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Haematological Effects of Dried Gedi Leaf Infusion in Postpartum Female Wistar Rats

Pengaruh Seduhan Daun Gedi Kering terhadap Profil Hematologi Tikus Wistar Betina Pascapersalinan

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ABSTRACT

The haematological effects of dried Gedi (*Abelmoschus manihot* L. Medik.) leaf infusion during the postpartum period remain unclear. This study evaluated its effect on the haematological profile of postpartum female Wistar rats. Six female Wistar rats were assigned to a control group or a dried Gedi infusion group (n = 3 each). The infusion was prepared from 2 g of dried leaf powder in 200 mL of boiled water and administered *ad libitum* for 34 days. Blood samples were collected 14 days postpartum and analysed for WBC, RBC, HGB, HCT, PLT, MCV, MCH, and MCHC. No significant differences were observed between groups for any haematological parameter (all $p > 0.05$). These findings indicate that dried Gedi leaf infusion did not produce detectable adverse changes in the haematological profile of postpartum female Wistar rats under the conditions of this study.

ABSTRAK

Efek seduhan daun Gedi (*Abelmoschus manihot* L. Medik.) kering terhadap profil hematologi pada periode pascapersalinan masih terbatas. Penelitian ini bertujuan mengevaluasi pengaruh seduhan daun Gedi kering terhadap profil hematologi tikus Wistar betina pascapersalinan. Enam ekor tikus Wistar betina dibagi menjadi kelompok kontrol dan kelompok seduhan daun Gedi kering (masing-masing n = 3). Seduhan dibuat dari 2 g serbuk daun kering dalam 200 mL air mendidih dan diberikan *ad libitum* selama 34 hari. Darah diambil pada hari ke-14 pascapersalinan dan dianalisis terhadap WBC, RBC, HGB, HCT, PLT, MCV, MCH, dan MCHC. Tidak terdapat perbedaan bermakna pada seluruh parameter hematologi ($p > 0,05$). Hasil penelitian menunjukkan bahwa seduhan daun Gedi kering tidak menimbulkan perubahan hematologi yang terdeteksi pada tikus Wistar betina pascapersalinan.

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1. INTRODUCTION

Gedi (*Abelmoschus manihot* L. Medik.) is a leafy vegetable widely consumed in eastern Indonesia and used in traditional herbal preparations. Its leaves contain various bioactive compounds, including flavonoids, polyphenols, saponins, tannins, and vitamins (Pandiangan et al., 2022). A comprehensive review by Luan et al. (2020) summarised the phytochemical constituents and reported biological activities of *A. manihot*, indicating its potential as a medicinal plant.

The postpartum period involves substantial physiological adjustments that may affect maternal haematological status. Parameters such as white blood cell count, red blood cell count, haemoglobin concentration, haematocrit, platelet count, and erythrocyte indices are commonly used to assess systemic physiological responses and general health following parturition (Thomas & Lumb, 2012). Therefore, haematological evaluation provides a useful preliminary approach for identifying possible physiological alterations associated with the consumption of herbal preparations during this period.

Most previous studies on *A. manihot* have focused on its phytochemical composition and biological activities. However, evidence concerning the haematological effects of dried leaf infusion during pregnancy and the postpartum period remains limited. In particular, available information does not adequately establish whether prolonged consumption of this preparation causes measurable changes in blood cell profiles. This knowledge gap warrants controlled experimental evaluation, particularly because reproductive physiological changes may influence responses to herbal preparations.

This study aimed to evaluate the effect of dried *A. manihot* leaf infusion on the haematological profile of postpartum female Wistar rats. The investigation compared white blood cell count, red blood cell count, haemoglobin concentration, haematocrit, platelet count, mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration between rats receiving the infusion and untreated controls.

2. METHODS

2.1. Study Period and Location

The study was conducted from August 2023 to February 2025 at the Pharmaceutical Laboratory, Sam Ratulangi University, Manado, and the Biovina Herbal Laboratory, Sea Mitra Village, Pineleng District, Minahasa Regency, North Sulawesi, Indonesia.

