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Synergistic Effects of *Synclistia Scarbrida* and *Sterculia tragacantha* on Pregnancy Development and Blood Parameter of Gravid Dams

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Abstract

This study evaluated the synergistic effects of the aqueous extract of Synclisia scabrida and Sterculia tragacantha (AESSST) on maternal and fetal parameters in mature pregnant Wistar rats. Eight groups of rats (five per group) were administered AESSST at oral doses of 0, 50, and 300 mg/kg/day for 0–21 days or 14–21 days. All dams received a single dose of oxytocin on day 12 of the experiment. Maternal and fetal outcomes, including litter size in utero and hematological indices, were assessed. Significant improvements in hematological parameters were observed. White blood cell (WBC) counts increased compared to the control (15.4 ± 0.0, 16.42 ± 0.2a, and 18.21 ± 1.0d), as did red blood cell (RBC) counts (5.8 ± 0, 6.6 ± 0.1a, and 8.4 ± 0.1d) and packed cell volume (PCV) (34.6 ± 0.4, 35.45 ± 0.1b, and 38.96 ± 0.4d). Platelet (PLT) and neutrophil (NEU) counts remained unaffected (PLT: 67.01 ± 0.2, 66.90 ± 0.2, and 66.89 ± 0.7; NEU: 20.98 ± 0.3, 21.00 ± 0.2, and 20.99 ± 0.3). The body weight index of gravid dams showed significant increases compared to the control at day 7 (183.9 ± 0.2, 192.1 ± 3.9b, and 204.2 ± 5.2d), with p-values at a = p < 0.05, b = p < 0.01, c = p < 0.001, and d = p < 0.0001. Standard procedures were used to assess gravid rats, including the number of uterine implants, quantal pregnancy (%), implantation index (%), pre-implantation loss (%), gestation index (%), and mean gestation day (days). The results indicated that AESSST acted as an immune-boosting agent and fertility enhancer, with significant increases in RBC, WBC, and PCV counts, while PLT and NEU levels remained stable. In conclusion, AESSST positively influenced pregnancy developmental parameters, increased litter sizes, prevented miscarriage, and acted as a natural immune-boosting agent. These findings support the traditional use of AESSST in pregnancy management.

1.0. Introduction

The use of medicinal plants during pregnancy has been a common practice in Nigeria. Despite the availability of modern antenatal prescriptions, some pregnant women prefer traditional medicine. Therefore, there is a need for the documentation and botanical identification of plants used by pregnant women [1]. Medicinal plants can play significant roles in pregnancy, such as ensuring proper fetal development and easing labor [2]. However, the lack of scientific research on traditional plants in Africa means that their purported benefits are not always measurable. This is due to the absence of scientific comparisons between modern antenatal prescriptions and traditional remedies for antenatal care. African women who practice traditional medicine believe that these remedies fortify pregnancy, facilitate labor and delivery, and may even contribute to the beautiful, rich dark skin of African babies [3].

1.1 Preterm Birth and Preterm Labor

Preterm birth is the leading cause of neonatal death and illness, while preterm labor refers to the onset of labor before the expected delivery date. This often results in the delivery of an underdeveloped newborn. Since preterm birth is a major cause of neonatal mortality and morbidity, even in developed countries, there is a need for an effective tocolytic agent that ensures optimal feto-maternal well-being. Currently, such an agent does not exist [4].

1.2. Botany of Synclisia scabrida

Synclisia scabrida (S. scabrida) is a climbing shrub with slender stems that can grow up to 40 meters long. These stems climb high into the forest canopy, twining around other plants for support. It is a commonly used and important traditional medicine within its native range, often harvested from the wild for local use. The plant is sometimes sold in local markets for medicinal purposes [5].

1.3. Botany of Sterculia tragacantha

Sterculia tragacantha is a species of the family Sterculiaceae. It is a medium-sized tree growing up to 15 meters tall, with smooth grayish bark and stiff, rugose branchlets. The leaves are clustered at the ends of the branches and are leathery, entire, broadly oblong, obovate-oblong, or ovate-oblong. The leaf apex is obtuse or abruptly acuminate [6].

