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Effect of Essential Oil of A*sparagus officinalis* L on Haematological Parameters of Swiss Mice

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Abstract

Asparagus officinalis L. is widely consumed as both a vegetable and medicinal plant, yet data on the safety and haematological effects of its essential oil remain limited. This study aimed to evaluate the influence of essential oil (EO) of A*sparagus officinalis* on haematological parameters in Swiss mice. Mice of both sexes (18 – 25 g) were divided into five groups (n=6). Group 1 received 5% Tween 80 (1 ml/kg), Groups 2–4 were administered the essential oil at doses of 125, 250, and 500 mg/kg, while Group 5 received a Bunto tonic (5 ml/kg). Treatments were given orally for 14 days, with body weights recorded on days 1, 7, and 14. On day 15, blood samples were collected from each animal by cardiac puncture into EDTA-coated containers for full blood count analysis. No significant ($P > 0.05$) changes in body weight were observed in the EO-treated mice compared with the negative control group. Haematological analysis revealed a non-significant ($P > 0.05$) increase in white blood cells and lymphocytes across all tested doses. Granulocytes increased significantly ($P < 0.05$) at 250 mg/kg, suggesting possible immune stimulation. Platelet and red blood cell counts decreased at all doses relative to the negative control, though the changes were not statistically significant ($P > 0.05$). Overall, *Asparagus officinalis* essential oil appears to modulate immune function, exhibits mild anti-platelet activity, and does not enhance erythropoiesis in mice.

Keywords: *Asparagus officinalis*, Essential oil, Haematological parameters, Immunomodulatory, Antiplatelet, Erythropoiesis

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Introduction

Plant parts have been a source of herbal remedies for treating ailments across different populations (Li and Weng, 2017). Regardless of the ethnomedicinal uses of plants, scientific validation of these claims for safety, efficacy and possible mechanism of action of the active compounds and secondary metabolites is of necessity (Okaiyeto and Oguntibeju, 2021). Some toxicological studies reveal possible safety concerns regarding the use of medicinal plants (Teschke and Eickhoff, 2015; García-Rodríguez *et al*., 2022) hence, the need for both acute and chronic toxicity evaluation to establish their safety (Mensah *et al*., 2019). Some herbal remedies are known for their haematological parameters modulating potentials, particularly haemoglobin concentration and packed cell volume. *Justicia carnea*, *Sorghum bicolor*, *Vernonia amygdalina*, and *Moringa oleifera* all enhance these indices in anaemic models (Oyeyemi *et al*, 2014; Obarisiagbon *et al*., 2019; Mesirionye and Johnson-Ajinwo, 2024). Some plants exert broader haemopoietic and immunomodulatory effects. For example, *Jatropha tanjorensis* stimulates erythropoiesis and increases white blood cell counts (Umoren *et al*., 2023), while *Tetracera alnifolia* improves red blood cell indices alongside immune cell activity (Mesirionye and Johnson-Ajinwo, 2024).

Essential oils such as peppermint, eucalyptus, rosemary, and cinnamon have been shown to possess measurable haematopoietic and immunomodulatory properties hence, providing evidence of their use as natural therapies for haematological disorders (Abo Ghanima *et al*., 2020; Kharvi *et al*., 2025; Shakya *et al*., 2025).
Asparagus officinalis L. has commonly been used locally in various parts of the world as dietary supplement or for therapeutic benefit. Asparagus contains large amounts of folic acid and vitamin C (Thakur and Sharma, 2015), however, its efficacy and safety with regards to blood parameters have not been scientifically reported. This study therefore, investigated the effect of the essential oil of the fresh young shoot of the plant on some haematological parameters.

Materials and Methods

Collection of plant material

Fresh young shoots of *Asparagus officinalis* L. were collected from Kajola Akile, Ile-Ife, Nigeria. The plant material was taxonomically identified and authenticated by Mr. I. I. Ogunlowo and a voucher specimen (FPI2348) was deposited in the Department of Pharmacognosy herbarium for future reference.

Extraction procedures

The extraction was carried out via hydro distillation process using a Clevenger-type apparatus. The extraction process was carried out at a temperature of 40^{o}C in order to prevent loss of the essential oil. The extraction process time was about 4-5 h until there was no longer increase in the yield of essential oil (EO). The oil obtained was dried over anhydrous sodium sulphate crystals to remove excess water from the oil and stored until use.

