HEMATOLOGIC UTILITY OF GINGER (*Zingiber officinale*)-*ANTICOAGULATED BLOOD*

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Abstract

This study aimed to evaluate the hematologic utility of Zingiber officinale (ginger) aqueous extract as a potential anticoagulant by comparing its effects with Ethylenediaminetetraacetic acid (EDTA) on normal blood samples. Utilizing an experimental design, blood samples from a qualified volunteer were divided and treated with 75% aqueous ginger extract and EDTA. The samples were then analyzed for key hematologic parameters, including hematocrit, hemoglobin, red and white blood cell counts, platelet count, and cellular morphology. Laboratory analyses involved standardized manual techniques, peripheral smear evaluations, and scoring by registered medical technologists. Statistical comparisons were made using paired sample t-tests at a 0.01 level of significance.

The findings revealed that samples treated with ginger extract exhibited significantly lower values in hematologic parameters— such as RBC and WBC counts, hemoglobin concentration, and platelet viability compared to EDTA. However, differential white blood cell counts and most cellular morphology parameters showed no significant differences, suggesting ginger's moderate ability to preserve cell structure. Despite its inferior performance in certain metrics, ginger extract demonstrated promising anticoagulant effects and preserved morphological integrity to a considerable extent. The results support ginger's potential as a sustainable, plant-based anticoagulant, particularly in resource-limited or environmentally conscious settings. Further studies and clinical validation are recommended to explore its full applicability in medical laboratory practice.

Keywords: *Ginger extract; Zingiber officinale; anticoagulant; EDTA; hematologic parameters; blood morphology*

1. Introduction

White blood cells (WBCs), red blood cells (RBCs), and platelets are fundamental components of the blood, each playing essential roles in maintaining human health. WBCs, which range from 4,500 to 11,000 cells per microliter in adults, are responsible for immune defense. These cells include five main types: neutrophils (50-70%), lymphocytes (20-40%), monocytes (2-8%), eosinophils (1-4%), and basophils (0.5-1%) (Smith et al., 2021).

Neutrophils are the first responders to infections, lymphocytes are involved in adaptive immunity, monocytes become macrophages to clean up debris, eosinophils are key in allergic responses, and basophils release histamine in inflammatory reactions. Abnormalities in WBC counts or distribution may indicate infections, immune disorders, or blood cancers (Jones & White, 2022).

RBCs, responsible for oxygen transport, are present in normal counts of 4.7-6.1 million cells per microliter in men and 4.2-5.4 million in women (Brown & Lee, 2020). Low RBC counts can lead to anemia, while high levels may suggest polycythemia.

Platelets, essential for blood clotting, ranging from 150,000 to 450,000 per microliter (Khan et al., 2021). Low platelet counts can result in thrombocytopenia, while high counts may cause thrombocytosis, affecting clotting and bleeding. Abnormalities in these blood components played a crucial role in diagnosing and managing various health conditions (Adams et al., 2020). These abnormalities highlight the delicate balance required for proper hemostasis, a process that not only depends on platelets but also on the intricate mechanisms of anticoagulation. Worldwide, blood coagulation and anticoagulation mechanisms were critical in various medical fields, including hematology, surgery, and cardiovascular medicine. Coagulation is the body's natural response to injury, where platelets and clotting factors work together to form a blood clot, preventing further blood loss. This process involves the activation of coagulation factors, such as fibrinogen, which helps to form a stable clot. However, the body must maintain a balance to prevent excessive clotting (thrombosis) or insufficient clotting (bleeding). This balance is crucial for overall health, as improper coagulation can lead to serious complications, such as stroke or hemorrhage.

In vitro, anticoagulation entails maintaining blood in a liquid state within a laboratory setting. This occurs when blood is collected in tubes containing anticoagulants for testing purposes. When appropriately diluted with blood, anticoagulants are substances that inhibit the clotting process. Anticoagulants are commonly found in collection tubes, serving the purpose of preserving blood for hematological tests or providing appropriate plasma for coagulation and clinical chemistry studies. The three widely utilized anticoagulants include citrate, heparin, and EDTA (Feng & Chen, 2021).

Accurate diagnostic results in clinical laboratories rely on blood coagulation, which anticoagulants inhibit. Blood samples were collected and maintained extensively using traditional anticoagulants, such as EDTA. In laboratory settings, EDTA is commonly used in blood collection tubes at specific concentrations to preserve blood samples for hematological and clinical tests. Solid EDTA (K2) is typically used at concentrations of 1.5 milligrams per milliliter of whole blood, while liquid EDTA is used at a 2% concentration, with 1-2 drops per milliliter of whole blood (Patel & Sharma, 2020; Chavez & Fernando, 2022). These concentrations ensure the proper prevention of clotting without significantly altering the morphology of blood cells, which is critical for accurate hematological analysis.

EDTA functions as an effective anticoagulant by chelating calcium ions, which are essential for the activation of several key coagulation factors in the blood, thereby preventing clot formation (Williams & Harrison, 2021). This chelation mechanism disrupts the coagulation cascade, specifically by inhibiting the function of calcium-dependent enzymes such as thrombin and fibrinogen, crucial for clot formation.

Despite the widespread use of EDTA as an anticoagulant in hematologic testing, concerns have arisen regarding its environmental impact and toxicity. EDTA is a persistent pollutant in the environment due to its stability and resistance to degradation. Studies have shown that EDTA can form stable complexes with heavy metals, which may lead to increased bioavailability of these toxic metals in aquatic ecosystems. Furthermore, its high reactivity can result in significant ecological disruptions, including harm to aquatic life and soil microorganisms, which are essential for maintaining healthy ecosystems (Ejaz et al., 2022). These environmental concerns, combined with the potential toxicity of EDTA to various organisms, underscore the necessity of exploring supplementary anticoagulants in hematologic testing. This is where the clinical utility of ginger (Zingiber officinale) as a natural anticoagulant may be warranted.

A recent study highlights the antioxidant and anti-inflammatory properties of ginger (Zingiber officinale), reinforcing its potential benefits in health maintenance. This is significant not only for general health but also for maintaining the integrity of biological samples due to its protective effects against oxidative stress (Mao et al., 2023; Yang et al., 2022). Ginger may alleviate symptoms of inflammatory diseases, demonstrating its effectiveness in improving health outcomes while being environmentally friendly (Suciyati et al., 2021).

In light of these factors, investigating the clinical hematology utility of ginger as a substitute for EDTA anticoagulated blood presents a promising avenue for research, aligning both clinical and environmental health considerations.

Plant and fruit extracts are commonly investigated worldwide for their potential anticoagulant effects. Their active components have been reported to suppress blood clotting in vivo. Numerous investigations have explored the effectiveness of plants in serving as therapeutic anticoagulants, yet none specifically focused on evaluating their suitability for use in laboratory diagnostic processes.

Plant-based anticoagulants have garnered significant attention for their potential in managing thrombotic disorders, particularly in cardiovascular health. Allium cepa (red onion) has demonstrated notable anticoagulant properties, primarily attributed to its rich sulfur compounds such as quercetin. A review by Dastmalchi and Mirmohammad Ali (2020) discusses the inhibitory effect of Allium cepa on platelet aggregation, which is crucial in preventing thrombosis. In animal models, Allium cepa has been shown to reduce fibrin formation and improve blood circulation, making it a promising therapeutic agent for thrombosis management (Rashid & Shah, 2021). The bioactive compounds in red onion are thought to influence platelet function

and coagulation pathways, positioning it as a potential natural alternative to synthetic anticoagulants.

Additionally, a narrative review in 2023 discussed the therapeutic effects of ginger, emphasizing its bioactive compounds, such as gingerol, which possess anti-inflammatory and antioxidant properties that contribute to its anticoagulant effects (Crichton et al., 2023). These findings underscore the promising role of ginger in managing thrombotic conditions while also offering an environmentally friendly and less toxic option for anticoagulation in clinical settings.

Zingiber officinale is recognized for its bioactive compounds, including gingerols, shogaols, and paradols. These compounds have been shown to inhibit platelet aggregation and influence the fibrinolytic pathway, which is crucial for managing coagulation processes. A systematic review from 2023 elaborates on the bioactive components of ginger, highlighting their various health benefits, including antioxidant and anti-inflammatory effects, which contribute to its potential as a natural anticoagulant (Crichton et al., 2023)

Despite extensive research on ginger, the literature reveals a notable inconsistency regarding its anticoagulant properties, especially concerning commonly utilized chemical anticoagulants such as EDTA, which is typically employed in laboratory settings to preserve blood sample integrity and prevent coagulation. Although EDTA is effective, it occasionally causes morphological alterations in blood cells, compromising the accuracy of hematologic assessments (Al Kindi et al., 2017). Particularly in reducing the side effects of synthetic drugs, the study of ginger's anticoagulant characteristics is essential. Although the precise mechanisms by which ginger generates its anticoagulant properties remain unknown, various investigations have looked at their activities.