2.0. Materials and Methods

2.1. Sample Collection

Fresh leaves of *S. scabrida* and *S. tragacantha* were collected from the Idunowina Community. The leaves were dried at room temperature and then placed in an oven at 40°C for three days. The dried leaves were ground into a fine powder and filtered through a 30-mesh sieve. The powdered samples were stored in airtight containers.

2.2. Extraction of Plant Materials

The powdered plant materials were extracted with distilled water using a Kedjah heating mantle at 45°C for one hour. The extraction was carried out in a 3000 ml beaker with a 2000 ml cylinder in a 1:1 ratio. The resulting crude extract was filtered using a cheesecloth, concentrated in a water bath, and dried in an oven at 40°C for 48 hours.

2.3. Experimental Animals

Female and male albino rats weighing approximately 180 g and 200 g, respectively, were obtained from the Pharmacology Animal House at the University of Benin, Benin City. The animals were acclimatized and maintained in the animal house, fed with pelletized feed, and provided with tap water *ad libitum*.

2.4. Drugs and Chemicals

The drugs and chemicals used in the experiment included salbutamol (GlaxoSmithKline) and the aqueous extract of *S. scabrida* and *S. tragacantha* (AESSST).

2.5. Mating Procedures

Female rats were mated with male counterparts in a 1:1 ratio during pro-estrus. Successfully mated females were separated from the males after microscopic examination confirmed the presence of sperm in the vaginal smear, marking day zero of pregnancy.

2.6. Pregnancy Outcome

The study utilized 40 gravid dams, divided into subgroups (1a, 1b, 2a, 2b, 3a, 3b, 4a, and 4b), with five gravid dams per group. Subgroups 1a–4a were treated with 0 mg/kg (control), 0.5 IU oxytocin intraperitoneally (negative control), 50 mg/kg, and 300 mg/kg of AESSST orally. Animals in subgroups 1a–4a were studied from day 0 to day 20, with uterine horns examined for implantation and resorption sites. Litter size was compared among these groups. Animals in subgroups 1b–4b were studied from day 0 to day 21 and allowed to litter. Pups in these groups were compared in terms of weight, mortality, day of fur appearance, and eye-opening day. Dams were monitored daily for signs of toxicity, including diarrhea, salivation, jaw movements (chewing, squinting, lacrimation), tremors, writhing, convulsions, hair loss, behavioral abnormalities, and mortality over 21 days. On day 12 of the experiment, all gravid rats were administered 0.5 IU of oxytocin one hour after AESSST extract administration. Dams in subgroups 1a–4a were laparotomized under chloroform anesthesia in sterile conditions on day 20. The uterus was examined for pregnancy outcomes, including the presence and location of resorption sites and live or dead fetuses *in utero*. For subgroups 1b–4b, birth parameters were recorded during and after parturition. The number of live or dead pups was recorded, and their body weight was measured. Pups were examined for gross congenital abnormalities, such as clubfoot, tail anomalies, and open eyelids. Pup mortality up to six days, eye-opening day, and fur appearance were also recorded. The following indices were computed:

$$\text{Quantal pregnancy} = \left[\frac{(\text{number of pregnant dams})}{(\text{number mated})}\right]*100 \quad (1)$$

$$\text{Implantation index} = \left[\frac{(\text{total number of implants})}{(\text{number mated})}\right]*100 \quad (2)$$

$$\text{Pre-implantation loss} = \left[\frac{(\text{numberofcorporalutea} - \text{numberofimplantations})}{(\text{numberofcorporalutea})}\right]*100$$

$$\left[\frac{(\text{numberofcorporalutea} - \text{numbero}numberofcorporalutea - numberofimplantations\text{fimplantations})}{(\text{numberofcorporal}numberofcorporalutea\text{utea})}\right]* 100 \quad (3)$$

$$\text{Post-implantation loss} = \left[\frac{(\text{numberofimplantations} - \text{numberofviableimplantations})}{(\text{numberofimplantations})}\right]*100$$

$$\left[\frac{(numberofimplantations - numberofviableimplantations)}{(numberofimplantations)}\right]* 100 \quad (4)$$

$$\text{Viability index} = \left[\frac{(\text{number of viable pups on day 4 after delivery})}{(\text{number of live-born pups})}\right]* 100 \quad (5)$$

$$\text{Birth index} = \left[\frac{(\text{number of pups born})}{(\text{number of implantations})}\right]* 100 \quad (6)$$

$$\text{Fetal survival ratio} = \left[\frac{(\text{number of surviving pups})}{(\text{number of implantations})}\right]* 100 \quad (7)$$