Animals

Swiss albino mice (18–25 g) were procured from the Animal House, Department of Pharmacology, Obafemi Awolowo University (OAU), Ile-Ife, Osun State, Nigeria. The animals were housed in clean, well-ventilated cages under natural light, dry conditions, and ambient room temperature. They were fed with standard animal pellets with free access to water. All experimental procedures were conducted in strict accordance with the National Institutes of Health guidelines for the care and use of laboratory animals, as implemented by the OAU Research Committee.

Drugs

Bunto tonic (Haematinics) (Tuyil Pharmaceutical limited, Ilorin, Nigeria), Tween 80

Methods

Sub-acute toxicity studies

Sub-acute toxicity studies are conducted to assess the effects of repeated exposures to a substance over a period of time, usually ranging from 14 to 28 days (Bhardwaj and Gupta, 2012). *Asparagus officinalis* essential oil was administered orally to three groups of Swiss mice (n=6 per group) at doses of 125, 250, and 500 mg/kg. Two additional groups received Bunto tonic (5 ml/kg) or 5% Tween 80 (1 ml/kg). Treatments were given daily for 14 days, and animals were monitored every 24 h for mortality and behavioural changes.

Effects of the essential oil of Asparagus officinalis. on body weight

Body weights of the mice were recorded at defined intervals using a weighing balance on days 1, 7, and 14 of treatment.

Effect of essential oil of Asparagus officinalis on haematological parameters in mice

The mice were humanely sacrificed on day 15 by cervical dislocation. Each mouse was carefully dissected, and blood was collected directly from the heart via cardiac puncture into ethylene diamine tetraacetic acid (EDTA) bottles. The samples were gently inverted to ensure thorough mixing with the anticoagulant. The specimens were subsequently transferred to the Haematology and Serology Department of Obafemi Awolowo University Teaching Hospitals Complex

(OAUTHC), where full blood count analysis was performed using an autoanalyzer.

Statistical analysis

The results were expressed as Mean and standard error of mean. Statistical analysis was carried out using one-way analysis of variance (ANOVA), followed by Dunnett's *post hoc* test. This was done using GraphPad prism 5. The level of significance was set at $P < 0.05$.

Results

Effect of essential oil of Asparagus officinalis on body weight of mice

Body weight monitoring revealed no significant ($P > 0.05$) differences between treatment groups and controls during the three weeks (Table 1).

Effect of essential oil of Asparagus officinalis (EOAO). on some haematological parameters in mice

The administration of EOAO modulated haematological parameters in a dose-dependent manner. Granulocyte counts increased significantly ($P < 0.05$) at 250 mg/kg, while platelet and red blood cell counts showed consistent but non-significant ($P > 0.05$) reductions across all the tested doses (Table 2).

Table 1: Effect of essential oil of *Asparagus officinalis* (EOAO) on body weight of mice

Treatment	Body weight (g)		
	First Week	Second Week	Third Week
VEH (0.1 ml/10 g)	21.17±0.60	21.67±0.95	22.50±0.85
EOAO 125 mg/kg	21.83±0.75	21.83±1.19	22.33±1.05
EOAO 250 mg/kg	21.17±0.83	22.67±0.92	22.83±0.65
EOAO 500 mg/kg	21.00±0.52	21.33±0.67	21.50±1.05
BNT (5 ml/kg, p.o.)	20.00±0.93	21.83±1.05	22.67±1.45

VEH: Vehicle (5% Tween 80); EOAO: Essential oil of *Asparagus* officinalis; BNT: Bunto tonic (haematinic), (n=6).