This research study aimed to assess the anticoagulant effects of ginger aqueous extract by evaluating key hematologic parameters and cellular morphology. Through these comparisons, the study sought to deepen the understanding of ginger's potential role in blood coagulation control and to evaluate its viability as a supplementary to the commonly used anticoagulant, EDTA. Should ginger extract prove effective, it could offer a safe, convenient, cost-effective, and readily accessible plant-based anticoagulant. This natural anticoagulant could enhance synthetic options, promoting a more sustainable approach to hematologic testing and enhancing the availability of anticoagulants in resource-limited settings.

This study examined the anticoagulant properties of ginger aqueous extract on whole blood to address the previously mentioned issues, including the high production costs of commercially available anticoagulants and the potential inaccuracies associated with their use.

This study highlighted the potential of ginger aqueous extract as a plant-based anticoagulant, offering cost-effective and sustainable synthetic options. It aimed to raise awareness of the utility of natural resources in laboratory settings, contributing to hematology and advancing the medical laboratory science (MLS) profession. By introducing MLS students to plant-based practices, the study encourages innovation and a deeper understanding of

natural anticoagulants. Additionally, MLS professionals may benefit from diversified and eco-friendly approaches to blood sample preparation, aligning with global sustainability efforts. Ultimately, the research supports public health by improving access to affordable anticoagulants, particularly in underserved communities.

2. **Objectives**
    1. To determine the Hematocrit (Hct) and Hemoglobin (Hgb) levels in blood samples treated with ginger extract and compare them with those treated with EDTA.
    2. To evaluate the Red Blood Cell (RBC) count and morphology (shape, size, and color) in ginger-anticoagulated samples compared to EDTA-treated samples.
    3. To assess the White Blood Cell (WBC) count and morphology (granulation, lobulation, presence of vacuolations, and cytoplasmic color) in both treatments.
    4. To examine the platelet count and viability, including the presence of clumping and satellitism, in ginger-treated blood compared to EDTA-treated blood.
    5. To determine whether there is a statistically significant difference in the hematologic parameters between blood samples treated with ginger extract and those treated with EDTA.
3. **Materials and Methods**

    This study utilized the quantitative approach through experimental research design. Experimental research was a practical route to take, as it allowed the researcher to find exactly what is working and what is not and account for these changes accordingly to solve the research problem.

    The research study was conducted at the LORMA Colleges, Campus for Health Sciences, Carlatan, City of San Fernando, La Union. Blood samples were collected from a 21-year-old male volunteer who met the criteria such as no history of hematologic disorders, chronic illnesses, or recent use of medications and current conditions that could interfere with blood coagulation, selected through purposive sampling.

    The study involved two groups: one control group used EDTA as an anticoagulant and one experimental group used ginger extract. These blood samples were used to evaluate the role of ginger extract as an anticoagulant by comparing the hematologic parameters and cellular morphology results between the two groups.

    For this study, raw fresh ginger (Zingiber officinale) rhizomes were procured from a reliable local market of San Fernando La Union. The ginger rhizomes were sliced into smaller pieces, air-dried and ground into a fine powder. Seventy-Five (75) mL of ginger powder was suspended in 75 mL of normal saline solution in a beaker resulting in 100% aqueous extract. The mixture was shaken and stored at a refrigerated temperature for 24 hours to facilitate the extraction of the active compounds into the NSS. The resulting mixture was then filtered using filter paper (size 42 mm) to separate the liquid extract from the solid plant material. To obtain a final concentration of 75%,

75 mL of the extract was diluted with 25 mL of NSS (Aves et al., 2015). The resulting 75% aqueous ginger extract was used for in vitro testing to assess its anticoagulant activity on blood samples by examining its effects on hematologic parameters and cellular morphology.

A 20 mL of blood was drawn to the donor using a venipuncture technique with a syringe. The blood was then transferred into several containers, including an EDTA tube (as the positive control) and a tube with ginger extract. Each of the tubes was securely closed, and the contents were gently inverted. All samples were promptly prepared for subsequent testing.

Two different setups were made and labeled T1 and T2. Two mL of whole blood was obtained from the volunteer and mixed with the corresponding treatment. For treatment 1, 2 mL of whole blood were mixed with an EDTA additive. Treatment 2 included 2 mL of blood and 500 uL of Zingiber officinale, known as ginger aqueous extract at 75% concentration. A volume of 500 uL of the aqueous extract was measured and added to 2 mL of whole blood using sterile test tubes (12 x 75 mm). Each treatment was performed in triplicate, meaning three separate samples were prepared for each treatment condition. The treatments are presented in Table 1.

Table 1. Treatment Distributions

Treatments	Constituents	
T1	2 mL of whole blood	EDTA additive
T2	2 mL of whole blood	500 µL of Zingiber officinale aqueous extract (75%)

The evaluation of ginger (Zingiber officinale) extract as an anticoagulant involved conducting hematocrit level tests to assess its effects on blood parameters. Microhematocrit tubes that contained no additives were filled with blood anticoagulated with EDTA and ginger extract separately. The microhematocrit tubes are then sealed with clay and centrifuged at about 10,000–12,000 rpm for 5 minutes. Using a micro hematocrit reader, the hematocrit was read and expressed in percentage (%).

The hemoglobin level of the blood samples was determined using a spectrophotometer, using the cyanmethemoglobin method. The two test tubes were filled with 20 uL of blood sample, one test tube was filled with blood sample treated by EDTA, and one test tube was filled with blood sample treated with ginger extract and 5 mL of Drabkin's reagent. Before measuring the absorbance, the samples were allowed to stand at room temperature for 10 minutes. The samples, together with the standard solution, were placed into the spectrophotometer set at a wavelength of 540 nm, and the absorbance reading was recorded. The readings were calculated using the formula: hemoglobin (g/dL) = (absorbance of sample/absorbance of standard) × concentration of standard (g/dL). The results of the two samples treated with different anticoagulants were documented and compared.

The RBC count of blood samples treated with EDTA and ginger extract was determined using the improved Neubauer counting chamber. The RBC

pipette was filled with blood up to the 0.5 mark, followed by drawing RBC diluting fluid into the pipette up to the 101 mark, achieving a 1:200 dilution.

The diluted blood was then dispensed in the hemocytometer, ensuring no bubbles were present. Red blood cells were counted in the four corners and the center square of the large central square of the hemocytometer, following the standard counting procedure under a microscope using a 40x magnification.

The WBC count of blood samples treated with EDTA and ginger extract was also determined using the improved Neubauer counting chamber. A 1:20 dilution was prepared by filling a WBC pipette with blood up to the 0.5 mark and drawing WBC diluting fluid up to the 11 mark. The WBC diluting fluid is used to lyse RBC and enhance WBC nuclei for easier visualization.

After proper mixing, the diluted sample was dispensed into the hemocytometer, ensuring an even distribution without bubbles. White blood cells were counted in the four large corner squares under a microscope at 40x magnification. The counts from the samples were analyzed to compare the results between the two groups.

Platelet counts were determined using the improved Neubauer counting chamber. A 1:100 dilution was prepared by filling a platelet pipette with blood up to the 0.5 mark and adding platelet diluting fluid (Rees-Ecker solution) up to the 101 mark. The diluted sample was then dispensed into the hemocytometer, ensuring even distribution without bubbles. Platelets were counted in the 25 small squares in the center square of the grid under a microscope at 40x magnification, and the results were compared between the EDTA and ginger extract-treated samples.

Blood smears from anticoagulated samples using the different treatments were examined under the microscope to examine their cellular morphology and platelet viability. Thin peripheral blood smears from each treatment were made and air-dried on microscope slides. The slides were then stained using Wright stain and viewed under a microscope equipped with an oil immersion focal length of 1000x. The cellular morphology of RBC in terms of shape, size, and color, the WBC morphology in terms of granulation, lobulation, presence of vacuolations, and color, and platelet viability in terms of the degree of platelet clumping (aggregation of platelets into clusters) and satellitism (where platelets surround or adhere to white blood cells, particularly neutrophils) were observed and recorded. In addition, a WBC differential count was performed to determine the proportion of each type of leukocyte, including neutrophils, lymphocytes, monocytes, eosinophils, and basophils, in the blood samples.

The collected data for Hematocrit (Hct), Hemoglobin (Hgb), Platelet count, RBC count, WBC count, and WBC differential count were organized in a tabular format, segregating the results for samples treated with ginger extract and EDTA. Each parameter was statistically analyzed using paired sample t-tests to determine the significance of any differences between the two groups. The level of significance was set at 0.01.

The results were counted by the researchers and mean scores were calculated. To ensure accuracy, the results were validated by a Registered

Medical Technologist. In terms of cellular morphology, a total of three (3) Registered Medical Technologists evaluated the morphology and mean scores were calculated. Each rater assigned scores based on standardized criteria, and the mean score for each parameter was calculated. This approach provided a reliable evaluation of the differences between blood samples treated with ginger extract and those treated with EDTA.