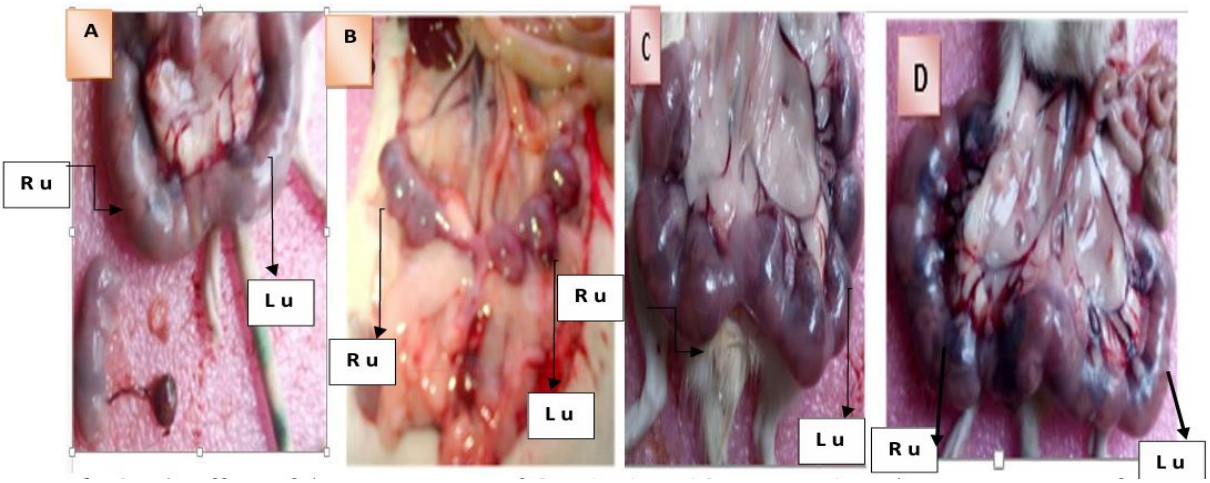
$$\text{Live birth index} = \left[\frac{(\text{number of live-born})}{(\text{total number of pups born})}\right]* 100 \quad (8)$$

$$\text{Gestation index} = \left[\frac{(\text{number of live pups})}{(\text{number of pregnant dams})}\right]* 100 \quad (9)$$

2.7. Statistical Analysis

Data were expressed as mean ± SEM (standard error of the mean). Statistical analysis was performed using GraphPad Prism 8 (UK). One-way analysis of variance (ANOVA) was used, and comparisons between control and treated groups were analyzed using Dunnett's multiple comparisons test. Significance levels were set at $p < 0.05$, $p < 0.01$, $p < 0.001$, and $p < 0.0001$.

3.0. Results



Plat 1: The effects of the aqueos extract of *S.scabrida and S.Tragacantha* on litters size in-utero of the dams

A, represent the control, orall fed distilled water **B** ,represent negative control, administerd oxytocin intraperitonialy **C**, represents50 mg/kg ,**D**, represent 300 mg/kg an respectively.

Key: Lu = left uterine horn, R u = right uterine horn

Table 1. The effect of aqueous extract of *S.scabrida and S.Tragacantha* leaves on some Dams parameters of female rats