Table 2: Effect of essential oil of A*sparagus officinalis* on some haematological parameters in mice

Parameters (UNIT)	Treatment				
	VEH (1 ml/kg)	EOAO (125 mg/kg)	EOAO (250 mg/kg)	EOAO (500 mg/kg)	BNT (5 ml/kg)
WBC (10^9/L)	5.7±0.91	6.27±1.836	9.64±1.56	5.82±1.02	5.18±0.97
Lymph (10^9/L)	4.8±0.75	4.78±1.52	7.2±0.82	4.88±0.88	4.26±0.82
RBC (10^12/L)	8.19±0.37	8.08±0.44	7.71±1.08	6.86±0.83	6.572±0.77
Gran (10^9/L)	0.47±0.11	0.82±0.19	1.56±0.59*	0.5±0.12	0.56±0.09
PLT (10^9/L)	508.2±98.35	253±36.31	320.8±76.49	273.7±89.18	136.8±29.42**
HCT%	42.67±2.10	41.33±2.64	38.76±5.27	33.78±4.11	34.86±4.18

WBC: White blood cell; Lymph: Lymphocyte; RBC: Red blood cell; PLT: Platelet; HCT%: Haematocrit; GRAN: Granulocyte; VEH: Vehicle (5% Tween 80); EOAO: Essential oil of *Asparagus* officinalis; BNT: Bunto tonic (haematinic) (n=6). to * $P < 0.05$, ** $P < 0.01$ represent significance compared vehicle
(Anova, Dunnet's post hoc test)

Discussion

A. officinalis essential oil did not induce weight changes during subacute administration. This contrasts with reports that certain haematinics and supplements may promote weight gain, which is undesirable in metabolic disorders where obesity is a major risk factor (Purdy and Shatzel, 2021; Ikeda *et al*., 2022). The oil possibly may not be eliciting a disruption in the central appetite regulation, amount of nutrient absorbed, or systemic metabolic homeostasis. Essential oils often contain terpenes and flavonoids capable of modulating gastrointestinal motility, lipid metabolism, and energy expenditure (Wang *et al*., 2022; Matera *et al*., 2023). The bioactive constituents of EO appear to have maintained a balance between catabolic and anabolic processes, hence, avoiding significant weight gain. Haematological parameters are sensitive indicators for consideration in toxicological assessment (Hewawasam *et al.*, 2016; Daniyan *et al*., 2021). Chronic use of medicinal plants without haematological profiling has been reported, and several studies confirm that such use can lead to alterations in haematological parameters which is indicative of potential haematotoxicity (Charles *et al*., 2021; Ekpe *et al*., 2025). This study however, provides scientific information on the haematological effects of EO.

The EO produced a dose-independent elevation in white blood cell counts, with the most pronounced effect observed at 250 mg/kg, indicating immunostimulatory potential consistent with its folkloric applications (Iqbal *et al*., 2017). The increased lymphocyte counts reinforce evidence of enhanced immune function (Bajaj *et al*., 2021). Increased granulocyte counts at 250 mg/kg also further supports possible activation of the immune system (Schulze and Bugert, 2018).

This may indirectly contribute to blood cell clearance through immune-mediated mechanisms (Onyeabo *et al*., 2017) In contrast, red blood cell counts and haematocrit showed insignificant decreases, pointing to possible haemolytic tendencies with chronic use (Hewawasam *et al*., 2016). The reduction in platelet counts suggests mild antiplatelet activity as seen in agents such as aspirin or clopidogrel (Sang *et al*., 2021; Bohula *et al*., 2022). This outcome is consistent with other studies that revealed that plant-derived compounds may interfere with platelet aggregation and survival (Chan *et al*., 2007; Kubatka *et al*., 2022). Phytochemicals such as terpenes and flavonoids present in the essential oil may have possibly exerted mild bone marrow suppression, reducing erythropoiesis and thrombopoiesis. This is in agreement with a previous report of plant extracts impacting hematopoietic activity impairment in rodents (Onyeabo *et al*., 2017). Furthermore, there have been reports that essential oils possess reactive oxygen species (ROS) generating potentials which can lead to oxidative stress that shortens the lifespan of circulating RBCs and platelets (Saba *et al*., 2010), hence, there may be a possible generation of ROS by the oil.

Overall, the EO showed immunomodulatory and antiplatelet potential but did not stimulate erythropoiesis. These findings emphasize the need for chronic studies, inclusion of other animal models, and organ-specific toxicity assessments to establish safety and identify the bioactive constituents, and other relevant follow-up assessment including bone marrow histology, oxidative stress biomarkers, and coagulation assays (Mohammadpour *et al*., 2020; Tauheed *et al*., 2021).

Conclusion

This study shows that *Asparagus officinalis* L. oil alters haematological parameters in mice, demonstrating immunomodulatory and antiplatelet effects.

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