2.2. Plant Material and Preparation of Dried Gedi Leaf Infusion

Mature Gedi (*A. manihot*) leaves were collected from the Biovina Herbal Garden, Kombot Village, South Bolaang Mongondow, North Sulawesi, Indonesia. Leaves located between the third and tenth positions from the shoot apex were selected. Yellow, damaged, and pest-affected leaves were removed during manual sorting. The selected leaves were washed under running water and drained.

The leaves were sun-dried until a constant weight was achieved and subsequently ground into powder using a blender. The preparation procedure was adapted from Pandiangan et al. (2018). The dried leaf powder was placed in tea bags at 2 g per bag. One tea bag was infused in 200 mL of boiled water, and the infusion was freshly prepared each day before administration.

2.3. Experimental Animals and Acclimatisation

Female Wistar rats (*Rattus norvegicus*) were obtained from the Biovina Herbal Laboratory, Sea Mitra Village, Pineleng District, Minahasa Regency. The animals were approximately two months old and weighed approximately 150–195 g before acclimatisation. They were housed in clean cages with wire covers and provided with standard feed and drinking containers.

The animals were acclimatised to the laboratory environment for 14 days. Their general physical condition, behaviour, and body weight were monitored during this period. Only animals that adapted successfully and showed no apparent signs of illness were included in the experiment. The acclimatisation and animal-maintenance procedures were adapted from Pandiangan et al. (2025) and Suyoko et al. (2022).

2.4. Experimental Design and Treatment

The study employed a laboratory experimental design involving six female Wistar rats divided into two groups, with three rats in each group. The control group received ordinary drinking water, whereas the treatment group received dried Gedi leaf infusion. At the beginning of the mating period, each group of three female rats was housed with one male rat, and the assigned fluids were administered from the initiation of mating and continued throughout pregnancy until 14 days postpartum. Each female rat was provided with a separate drinking bottle containing 80 mL of ordinary drinking water or dried Gedi leaf infusion per day, according to its assigned group. The fluids were provided *ad libitum* and replaced daily. Parturition occurred approximately 21 days after the initiation of mating, and blood samples were collected 14 days after parturition. The experimental procedure was adapted from Christianty and Winarti (2015), Pandiangan et al. (2018), and Taghulihi et al. (2022).

2.5. Measurement of Body Weight and Fluid Consumption

Body weight was measured using a digital balance. Fluid consumption was monitored daily by recording the volume provided and the remaining volume in each drinking bottle. Daily fluid intake was calculated as follows:

$$\text{Daily fluid intake (mL/day)} = \text{Volume offered (mL)} - \text{Remaining volume (mL)}$$

The mean daily fluid intake of each animal was calculated over the observation period. Group values were expressed as the mean ± standard deviation. Initial body weight and fluid consumption were treated as supporting descriptive variables and were not subjected to inferential statistical analysis.

2.6. Blood Collection

Blood samples were collected after 34 days of treatment. The rats were anaesthetised, and blood was collected through terminal cardiac puncture using a 3-mL syringe, following the procedure described by Pandiangan et al. (2018). The collected blood was immediately transferred into tubes containing ethylenediaminetetraacetic acid (EDTA) and gently mixed before haematological analysis.

2.7. Haematological Analysis

Haematological measurements were performed using an ABX Micros 60 OT Haematology Analyzer, serial number 704OT97358 (Horiba Medical, Montpellier, France). Before sample analysis, the instrument underwent its automatic start-up, rinsing, reagent-checking, and background-verification procedures.

The EDTA-anticoagulated blood samples were gently mixed and analysed according to the instrument's operating procedure. The evaluated parameters comprised white blood cell count (WBC), red blood cell count (RBC), haemoglobin concentration (HGB), haematocrit (HCT), platelet count (PLT), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC).

