some concentration of a particular extract increase it while another concentration had no significant change or reduced it.

4. CONCLUSION

From the study, the extracts of the various plants at different degree caused increases in PCV and as such could be used in the management of anemia. There capability to improve platelet counts means at different levels also implied that they could be employed in the management of thrombocytopenia. With increases in the white cell counts, the extracts can be useful in improving immunity responses.

ETHICAL APPROVAL

The Research and Ethics Committee of the Faculty of Life Sciences, University of Benin, Benin City, granted ethical approval on March 7, 2019, with reference LS19017.
COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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