Table 2. Scoring for RBC Morphology

	Shape	Size	Color
1	Abnormal shape present	Significant anisocytosis (wide variation in RBC size)	Presence of hypochromic or hyperchromic cells
2	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Mild anisocytosis (occasional cells outside the normal range)	Slight color variations; minimal central pallor
3	Normal	Uniform size	Normal color (consistent central pallor and hemoglobin distribution)

Table 3. Scoring for WBC Morphology

	Granulation	Lobulation	Presence of Vacuolations	Color
1	Absence of granules	Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Numerous or large vacuoles are present	Abnormal cytoplasmic color
2	Granules are faint	Slight deviation from typical nuclear segmentation	Few or small vacuoles, not affecting cell integrity	Slight variations in cytoplasmic color
3	Granules are prominent	Normal lobulation for the specific WBC type.	No vacuoles visible	Normal, expected cytoplasmic color for the cell type

Table 4. Scoring for Platelet Viability

	Clumping and Satellitism
1	Numerous large clumps or prominent satellitism.
2	Minor clumping or mild satellitism

3	Platelets are evenly distributed with no clumping or satellitism

Table 5. Means Score and Equivalent Interpretation

Scale	**Range**	**Descriptive Equivalence**
1	1.00-1.66	Poor
2	1.67-2.33	Fair
3	2.34-3.00	Good

4. Results and Discussion

Determination of Hematocrit and Hemoglobin Levels of Blood Samples Anticoagulated with Ginger Extract and EDTA

Table 6. Hemoglobin and Hematocrit Level of Treatments

Treatment	Hemoglobin Level		Hematocrit Level	
	Mean	SD	Mean	Sd
T1	15.34 g/dL	0.20	45.67%	0.58
T#	11.53 g/dL	0.087	34%	0

Table 6 shows that the T1 blood sample treated with EDTA had a mean hemoglobin level of 15.34g/dL and an SD of 0.20. This indicated that EDTA-treated samples showed a healthy hemoglobin level within the normal range. In contrast, T2 had a mean hemoglobin level of 11.53 g/dL and an SD of 0.087, which was significantly lower than the normal range of 13 g/dL to 17 g/dL. This lower hemoglobin level suggested that ginger extract treatment led to a reduction in hemoglobin concentration compared to EDTA. This finding was consistent with the study of Oboh et al. (2021), who reported that the phytochemicals in ginger, particularly phenolic compounds, potentially affected cellular proteins such as hemoglobin.

The blood sample treated with EDTA (T1) had a mean hematocrit level of 45.67% and an SD of 0.58, which fell within the normal range for male (38-50%). In comparison, the sample treated with ginger extract (T2) had a mean hematocrit level of 34% and an SD of 0, which was below the normal range. This suggested that ginger extract may have caused a reduction in red blood cell volume, possibly indicating adverse effects on red blood cell integrity. Supporting this, the study by Ali et al. (2023) concluded that ginger may compromise red blood cell membrane stability, potentially leading to hemolysis and a reduction in red blood cell volume. These results align with observations where ginger extract-treated samples exhibited lower hematocrit levels, supporting the hypothesis that ginger extract may negatively impact red blood cell integrity.

Comparison of RBC Count in Blood Samples Anticoagulated with Ginger Extract and EDTA

Table 7. RBC Count of the Treatments

Treatment	RBC Count	
	Mean	SD
T1	4.85×10^{12}/L	0.015

T#	3.77 x 10^{12}/L	0.057

The RBC count in blood samples anticoagulated with EDTA (Treatment 1) demonstrated a significantly higher mean value of 4.85 × 10^{12}/L (SD = 0.015) compared to those treated with ginger extract (Treatment 2), which yielded a mean of 3.77 × 10^{12}/L (SD = 0.057). The lower RBC count in ginger-treated samples suggests that ginger extract, while containing phytochemicals with known anticoagulant properties, may not sufficiently prevent red cell degradation, lysis, or aggregation under in vitro conditions.

These findings are consistent with the study by Ali et al. (2020), which observed increased hemolysis and reduced RBC integrity in blood samples treated with ginger extract compared to conventional anticoagulants. The study attributed this to ginger's incomplete inhibition of clotting and limited membrane stabilization over extended durations. Furthermore, Oboh et al. (2021) highlighted that certain phenolic compounds in ginger, while biologically active, may induce protein denaturation under specific conditions, potentially compromising erythrocyte membrane integrity and contributing to reduced RBC count or hemolysis.

Evaluation of the Efficacy of Ginger Extract Compared to EDTA in Retaining Red Blood Cell Morphology

Table 8. Means Scores of Red Blood Cell Morphology in Blood Sample Treated with EDTA and Ginger Extract

Treatment	Shape		Size		Color	
	Mean	SD	Mean	Sd	Mean	Sd
T1	2.89	0.33	2.89	0.33	3	0
T2	2.11	0.60	2.11	0.78	1.89	0.60

The efficacy of the ginger extract in retaining red blood cell (RBC) morphology is evaluated in terms of shape, size, and color. For the shape, the mean score for the ginger-treated group (T2) is 2.11, which falls within the Scale 2 (1.67-2.33) range according to Table 5, indicating mild irregularities (occasional irregular cells, but not significantly affecting interpretation). This suggests that ginger extract moderately maintains the normal biconcave shape of RBCs. Similarly, the mean score for size was also 2.11, placing it within Scale 2, which reflects mild anisocytosis occasional size variations among RBCs. This result suggests that the ginger extract had a notable effect in maintaining the overall size consistency of red blood cells. When it comes to color, the mean for T2 is 1.89, which clearly falls in Scale 2, meaning there are slight color variations and minimal central pallor. These findings suggest that while ginger extract does not preserve RBC morphology to the same extent as EDTA, it does offer a moderate degree of preservation, resulting in only minor morphological deviations.

These findings are consistent with the study by Ekwere et al. (2022), which specifically investigated the use of ginger extract as a natural anticoagulant and its effects on blood cell morphology. Ekwere et. al reported that blood samples preserved with ginger extract showed mild anisocytosis and slight color variations, but the overall cell morphology was still largely interpretable

Comparison of WBC Count in Blood Samples Anticoagulated with Ginger Extract and EDTA

Table 9. WBC Count of the Treatments

Treatment	WBC Count	
	Mean	SD
T1	5.66×10^9/L	0.23
T#	3.54×10^9/L	0.23

Blood samples anticoagulated with EDTA (Treatment 1) recorded a mean WBC count of 5.66×10^9/L (SD = 0.23), while samples treated with ginger extract (Treatment 2) had a significantly lower mean count of 3.54×10^9/L (SD = 0.23). These results suggest that ginger extract affects the total leukocyte count in vitro. Although ginger contains bioactive compounds with anticoagulant and antioxidant properties, it does not preserve white blood cells in vitro as effectively as EDTA.

This findings aligns with the study by Ayustaningwarno et al. (2024) which evaluated the impact of ginger extract on leukocyte parameters and concluded that while ginger demonstrated immunomodulatory effects in vivo, it did not consistently preserve leukocyte counts under laboratory storage conditions. Ayustaningwarno et al. (2024) suggested that ginger's antioxidant action might reduce oxidative stress, but its inability to stabilize membrane integrity in vitro contributes to leukocyte degradation.

Evaluation of the Efficacy of Ginger Extract Compared to EDTA in Retaining White Blood Cell Morphology

Table 10. Mean Scores of WBC Morphology in Blood Samples Treated with Ginger Extract and EDTA

Treatment	Granulation		Lobulation		Presence of Vacuolations		Color	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
T1	3	0	2.89	0.33	2.78	0.44	3	0
T2	2.56	0.53	2.56	0.53	2.44	0.53	2.67	0.50

This study compares the efficacy of ginger extract (T2) and EDTA (T1) in preserving the morphology of white blood cells (WBCs), specifically in terms of granulation, lobulation, presence of vacuolations, and color.

The mean score for granulation in both EDTA-treated samples (T1) and ginger extract-treated samples (T2) was 3.00 for T1 and 2.56 for T2, both indicating prominent granulation in the WBCs. This suggests that while both EDTA and ginger extract are effective in preserving the granulation of WBCs, EDTA appears to be slightly more efficient in maintaining this characteristic. The preservation of granules is crucial for the integrity of WBCs, and these findings highlight the comparable effectiveness of both treatments, with EDTA offering a slight edge.

For lobulation, EDTA-treated samples (T1) and ginger extract-treated samples (T2) showed similar scores for lobulation, with T1 scoring 2.89 and

T2 scoring 2.56. These scores fall within the acceptable range for normal lobulation. This indicates that both EDTA and ginger extract were equally effective in preserving the lobulation of WBCs, making lobulation a less sensitive parameter to the anticoagulant used.

The mean score for the presence of vacuolations in EDTA-treated samples was 2.78, while ginger extract-treated samples had a score of 2.44. This suggests that both EDTA and ginger extract were similarly effective in preventing the formation of vacuoles in the WBCs. The presence of vacuolations can indicate cellular damage or degeneration, and the lack of significant differences here implies that both anticoagulants were effective in preserving WBC integrity in this regard.