2.8. Statistical Analysis

Data were tabulated and expressed as the mean ± standard deviation. Initial body weight and mean daily fluid intake were analysed descriptively. Haematological parameters were compared between the control and dried Gedi leaf infusion groups using Welch's independent-samples *t*-test. Statistical significance was defined as $p < 0.05$. Because each group comprised only three animals, the inferential results were interpreted cautiously with consideration of the limited statistical power and interindividual variation.

3. RESULTS AND DISCUSSION

3.1. Body Weight and Fluid Consumption

The initial body weight and mean daily fluid intake of the experimental rats are presented in **Table 1**. The mean initial body weights were 221.67 ± 9.81 g in the control group and 222.00 ± 24.02 g in the dried Gedi group, indicating similar baseline body weights between the groups. Mean daily fluid intake was 17.13 ± 5.09 mL/day in the control group and 32.38 ± 4.94 mL/day in the dried Gedi group. These values are presented descriptively because body weight and fluid consumption were supporting variables rather than the primary outcomes of the study. The greater mean fluid intake in the dried Gedi group should therefore not be interpreted as a statistically confirmed treatment effect.

3.2. Haematological Profile

The haematological parameters of rats in the control and dried Gedi leaf infusion groups are presented in **Table 2**. No statistically significant differences were detected between the groups for any of the evaluated parameters ($p > 0.05$). Descriptively, the dried Gedi group showed higher mean values of WBC, RBC, HGB, HCT, PLT, MCV, and MCH than the control group, whereas MCHC was slightly lower. However, these numerical differences were not supported by inferential statistical evidence and should not be interpreted as definitive treatment effects.

Table 1. Initial body weight and mean daily fluid intake of rats in the control and dried Gedi leaf infusion groups.

Group	n	Initial body weight (g)	Mean daily fluid intake (mL/day)
Control	3	221.67 ± 9.81	17.13 ± 5.09
Dried Gedi	3	222.00 ± 24.02	32.38 ± 4.94

Values are presented as mean ± standard deviation. Fluid intake was recalculated from the difference between the volume provided and the remaining volume recorded for each animal.

Table 2. Haematological parameters of rats following administration of dried Gedi leaf infusion.

Parameter	Control (n = 3)	Dried Gedi (n = 3)	*p*-value
WBC ($\times 10^3/mm^3$)	9.43 ± 3.11	11.27 ± 1.97	0.448
RBC ($\times 10^6/mm^3$)	5.96 ± 1.37	6.28 ± 1.92	0.828
HGB (g/dL)	11.17 ± 2.60	12.17 ± 3.61	0.719
HCT (%)	33.73 ± 8.17	37.03 ± 11.64	0.710
PLT ($\times 10^3/mm^3$)	878.33 ± 10.69	978.00 ± 100.61	0.227
MCV (fL)	56.67 ± 1.15	59.00 ± 1.73	0.135
MCH (pg)	18.80 ± 0.17	19.40 ± 0.53	0.180
MCHC (g/dL)	33.23 ± 0.38	32.93 ± 0.61	0.544

Values are presented as mean ± standard deviation. Between-group comparisons were performed using Welch's independent-samples t-test. Differences were considered statistically significant at $p < 0.05$.

The erythrocyte-related parameters, including RBC, HGB, HCT, MCV, MCH, and MCHC, did not differ significantly between the groups. RBC represents the circulating erythrocyte population, whereas HGB reflects the haemoglobin available for oxygen transport. HCT indicates the proportion of blood volume occupied by erythrocytes, and the erythrocyte indices provide information on red blood cell size and haemoglobin content. Haemoglobin plays an essential role in binding and transporting oxygen to body tissues (Thomas & Lumb, 2012). Accordingly, the absence of significant changes in these parameters indicates that dried Gedi leaf infusion did not produce a detectable alteration in erythrocyte status or blood oxygen-carrying capacity under the conditions of this study.