Parameter	Control (N=5)	Negative control (N =5)	Positive control (N=5)	50,300 mg/kg Mid-pregnancy (N=20)	50,300, 1000mg/kg Late-Pregnancy (N=21)
Number of uterine implants	(6-8)	(0)	3-5	(5-10)(7-12)(10-12)	(5-10)(7-12)(10-12)
Quantal pregnancy (%)	100	0.00	100	100	100
Implantation index (%)	52.08	70.83	100	100	100
Pre-implantation loss (%)	4.7±0.1	100±0.0^{c}	2.99±0.1^{a}	(1.75±3.6$^{a)}$)(1.5±0.4)(1.45±0.2)	(1.81^{a}±0.2)(1.3±0.5)(1±00)
Gestation Index (%)	100	100	100	100	100
Meangestation day(days)	21.3±0.2	21±00	21.4±0.3	(22.5± 0.3^{a})(22.9±0.1^{b})(23.0)	(23.0±0.6^{c})(24.6±0.3^{c})(25.8±01^{d})

Data are reported as means ±SEM *P<0.05,**P< 0.01 compared to control using graph pad prism 8 uk.

Table 2. Out-come of aqueous extract of *Sterculia tragcactha* leaves on litter parameters of female rats

Parameters	Number of Pups (g) Born	Number of living born pups (mean)	Pups Weight at birth(g)	Number of Deformed Pups	Birth index (%)	Pup Survival Ratio(%)	Life birth Index(%)	Eye opening day	Appearance Of fur day
Control	6.8±0.5	5.5±0.8	2.96±0.3	0.00	100	95.2±0.2	100	21±0.5	7.4±0.3
N.Control	5.5±0.8	1.6±1.1	2.8±0.3	0.00	100	35±0.1	100	21±0.3	9.1±0.1
150mg/kg	9.68±0.5[a]	6.8±0.3[a]	3.57±0.1	0.00	100	97.7±0.3[b]	100	14.9[b]	6.8±0.3[b]
500mg/kg	9.88±0.2[c]	9.7±0.3[c]	4.09±0.2[a]	0.00	100	98.7±0.3[c]	100	14±0.5[c]	6.3±0.4[c]
1000mg/kg	11.58±0.3[d]	12±0.0[d]	4.36±0.4[d]	0.00	100	100±0.2[d]	100	13.6±0.5[d]	6±0.1[d]

The gravid rats administered 150, 500 and 1000g/kg, *s.t*, daily commencing day 0- 21 and day14-21middle- late gravid group. Datas were represented as means ±SEM *P<0.05,**P < 0.01 and ***p< 0.001 .

Table 3: Summary of the results obtained from hematological analysis of blood samples collected from the dams. The result reveals that the aqueous extract was found to have significantly increased WBC, RBC, PCV, PLT, NEU and BASO.

Parameter	White blood cell(Wbc)	Red lood Cell(Rbc)	Packcell volume (Pcv)	Platelet(Plt)	Neutrophil (Neu)	Basophil (Baso)
Control	15.4±0.0	5.8±0.0	34.6±0.4	67.54±2.2	16.07±	1.44±0.1
150mg/kg	16.42±0.2[a]	6.6±0.1[a]	35.45±0.1[b]	70.89±0.3	20.98±0.3[d]	1.040±0.0
500mg/kg	17.53±0.1[d]	7.14±0.1[d]	38.96±0.4[d]	74.90±0.6[a]	22.40±0.2[d]	7.98±0.2[d]
1000mg/kg	18.21±1.0[d]	8.4±0.1[d]	40.82±0.8[d]	77.20±0.9[d]	23.27±0.3[d]	8.44±0.2[d]

Key:[a]p< (0.05), [b]p< (0.01),[c] p< (0.001) and[d]p< (0.0001).

3.1. Body Weight Index

Results obtained from the body weight index of the dams during the course of pregnancy, revealed that even in the presence of induction of abortion the extract treated Dams had successful progression of pregnancy and development (Table 4).

Table 4: Progression of pregnancy and development

Treatment	Day0	Day7	Day14	Day21
Control	183.38±0.1	183.9±0.2	184.2±0.3	198±0.3[b]
N. control	187.8± 04	188.6± 0.1	170±0.2	157.1±1.1
50mg/kg	187.8±3.3	192.1±3.9	195.7±2.4[a]	259.6±0.9[b]
300mg/kg	183.8±1.3	204.2±5.2	275.9±4.1[d]	285.1±3.8[d]

Key: [a] p< (0.05),[b] p (0.01) [c] p< (0.001), and [d] p< (0.0001).