The mean score for color in EDTA-treated samples was 3.00, indicating normal cytoplasmic color for the WBCs. In contrast, ginger extract-treated samples had a score of 2.67, reflecting normal, expected cytoplasmic color for the cell . This finding suggests that while EDTA preserves the color of WBCs slightly better, both anticoagulants were quite effective in maintaining the typical color of the cells.

The study comparing the effects of ginger extract (T2) and EDTA (T1) on the morphology of white blood cells (WBCs) shows that both treatments are effective in preserving WBC integrity, with slight variations in their efficacy. EDTA, in general, performed slightly better than ginger extract, particularly in terms of granulation and color preservation. However, both EDTA and ginger extract showed similar results for lobulation and vacuolation, indicating their comparable effectiveness in these aspects. The overall findings suggest that while both substances are suitable for preserving WBC morphology, EDTA may offer slight advantages, particularly in maintaining granulation and cytoplasmic color, which are crucial for WBC function.

A study conducted by Ayustaningwarno et al. (2024) highlighted the ginger's antioxidant and anti-inflammatory properties that contribute to its capacity to modulate immune cells and protect against oxidative damage, which can affect WBC morphology. The study supports the findings that ginger extract exerts protective effects on WBC morphology by modulating granulation, lobulation, vacuolation, and cytoplasmic color, because of its antioxidant, anti-inflammatory, and immunomodulatory actions.

Comparison of WBC Differential Count in Blood Samples Anticoagulated with Ginger Extract and EDTA

Table 11. WBC Differential Count of Ginger Extract and EDTA Treated Blood

Treatment	Neutrophil		Lymphocyte		Monocyte		Eosinophil		Basophil	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
T1	53.89	1.54	35.67	1.41	5.89	0.93	4.56	0.73	0	0
T2	53.11	1.36	36.44	1.42	5.67	0.87	4.87	0.67	0	0

Table 11 presents the comparison of WBC differential counts in blood samples treated with EDTA(T1) and ginger extract (T2). From the data

obtained, the mean neutrophil count in the ginger extract treated sample is 53.11 with a SD of 1.36, which is almost similar to the EDTA group with 53.89 and 1.54 SD. Both values fall within the normal reference range for neutrophils, which is typically 50–70% of total WBCs. Lymphocyte counts are also similar with the two treatments having a mean of 35.67 and 36.44 respectively, aligning well with the normal range of 20–40%. For monocyte counts, the EDTA group exhibited a mean of 5.89 with a 0.93 SD, while the ginger extract group showed a mean of 5.67 with 0.87 SD. Both values are within the expected normal range of 2–8%. Eosinophil counts were similarly close, with the EDTA group at 4.56 and the ginger extract group at 4.78, both fitting within the standard range of 1–4%. Notably, basophils were undetectable in both groups, which is consistent with their normal reference range of 0–1%.

These findings indicate that the use of ginger extract as an anticoagulant does not significantly alter the WBC differential count compared to EDTA. All measured values for neutrophils, lymphocytes, monocytes, eosinophils, and basophils remain within normal physiological ranges. This observation is consistent with previous studies, which have demonstrated that ginger extract preserves the integrity of WBC differential counts. Manglani et al. (2017) found no statistically significant difference in the differential counts of neutrophils, lymphocytes, monocytes, eosinophils, and basophils between blood samples treated with ginger extract and those treated with EDTA. Similarly, Taj et al. (2016) reported that ginger extract did not significantly affect the WBC differential count, further supporting the use of ginger as a natural anticoagulant.

Evaluation of Platelet Viability in Ginger Extract-Anticoagulated Blood Compared to EDTA in Terms of Clumping and Satellitism

Table 12. Platelet Viability Mean Scores of Treatments

Treatment	Platelet Clumping and Satellitism	
	Mean	SD
T1	3	0
T#	2.44	0.88

Table 12 shows that EDTA (T1) achieved a mean score of 3.00, indicating that platelets were evenly distributed with no clumping and satellitism, while ginger extract(T2) had a mean score of 2.44 with SD of 0.88, suggesting that most samples also had evenly distributed platelets, but with some minor clumping or mild satellitism in a few cases. These findings are consistent with the study by Shanmugam et al. (2022) which demonstrated that ginger extract exhibits significant antiplatelet activity due to its bioactive compound, resulting in reduced platelet aggregation. However, the study also noted that while ginger extract is effective in minimizing platelet clumping, it may not consistently achieve the same level of platelet preservation as synthetic anticoagulants such as EDTA.

Significant Differences in Hematologic Parameters Between Blood Samples Treated with Ginger Extract and those Treated with EDTA

Table 13. Significant Differences in the Hematologic Parameters

	T1		T2		P	Interpretation
	Mean	SD	Mean	SD		
Hematocrit Level	45.67	0.58	34	0	0.0000039	Significantly Different
Hemoglobin Level	15.34	0.20	11.53	0.087	0.0000075	Significantly Different
RBC Count	4.85 x 10^{12}/L	0.015	3.77 x 10^{12}/L	0.057	0.0000013	Significantly Different
WBC Count	5.66 × 10^{9}/L	0.23	3.54 × 10^{9}/L	0.23	0.0000014	Significantly Different
Platelete Count	236.11	1.05	175	0.83	0.0000061	Significantly Different

Hematologic analysis revealed significant differences in the hematocrit levels between blood samples treated with EDTA (T1) and those treated with ginger extract (T2). T1 exhibited a mean hematocrit level of 45.67 with an SD of 0.58, whereas samples treated with T2 demonstrated a substantially lower mean of 34 and an SD of 0. The p-value obtained was 0.0000039, indicating a statistically significant difference. This suggests that the use of ginger extract as an anticoagulant may negatively affect hematocrit preservation, potentially due to alterations in red cell integrity.

For the hemoglobin levels, T1 and T2 yield a statistically significant result. The mean in T1 samples was 15.34 and an SD of 0.20 and T2 samples had a lower mean of 11.53 and an SD of 0.087. Moreover, the p-value of 0.0000075 indicates that the observed differences are statistically different. This suggests that ginger extract significantly impacts the hemoglobin concentration in blood samples. These results indicate that ginger's bioactive compounds may exert hemolytic effects or interfere with erythrocyte membrane integrity under in vitro conditions. Study conducted by Almajeed and Ibrahim (2022) reported a decrease in hemoglobin concentration in human blood samples treated with aqueous ginger extract, which they attributed to potential membrane destabilization or altered iron metabolism. The anticoagulant properties of ginger may also contribute to reduced hemoglobin levels by affecting blood viscosity and erythrocyte stability.

The mean RBC count for the EDTA group (T1) was 4.85 × 10^{12}/L (SD = 0.015), while the ginger-treated group (T2) showed a lower mean of 3.77 × 10^{12}/L (SD = 0.057), with a p-value of 0.0000013, indicating a statistically significant difference between the two treatments. This suggests that EDTA was more effective in preserving the number of red blood cells compared to ginger extract. The reduced RBC count in the ginger group may be due to partial cell damage, clot formation, or insufficient anticoagulant activity, all of

which can lead to a decrease in the number of measurable red cells during analysis.

Similarly, the white blood cell (WBC) count showed a significant difference between the two groups. The EDTA-treated samples (T1) had a mean count of 5.66 × 10^9/L (SD = 0.23), while the ginger extract-treated samples (T2) had a lower mean of 3.54 × 10^9/L (SD = 0.23), with a p-value of 0.0000014 confirming statistical significance. This indicates that EDTA preserved white blood cells more effectively than ginger extract. The lower WBC count in the ginger group suggests that the extract may not have provided sufficient protection against cellular breakdown during sample handling and analysis

Finally, the platelet count in the EDTA group (T1) had a mean of 236.11 and 1.05 SD, while the ginger group (T2) had a mean of 175 and 0.83 SD. The p-value was 0.0000061, showing a significant difference. This notable difference suggests that ginger extract may cause platelet degradation, as the mean platelet count for the ginger extract treated blood was significantly lower to that of the control, making it less reliable for platelet enumeration

Significant Differences in Cellular Morphology Between Ginger Extract-Anticoagulated Blood and EDTA-Anticoagulated Blood

Table 14 presents the significant differences of blood treated with EDTA (T1) and Ginger extract (T2) in preserving cellular morphology, including WBC differential count, WBC and RBC morphology, and platelet viability.

The comparison of WBC differential counts between EDTA-anticoagulated blood (T1) and ginger extract anticoagulated blood (T2) showed no statistically significant differences across all types of white blood cell, including neutrophils, lymphocytes, monocytes, eosinophils, and basophils. This suggests that the use of ginger extract as anticoagulant does not significantly alter WBC distribution. This findings aligns with the study by Manglani et al. (2017) and Taj et al. (2016) both concluded that ginger extract preserved integrity of WBC differential count when compared to EDTA.