Most erythrocyte-related values remained within the reference intervals used in the original study. The reported reference ranges were 5–10 $\times$ 10^6/mm^3 for RBC, 11–19 g/dL for HGB, 46–65 fL for MCV, 18–23 pg for MCH, and 31–40 g/dL for MCHC (Pandiangan et al., 2022). The mean HCT value in the control group was slightly below the cited range of 35–57%, whereas the large standard deviations in both groups indicate substantial interindividual variability. Therefore, the HCT findings should be interpreted cautiously and should not be attributed solely to the administration of the infusion.

WBC counts were also not significantly different between the control and dried Gedi groups. The mean WBC values in both groups were within the reference range of 3–17 $\times$ 10^3/mm^3 used in the original manuscript (Pandiangan et al., 2022). Consequently, the reconstructed data do not support the previous interpretation that dried Gedi leaf infusion caused excessive leukocyte elevation. The observed numerical difference may reflect normal biological variability, particularly given the small number of animals analysed.

The lack of a significant change in WBC count indicates that administration of the infusion was not associated with a detectable systemic leukocyte response. *A. manihot* contains several groups of bioactive constituents, including flavonoids, amino acids, nucleosides, polysaccharides, organic acids, steroids, and essential oils (Luan et al., 2020). Nevertheless, the present study did not measure these constituents in the infusion or examine inflammatory biomarkers. Their specific contribution to the observed haematological profile therefore cannot be determined from the current data.

Platelet counts did not differ significantly between the groups and remained within the cited reference range of 200–1,500 $\times$ 10^3/mm^3 (Pandiangan et al., 2022). Platelets contribute to haemostasis and the initial response to vascular injury. The comparable platelet counts indicate that the dried Gedi leaf infusion did not produce a detectable alteration in circulating platelet numbers. However, platelet count alone does not provide information on platelet function, aggregation, or coagulation activity.

Overall, administration of dried Gedi leaf infusion for 34 days did not cause statistically significant alterations in the evaluated haematological parameters. The findings provide preliminary evidence that the infusion did not adversely affect erythrocyte, leukocyte, or platelet profiles at the tested treatment level. Nevertheless, this interpretation is limited by the small sample size, which reduced the statistical power to detect subtle biological effects. Further studies involving larger and balanced groups, clearly standardised doses, and complementary biochemical or histopathological assessments are required to confirm the haematological safety of dried Gedi leaf infusion.

4. CONCLUSION

Administration of dried Gedi (*A. manihot*) leaf infusion did not produce statistically significant differences in the evaluated haematological parameters of postpartum female Wistar rats compared with the control group. White blood cell count, red blood cell count, haemoglobin concentration, haematocrit, platelet count, mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration remained comparable between groups. These findings indicate that, under the conditions of this study, dried Gedi leaf infusion did not cause detectable adverse alterations in the haematological profile. However, because only three animals were included in each group, the findings should be interpreted as preliminary and require confirmation in studies with larger sample sizes.

AUTHOR CONTRIBUTIONS

Conceptualization, D.P.; methodology, D.P., L.D.K., and H.L.R.; validation, D.P. and H.L.R.; formal analysis, D.P. and N.N.; investigation, D.P. and L.D.K.; resources, D.P.; data curation, L.D.K. and N.N.; writing—original draft preparation, D.P. and L.D.K.; writing—review and editing, D.P., L.D.K., H.L.R., N.N., and P.V.Y.L.; visualization, N.N.; supervision, D.P. and H.L.R.; project administration, D.P.; funding acquisition, D.P. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

The animal study protocol was approved by the Health Research Ethics Committee of the Health Polytechnic of the Ministry of Health, Manado, Indonesia, under ethical clearance number DP.04.03/FXXX.28/568/2025.

INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available upon reasonable request from the corresponding author.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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The funders had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

DECLARATION OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI) USE

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist in improving the clarity, structure, and readability of the text. After using this tool, the authors thoroughly reviewed, edited, and verified the entire content to ensure that it accurately represented their ideas, data, and interpretations. The authors take full responsibility for the integrity and originality of the published work.

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