3.2. Discussion

The aqueous extract of *Synclisia scabrida* and *Sterculia tragacantha* (AESSST) demonstrated significant improvements in hematological parameters. Specifically, increases in white blood cell (WBC) counts, red blood cell (RBC) counts, and packed cell volume (PCV) were observed, while platelet aggregation, neutrophil, and basophil counts remained unaffected. These findings suggest that AESSST has a positive effect on immune system regulation, as evidenced by the boosted counts of WBC, RBC, and PCV. This aligns with previous studies by Lee et al. and Jung et al., which also reported improvements in blood parameters [7].

The WBC count, particularly, indicated that platelet (PLT) levels remained unchanged, while the increased WBC count is beneficial for immune system enhancement [7, 8]. Similarly, the rise in RBC and PCV levels suggests that AESSST may act as a hematinic agent, promoting erythropoiesis and potentially addressing conditions like polycythemia [9–11]. Notably, the significant increase in RBC counts without alterations in PCV indicates that AESSST has no toxic effects on RBCs. Furthermore, the increased platelet aggregation and basophil counts support the immune-boosting potential of AESSST, as observed in the in-utero examination findings.

In terms of pregnancy outcomes, AESSST administration led to increased body mass in gravid dams, contrasting with the weight loss observed in the negative control group following oxytocin administration. This suggests that AESSST may prevent abortion and preterm labor, as evidenced by the progressive fetal development in extract-treated groups despite oxytocin-induced challenges [5]. The negative control group, which received oxytocin, exhibited significant weight loss and high resorption sites, indicating induced abortion and preterm labor. In contrast, AESSST-treated dams showed improved fetal development and healthier litters, even in the presence of oxytocin-induced abortion and preterm labor [6].

The pregnancy outcome results further revealed that AESSST effectively managed pregnancy and prevented miscarriage. For instance, the negative control group (Plate I: B) exhibited high resorption sites and no live litters, confirming oxytocin-induced abortion [7, 8]. In contrast, extract-treated dams had larger and healthier litters, with up to 10–12 pups per dam (Plate C–D) [1]. Additionally, the onset of labor was delayed by up to 73.3 hours in extract-treated dams, suggesting that AESSST may have tocolytic properties.

The pups delivered by AESSST-treated dams were grossly better in size, appearance, and weight compared to those from the control groups [9]. The survival rate of pups from extract-treated dams was significantly higher, with almost no deaths recorded except for one case attributed to untimely feeding [10]. These findings indicate that AESSST positively influences pregnancy outcomes,

including uterine implants, gestation index, and implantation index, without posing significant risks to successful pregnancy [11].

The non-toxic nature of AESSST, coupled with its ability to reduce developmental deaths and promote intrauterine growth, makes it a promising option for women at high risk of miscarriage or preterm labor. The increased birth weights of pups from dams treated with AESSST (50 mg/kg and 300 mg/kg) suggest enhanced intrauterine growth without preterm delivery or intrinsic deleterious effects. This may be attributed to improved placental blood flow and nutrient supply to the fetuses. Furthermore, AESSST appears to be non-teratogenic in rodents, as no fetal abnormalities or malformations were observed [12].

The viability index of pups exposed to AESSST was improved, although some postnatal development parameters, such as eye-opening day and fur appearance, remained unchanged. The potential application of AESSST in human pregnancy, particularly for women experiencing recurrent miscarriage or preterm labor, is supported by its positive effects on fetal growth and neonatal well-being. Normal birth weight is a critical factor in reducing neonatal morbidity and neurocognitive deficiencies, and AESSST's ability to promote intrauterine growth without adverse effects makes it a valuable dietary supplement for pregnant women [13].

4.0. Conclusion

The present study demonstrates that AESSST has significant positive effects on pregnancy development and hematological parameters. The extract improves immune function, promotes fetal growth, and prevents miscarriage and preterm labor, making it a promising natural remedy for enhancing maternal and fetal health. The incorporation of AESSST into the diet of pregnant women is encouraged, particularly for those at high risk of pregnancy complications.

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Conflict of interest

The authors declares no conflict of interest

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