Table 14. Significant Differences in Cellular Morphologies

		T1		T2		P	Interpretation
		Mean	SD	Mean	SD		
WBC differential count	Neutrophil	53.89	1.54	53.11	1.36	0.27	Not Significantly Different
	Lymphocyte	35.67	1.41	36.44	1.42	0.26	Not Significantly Different
	Monocyte	5.89	0.93	5.67	0.87	0.61	Not Significantly Different
	Eosinophil	4.56	0.73	4.78	0.67	0.51	Not Significantly Different

	Basophil	0	0	0	0	0	0
WBC Morphology	Granulation	3	0	2.56	0.53	0.13	Not Significantly Different
	Lobulation	2.89	0.33	2.56	0.53	0.13	Not Significantly Different
	Presence of Vacuolations	2.78	0.44	2.44	0.53	0.16	Not Significantly Different
	Color	3	0	2.67	0.50	0.06	Not Significantly Different
RBC Morphology	Shape	2.89	0.33	2.11	0.60	0.0037	Significantly Different
	Size	2.89	0.33	2.11	0.78	0.014	Not Significantly Different
	Color	3	0	2.44	0.88	0.077	Significantly Different
Platelet Viability	Platelet clumping and satellitism	3	0	2.44	0.88	0.077	Not Significantly Different

The data presented compares the effects of EDTA (T1) and ginger extract (T2) on the morphology of white blood cells (WBCs), specifically focusing on four key parameters: granulation, lobulation, presence of vacuolations, and color. The results show no statistically significant difference between EDTA and ginger extract across all parameters. For granulation, lobulation, vacuolation presence, and color, the p-values were 0.02, 0.13, 0.16, and 0.06 respectively — all exceeding the standard significance threshold of 0.01. This indicates that EDTA and ginger extract have comparable effectiveness in preserving the morphological features of WBCs. Overall, the findings suggest that both EDTA and ginger extract are equally effective in maintaining WBC morphology in terms of granulation, lobulation, vacuolation, and color.

The findings of this study are corroborated by previous research highlighting the effectiveness of EDTA and ginger extract in preserving cell morphology. EDTA's ability to maintain white blood cell granulation is supported by Pázmándi et al. (2024), who demonstrated its role in stabilizing cellular structures by chelating metal ions, which is essential for WBC integrity. On the other hand, ginger extract's antioxidant properties, as shown by Jiang et al. (2023), help in reducing oxidative stress and preserving cell structures, supporting the study’s finding that ginger extract effectively maintains WBC morphology, albeit slightly less efficiently than EDTA. Additionally, research by Sundaramoorthy et al. (2021) confirms that both EDTA and ginger extract are effective in preventing vacuolation and preserving lobulation in WBCs, which aligns with the study’s results that showed no significant differences between the treatments in these aspects.

The analysis of RBC morphology revealed significant differences between the samples treated with EDTA (T1) and those treated with ginger extract (T2). For RBC shape, the mean score for EDTA was 2.89, while the ginger extract

group showed a mean score of 2.11. The difference in shape between the two treatments was statistically significant ($p = 0.0037$). In terms of RBC size, EDTA samples maintained a mean score of 2.89, whereas ginger extract samples had a mean score of 2.11. However, this difference was not statistically significant ($p = 0.014$), as it exceeds the standard significance threshold of 0.01. This indicates that both treatments had a comparable effect on RBC size. Regarding RBC color, EDTA-treated samples had a perfect mean score of 3.00, while the ginger extract samples had a mean score of 1.89, a highly significant difference ($p = 0.000044$). EDTA preserved the normal morphology of RBCs in terms of shape, size, and color, the use of ginger extract resulted in mild but statistically significant morphological changes. These findings suggest that although ginger extract is a potential natural alternative anticoagulant, it may slightly affect the structural integrity of red blood cells compared to the standard EDTA. These findings are consistent with the study by Singh et al. (2021), which reported that ginger extract, while effective as a natural anticoagulant, could cause mild alterations in red blood cell morphology, particularly affecting cell size and shape without severely compromising overall blood interpretation. This supports the present observation that although ginger extract shows potential as an alternative to EDTA, it may slightly affect the structural integrity of red blood cells.

Lastly, the comparison of platelet viability between T1 and T2 showed mean platelet clumping scores of 3.00 (SD=0) and 2.44 (SD=0.88), respectively. Statistical analysis revealed a p-value of 0.077, indicating that the difference between the two groups was not statistically significant. This suggests that ginger extract does not significantly differ from EDTA in maintaining platelet viability.

5. Conlusions

Based on the findings presented in this study, we hereby draw the following conclusions:

1. The blood samples that were treated with EDTA (T1) had significantly higher hemoglobin (15.34 g/dL) and hematocrit levels (45.67%) compared to those that were treated with ginger extract (T2), which showed lower hemoglobin (11.53 g/dL) and hematocrit (34%) values. These findings indicated that EDTA had been more effective in preserving red blood cell integrity. The reduced levels in the ginger-treated samples might have been due to the oxidative effects of ginger's phenolic compounds, and potentially leading to hemolysis and reduction of red blood cell which could have destabilized hemoglobin and compromised red cell membranes (Oboh et al., 2021; Ali et al., 2023).
2. The RBC count in Blood samples that were anticoagulated with EDTA (T1) had a significantly higher mean RBC count of 4.85×10^{12}/L (SD = 0.015), while those that were treated with ginger extract (T2) showed a lower mean RBC count of 3.77×10^{12}/L (SD = 0.057). This indicated

that EDTA had preserved red blood cells more effectively than ginger extract, which likely led to RBC degradation or hemolysis during storage (Ali et al., 2020; Oboh et al., 2021).

3. The efficacy of the ginger extract compared to EDTA in retaining the red blood cell morphology in terms of shape the EDTA-treated samples (T1) had a higher mean morphology score of 2.89 (SD = 0.33), which indicated a well-preserved biconcave shape. In contrast, ginger extract-treated samples (T2) had a mean score of 2.11 (SD = 0.60), which corresponded to mild shape irregularities, such as occasional misshapen cells. In size, EDTA again demonstrated better preservation with a mean score of 2.89 (SD = 0.33), while ginger-treated samples had a mean score of 2.11 (SD = 0.78), indicating mild anisocytosis (size variation). This suggested that ginger extract had provided only moderate effectiveness in maintaining uniform RBC size. The color score for EDTA-treated samples was 3.00 (SD = 0), indicating consistent and normal hemoglobin staining. Ginger extract-treated samples scored 1.89 (SD = 0.60), which reflected slight color variations and minimal central pallor. Thus, EDTA had preserved RBC staining characteristics better than ginger extract. These findings were supported by Ekwere et al. (2022), who reported mild anisocytosis and color changes in ginger-treated blood, but noted that the overall morphology remained largely interpretable.
4. The WBC count in blood samples that were treated with EDTA (T1) had a significantly higher WBC count of 5.66×10^9/L (SD = 0.23), compared to 3.54×10^9/L (SD = 0.23) in ginger extract-treated samples (T2). This showed that EDTA had more effectively preserved leukocyte count and integrity, whereas ginger extract had resulted in a lower WBC count, possibly due to cell degradation or membrane instability (Ayustaningwarno et al., 2024).
5. The study evaluated the effectiveness of ginger extract compared to EDTA in preserving the morphology of WBCs in terms of granulation, the mean score was 3.00 for EDTA-treated samples and 2.56 for ginger extract-treated samples, with a statistically significant difference ($p = 0.02$), which indicated better preservation by EDTA. For lobulation, both treatments exhibited comparable efficacy. EDTA-treated samples had a mean score of 2.89, while ginger extract-treated samples scored 2.56. The difference was not statistically significant ($p = 0.13$), suggesting that both anticoagulants preserved lobulation similarly. The presence of vacuolations in WBCs showed no significant difference between the two treatments. EDTA-treated samples had a mean score of 2.78, while ginger extract-treated samples had a score of 2.44 ($p = 0.16$). This indicated that both substances were equally effective in preventing vacuole formation and maintaining cell integrity. In terms of cytoplasmic color, EDTA again showed slightly better preservation, with a perfect mean score of 3.00, compared to 2.67 for ginger extract. However, the difference was not statistically significant ($p = 0.06$),

which indicated that both anticoagulants maintained typical WBC coloration effectively, with EDTA offering a slight advantage.

6. The WBC differential count remained consistent between ginger extract and EDTA-treated samples. Neutrophil counts were nearly identical (53.89% for EDTA vs. 53.11% for ginger), as were lymphocyte counts (35.67% vs. 36.44%), monocytes (5.89% vs. 5.67%), eosinophils (4.56% vs. 4.78%), and basophils (0% in both). The p-values for all parameters exceeded 0.05, indicating no statistically significant differences. These results confirmed that ginger extract preserved the WBC differential count similarly to EDTA.
7. The effect of platelet clumping and satellitism were slightly more pronounced in ginger-treated samples compared to EDTA. EDTA-treated blood had a mean score of 3.00, while ginger extract-treated samples had a lower mean score of 2.44. However, the difference was not statistically significant ($p = 0.077$), suggesting that ginger extract still maintained acceptable platelet distribution. In terms of number, a significant difference was observed in platelet counts between the two treatments. EDTA samples had a higher mean platelet count of 236.11 ($SD = 1.05$), compared to 175 ($SD = 0.83$) in the ginger extract group. The p-value of 0.0000061 indicated a statistically significant difference, suggesting that EDTA preserved platelet numbers more effectively than ginger extract.
8. The results obtained show that there are statistically significant differences between ginger extract and EDTA in several hematological parameters. EDTA-treated samples consistently showed higher values in hematocrit, hemoglobin, RBC count, WBC count, and platelet count, all with p-values well below 0.05. Additionally, significant differences were found in RBC morphology, specifically shape and color with EDTA providing better preservation. However, no significant differences were observed in WBC differential counts and WBC morphology. Platelet viability in terms of clumping also did not show a significant difference. EDTA outperformed ginger extract in preserving cellular integrity and quantitative parameters, though ginger extract showed promise as a natural anticoagulant with generally acceptable performance.

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8. Appendices

APPENDIX A

Letter of Intent to Conduct a Study

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences – Carlatan Campus
City of San Fernando, La Union, Philippines 2500

September 2024

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science
LORMA College of Medical Laboratory Science Center for Health Sciences Cartatan Campus
City of San Fernando, La Union 2500

RE: LETTER OF INTENT TO CONDUCT A STUDY

Warm greetings of peace and healthy

The undersigned BMLS third year students are interested to conduct an Experimental research entitled "Hematology Utility of Ginger *(Zingiber Officinale)- Anticoagulated Blood.*" This is in partial fulfilment of the requirements for MRESEARCH2 Introduction to Medical Laboratory Science Research 2 course.

In this regard, we respectfully request your acceptance and approval regarding the conduct of our research study.

We hope that you will be able to consider our request. Thank you very much and God bless!

Respectfully yours,

The researchers of BMLS III-Section 3 Group 5

Balag, Irish Marie C. | Manzano, Joric J. | Deleña, Paulo Miguel L.
Palaming, Jemuel Thrixian M. | Jallorina, Asheley I. | Sanson, John Philip A.

Noted by:

MARK ERICSON B. BALADAD, MMPHA, RMT
Instructor, Research Lecture

Jose Enrico M. Sumaya, RMT
Research Adviser

Tyson Orpiano, RMT, MLS (ASCPi)
Laboratory Instructor

Raeuelle Ken G. Novero,RMT
Laboratory Instructor

Recommending approval:

MARK ERICSON B. BALADAD, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science

Approved by:

JOSEPHINE V. CULATON-MILAN, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science
September 2024

APPENDIX B

Letter of Intent to the Faculty Research Adviser

LORMA COLLEGES

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

October 15, 2024

Mark Ericson B. Baladad
Instructor
LORMA College of Medical Laboratory Science
City of San Fernando, La Union 2500

Re: Letter to the Research Adviser

Warm greetings of peace and health!

The undersigned BMLS third year students are interested to conduct a research entitled **"Clinical Hematology Utility of Ginger (*Zingiber officinale*) – Anticoagulated Blood".** This is in partial fulfillment of the requirements for the course MRESEARCH1: Introduction to Medical Laboratory Science Research 1.

On this regard, we are humbly requesting for your service as our Research Adviser for this study. We believe that your knowledge, expertise, and valuable insights will help us accomplish this endeavor successfully.

Should there be any further questions, concerns, or clarifications, please do not hesitate to reach our lead research proponent:

Name: MANZANO, JORIC J. (BMLS 3-3)
Phone number: 09773454002
E-mail: joric.manzano@lorma.edu

We hope that you will be able to consider our request.

Thank you very much and God bless!

Respectfully yours,

Balao, Irish Marie C.
Deleña, Paulo Miguel L.
Jallorina, Asheley I.
Manzano, Joric J.
Sanson, John Philip A.
Palaming, Jomdel Thrixian M.
Student Researchers

Noted by:

Raeuelle Ken G. Novero, RMT
Instructor, Research Laboratory

Tyson L. Orpiano, RMT, MLS (ASCPi)
Instructor, Research Laboratory

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science
Instructor, Research Lecture

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

Conformed:

Mark Ericson B. Baladad, MMPHA, RMT
Faculty Research Adviser
Date: October 15, 2024

APPENDIX C

Contract of Acceptance for Faculty Adviser

LORMA COLLEGES

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Carlatan, City of San Fernando, La Union, Philippines, 2500
Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

Contract of Acceptance for Faculty Research Adviser

Choosing a research topic and finding an adviser are clearly linked, although, the first precedes the second. The competency and passion of Research Advisers parallel the successful completion of the research initiative.

As per the current standing CMLS Research Manual, only bona fide employees of the LORMA Colleges may be assigned as Research Advisers by the Research Coordinator and Instructor, with the approval of the office of the Dean. Priority for research paper advising will be given to full-time faculty members of the College.

Every member of the faculty must handle at least one (1) research group per Academic Year. A maximum of five (5) groups can be handled by a Faculty Research Adviser to ensure the quality of the outputs.

Lastly, the Faculty Adviser's research interests, expertise, experiences, previous research works/publications, as well as their acceptance, credence, and initiative to help must be considered.

Responsibilities of the Faculty Research Advisers

Research is one of the pillars of higher education, alongside instruction and extension. Therefore, it is imperative for faculty members to engage in research activities which would contribute to the current pool of knowledge in the field of medical laboratory science, public health, allied health education, and other related fields.

1. Formulate general and specific questions and decide of the overall direction of the study proposed by the student.
2. Input ideas, monitor, and supervise the progress of the paper.
3. Help resolve group disputes or conflicts and unify the group.
4. Extensively and substantially assist on the data gathering procedure (either during interview, dissemination of questionnaires, experimentation) in Research 2 and writing of the manuscript.
5. Minimize the risk of the study to the research participants by stringently ensuring that all legal and ethical principles are followed and implemented as prescribed by institutional research standards.
6. Contribute on the revisions based on the suggestion and recommendations by the Research Technical Panel and partner institution (if present).
7. Check the completeness, accuracy, validity, and rigor of methodology to be employed and the data gathered.
8. Attend on the proposal and final defense schedules and clarify concepts to the Research Defense Panel if asked to intervene.
9. Obligated to oversee the research paper even after defense (for publication and participation in various fora or academic conferences).

I understand all the terms and conditions stated herein.

Therefore, I fully accept the duties and responsibilities inherent to becoming a Faculty Research Adviser for the research entitled: **"Clinical Hematology Utility of Ginger (*Zingiber officinale*) – Anticoagulated Blood".**

Conformed:

Mark Ericson B. Baladad, MMPHA, RMT
Faculty Research Adviser
Date: October 15, 2024

Noted by:

Raeuelle Ken G. Novero, RMT
Instructor, Research Laboratory

Tyson L. Orpiano, RMT, MLS (ASCPi)
Instructor, Research Laboratory

Mark Ericson B. Baladad, MMPHA, RMT
Research Coordinator, LORMA College of Medical Laboratory Science
Instructor, Research Lecture

Josephine V. Culaton-Milan, MSMT, RMT
Dean, LORMA College of Medical Laboratory Science

APPENDIX D

Letter of Approval

LORMA COLLEGES

LC-REC Form 0024
APPROVAL LETTER
REC Reference #: 2025-046

February 10, 2025

To: Irish Marie Balao, Paulo Miguel Delena, Asheley Jallorina, Joric Manzano, Jomuel Thrixian Palaming, John Philip Sanson
LORMA Colleges, College of Medical Laboratory Science

Subject: Approval of the Research Study "HEMATOLOGY UTILITY OF GINGER *(ZINGIBER OFFICINALE)* - ANTICOAGULATED BLOOD" by the Research Ethics Committee (REC).

Dear Researchers,

The Research Ethics Committee (REC) has reviewed your application to conduct the above-mentioned research study in the LOCALE OF STUDY with you as the Principal Investigators within the duration of February 10, 2025 to February 10, 2026.

The Following documents have been reviewed and approved:

1. Letter of Intent to Conduct the Study
2. Endorsement of the Research Technical Panel
3. Title and Statement of the Problem/ Objective
4. Literature Review
5. Methods and Procedures
6. Population and Locale
7. Exclusion/Inclusion Criteria
8. Data Analysis
9. Ethical Considerations

We approve the study to be conducted in the presented form provided the following are integrated in the final research protocol:

1.In Chapter 2, be consistent that there is only one (1) participant in the study and use purposive sampling instead of random sampling.
2.Indicate how many times that 10ml of blood will be extracted from the participant and how researchers will address instances – if the participant will experience physical harm or side effects during and after extraction.
3.The research paradigm should be revised from I-P-O model to causal paradigm.

None of the Investigators participating in this study took part in the decision making and voting procedure for this study.

The Institutional REC expects to be informed about the progress of the study, any revision in the protocol before implementation and participants'/respondents' information/informed consent. Likewise, you are required to provide the Board a copy of the final report.

Yours Sincerely,

BEVERLY B. BARUT, RPh
Member, Lorma Colleges-Research Ethics Committee

APPENDIX E

Informed Consent Form

LC-REC Form #011
INFORMED CONSENT FORM

INFORMED CONSENT FORM

INSTRUCTION: Please accomplish the form and ensure that all necessary documents are included in your submission.

GENERAL INFORMATION:

Title of the Study: **Hematology Utility of Ginger *(Zingiber Officinale)*-*Anticoagulated Blood***
REC Code :_____ No. of Study Participants: **1**
Study Site : **LORMA Colleges, College of Medical Laboratory Science**
Name of Researcher/s: **Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson**
Contact Information : Telephone Number: _____ Mobile Number: **09773454002**
Fax Number: _____ Email : **joric.manzano@lorma.edu**
Name of Institution: **LORMA Colleges**
Institution's Address : **Carlatan, City of San Fernando, La Union**

Type of Study: □ Sponsored Clinical Trial □ Biomedical Research
□ Researcher-Initiated Clinical Trials □ Stem Cell Research
□ Health Operations Research □ Genetic Research
□ Social or Behavioral Research □ Others: _____
☑ Public Health or Epidemiologic
Source of Funding : ☑ Self-Funded □ Scholarship/Research Grant
□ Government-Funded □ Institution-Funded
□ Sponsored by Pharmaceutical Company
□Others: _____
Duration of the Study: Start Date: September 2024 End Date: May 2025

INTRODUCTION (Use Extra Sheet if Necessary)

We, the student researchers from the College of Medical Laboratory Science, LORMA Colleges, are currently working on a study entitled, "Hematology Utility of Ginger *(Zingiber Officinale)- Anticoagulated Blood*." Sir/Ma'am, we are going to give you information about the study and invite you to participate. Should you want to participate, please read the informed consent beforehand to understand the terms and conditions, and feel free to ask the researchers about the research. Seek assistance to any of the student researchers should there be pertinent questions or important queries and the researchers would be happy to explain.

PURPOSE OF RESEARCH (Use Extra Sheet if Necessary)

This study aims to evaluate the anticoagulant effects of ginger *(Zingiber officinale*) extract by comparing its impact on hematologic parameters and cellular morphology to Ethylenediaminetetraacetic acid (EDTA), a commonly used anticoagulant. The study seeks to determine whether ginger can serve as a safe, cost-effective, and sustainable plant-based anticoagulant for laboratory use. The result of this study lies in its potential contributions to both environmental sustainability and advancements in medical laboratory science. Clinically, the study contributes to the understanding of natural anticoagulants and their role in preserving blood samples for hematological tests. Furthermore, this research supports innovation within the medical laboratory science field by encouraging the use of plant-based alternatives, which are cost-effective and accessible. This study may also be used to contribute to the information and to raise awareness regarding the potential of plants for laboratory utilization. Ultimately, this study may also contribute to the field of hematology and eventually advance the medical laboratory science profession.

TYPE OF RESEARCH INTERVENTION (Use Extra Sheet if Necessary)

1. Participant Selection

Participants for this study will be selected from Medical Laboratory Science students at LORMA Colleges. A random sampling method will be used to ensure fairness and equal opportunity for all students to participate. Participants will be excluded if they have any medical conditions that might affect blood parameters or if they decline to participate after being informed of the study's nature and purpose.

2. Voluntary Participation

As a participant, your participation in the study is entirely voluntary, we are not forcing you to participate if you are willing to be part of the study. It is always your choice to choose if you agree to participate, you are free to decide on your own.

3. Procedures

Participants will provide a blood sample of 10 milliliters, drawn by a Medical Laboratory Science student with the supervision of a registered Medical Technologist. The sample will then be divided into two portions: one treated with EDTA and the other with ginger extract. Standard hematological tests, including Hematocrit, Hemoglobin, RBC count and morphology, WBC count, differential count and morphology, and platelet viability, will be conducted on both portions to compare the anticoagulant effects.

4. Risks

Ma'am/Sir, we would like to inform you that risk will always be associated with participating in this research study. Minor discomfort or pain associated with blood

sample collection are recognized to occur possibly. There is also a very minimal risk of bruising, hematoma at the puncture site. If you decide to participate, we, the researchers, will do our best to mitigate these risks by strictly adhering to proper techniques and post-procedure care will be implemented. The researchers will always be ready to assist and guide you to protect you from and minimize any possible harm amidst and after the study.

5. Benefits

Participants will contribute to advancing knowledge in hematology and exploring natural to synthetic anticoagulants. While there are no direct benefits to participants, the findings could benefit future hematologic testing practices.

6. Reimbursements

Sir/Ma'am, this study was self-funded and free from conflicts of interest, which entails that we, the researchers, are responsible for covering all expenses. This guarantees that there will not be any financial or other discrepancies during the study, and this certifies that there will be no financial issues arising while conducting the study. Moreover, if there is any funding, whether internal or external, it will be appropriately stipulated.

7. Confidentiality

Ma'am/Sir, this study will be conducted and kept confidential. Information will only be exclusively used for the study to protect you from potential risks. The collected data will be secured with full confidentiality and will not be shared with anyone else without your approval. We, the researchers, will assure you that information will not be made available or accessed by anyone. All data gathered for the study will be coded to safeguard your identity. No names or other personal information will be utilized when discussing or reporting data. Results will only be accessible to the researchers, technical panelists, schools involved, faculty, and the College.

8. Sharing of Results

Ma'am/Sir, the results will primarily be available to the research team, and College, mainly the executive committees, administrators, and preceptors. You and the stakeholders, specifically the faculty and administrators of the school where the study will be conducted, will be given the authority to access the study results. After critiquing and revisions with the guidance of technical panelists and approval of the Regional College of Education, the paper can be published and freely utilized to benefit others and by other researchers for future studies.

9. Right to Refuse or Withdrawal

Ma'am/Sir, you are given the authority to refuse data collection or withdraw during the study duration. No penalty, judgment, or prejudice will be issued or enforced. If a withdrawal is made during or after the data collection, all information collected from you will be destroyed or deleted unless you indicate otherwise.

10. Who to Contact

Ma'am/Sir, for further questions, concerns, and clarifications, you can reach our lead research proponent:

Name: Joric J. Manzano

Phone number: 09773454002

E-mail: joric.manzano@lorma.edu

CERTIFICATE OF CONSENT:

I have read the information stated herein or it was properly explained to me. I was provided with a chance to ask questions relative to it. All questions I asked were answered properly; therefore, I consent and voluntarily participate in this study.

Name of Participant: _____
Signature of Participant: _____
Date: _____

Statement from the Researcher/Person Obtaining the Consent

All information pertaining to this study was explained to the possible participant and made sure that he/she fully understood what she/he has to do in the research.

Similarly, I affirm that the potential participant was given a chance to ask questions which I have answered accurately to the best of my ability.

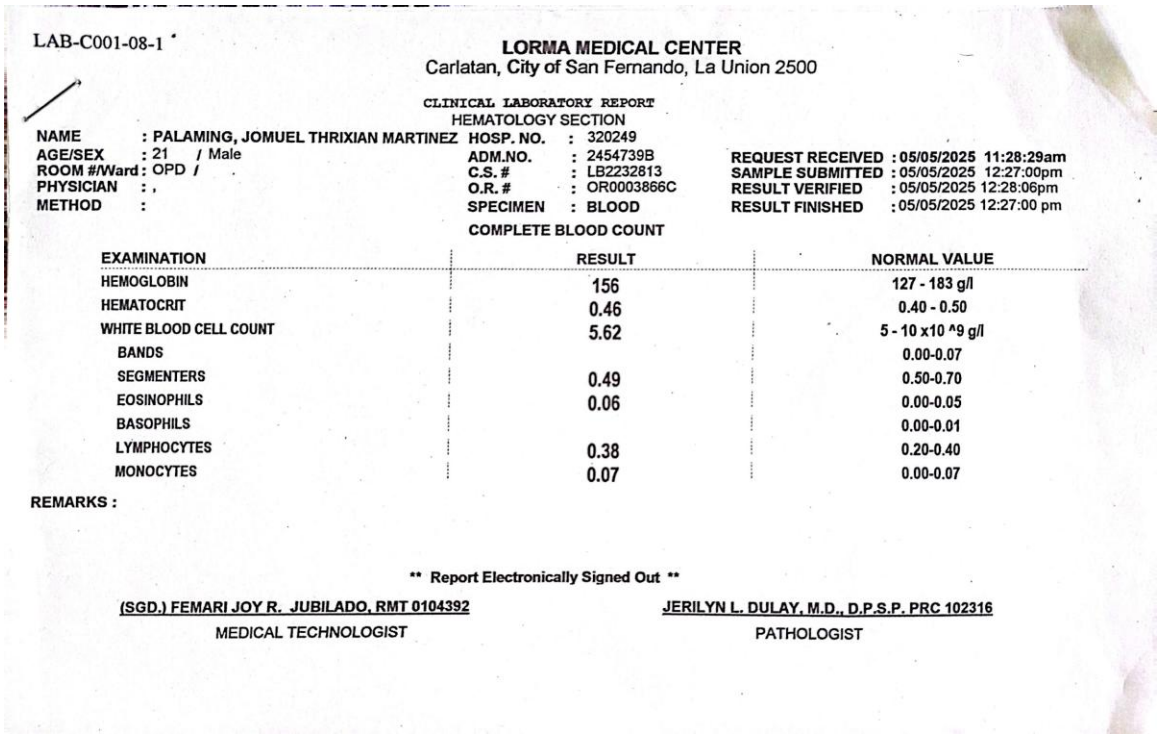
Likewise, I affirm that the participant was not coerced or forced in giving consent. That he/she has voluntarily provided the consent.

Accomplished by: _____ Date Submitted: _____

(Signature over Printed Name)

APPENDIX F

CBC result of Blood Donor



LAB-C001-08-1

LORMA MEDICAL CENTER
Carlatan, City of San Fernando, La Union 2500

CLINICAL LABORATORY REPORT
HEMATOLOGY SECTION

NAME : PALAMING, JOMUEL THRIXIAN MARTINEZ
AGE/SEX : 21 / Male
ROOM #/Ward : OPD /
PHYSICIAN : ,
METHOD :

HOSP. NO. : 320249
ADM.NO. : 2454739B
C.S. # : LB2232813
O.R. # : OR0003866C
SPECIMEN : BLOOD

REQUEST RECEIVED : 05/05/2025 11:28:29am
SAMPLE SUBMITTED : 05/05/2025 12:27:00pm
RESULT VERIFIED : 05/05/2025 12:28:06pm
RESULT FINISHED : 05/05/2025 12:27:00 pm

COMPLETE BLOOD COUNT

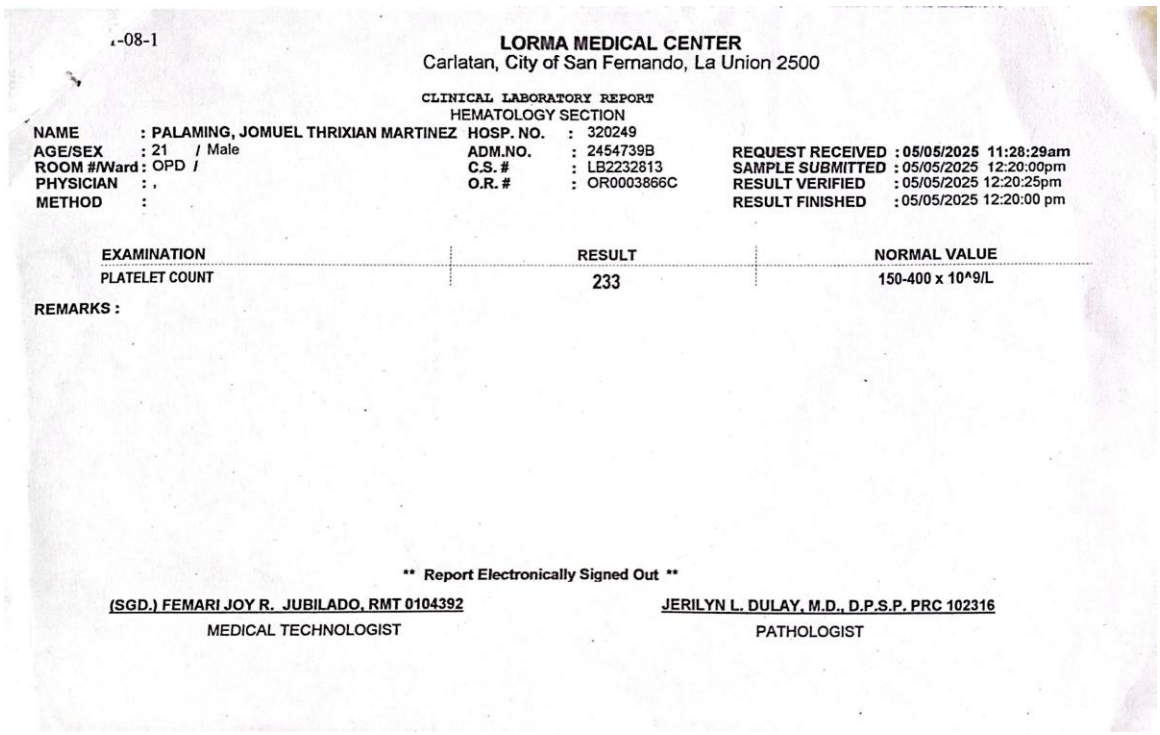
EXAMINATION	RESULT	NORMAL VALUE
HEMOGLOBIN	156	127 - 183 g/l
HEMATOCRIT	0.46	0.40 - 0.50
WHITE BLOOD CELL COUNT	5.62	5 - 10 x10 ^9 g/l
BANDS		0.00-0.07
SEGMENTERS	0.49	0.50-0.70
EOSINOPHILS	0.06	0.00-0.05
BASOPHILS		0.00-0.01
LYMPHOCYTES	0.38	0.20-0.40
MONOCYTES	0.07	0.00-0.07

REMARKS :

** Report Electronically Signed Out **

(SGD.) FEMARI JOY R. JUBILADO, RMT 0104392
MEDICAL TECHNOLOGIST

JERILYN L. DULAY, M.D., D.P.S.P. PRC 102316
PATHOLOGIST



-08-1

LORMA MEDICAL CENTER
Carlatan, City of San Fernando, La Union 2500

CLINICAL LABORATORY REPORT
HEMATOLOGY SECTION

NAME : PALAMING, JOMUEL THRIXIAN MARTINEZ
AGE/SEX : 21 / Male
ROOM #/Ward : OPD /
PHYSICIAN : ,
METHOD :

HOSP. NO. : 320249
ADM.NO. : 2454739B
C.S. # : LB2232813
O.R. # : OR0003866C

REQUEST RECEIVED : 05/05/2025 11:28:29am
SAMPLE SUBMITTED : 05/05/2025 12:20:00pm
RESULT VERIFIED : 05/05/2025 12:20:25pm
RESULT FINISHED : 05/05/2025 12:20:00 pm

EXAMINATION	RESULT	NORMAL VALUE
PLATELET COUNT	233	150-400 x 10^9/L

REMARKS :

** Report Electronically Signed Out **

(SGD.) FEMARI JOY R. JUBILADO, RMT 0104392
MEDICAL TECHNOLOGIST

JERILYN L. DULAY, M.D., D.P.S.P. PRC 102316
PATHOLOGIST

APPENDIX G

Score Sheets

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences, Carlatan, City of San Fernando, La Union, Philippines,
2500 Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

Title of the study: Hematology Utility of Ginger (Zingiber Officinale) - Anticoagulated Blood

Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

GINGER EXTRACT- ANTICOAGULATED BLOOD				
TEST	**RESULT**			
WHITE BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1		✓	
	2			✓
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1		✓	
	2		✓	
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1			✓
	2		✓	
	3			✓
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1		✓	
	2			✓
	3			✓
RED BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1		✓	
	2			✓
	3			✓
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1		✓	
	2			✓
	3			✓

		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1		/	
	2		/	
	3		/	
PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1			/
	2			/
	3			/

Evaluator

Date: May 06, 2025

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences, Carlatan, City of San Fernando, La Union, Philippines,
2500 Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

EDTA- ANTICOAGULATED BLOOD

TEST		RESULT		
WHITE BLOOD CELL MORPHOLOGY		1	2	3
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1			✓
	2			✓
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1			✓
	2		✓	
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1			✓
	2			✓
	3			✓
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1			✓
	2			✓
	3			✓
RED BLOOD CELL MORPHOLOGY		1	2	3
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1			✓
	2		✓	
	3			✓
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1			✓
	2			✓
	3		✓	
		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1			✓
	2			✓
	3			✓
PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1			✓
	2			✓
	3			✓

Evaluator

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences, Carlatan, City of San Fernando, La Union, Philippines, 2500 Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

Title of the study: Hematology Utility of Ginger (Zingiber Officinale) - Anticoagulated Blood

Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

GINGER EXTRACT- ANTICOAGULATED BLOOD				
TEST	**RESULT**			
WHITE BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1		✓	
	2		✓	
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1		✓	
	2		✓	
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1		✓	
	2		✓	
	3		✓	
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1			✓
	2		✓	
	3		✓	
RED BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1		✓	
	2		✓	
	3		✓	
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1		✓	
	2		✓	
	3			✓

		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1		/	
	2		/	
	3			/

PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1			/
	2			/
	3			/

ALDRIN PATRICK ECTOCAPIN

Evaluator

Date: May 06, 2025

LORMA COLLEGE OF MEDICAL LABORATORY SCIENCE
Center for Health Sciences, Carlatan, City of San Fernando, La Union, Philippines, 2500 Facebook: @LormaCMLS | E-mail: cmls@lorma.edu

EDTA- ANTICOAGULATED BLOOD

TEST		RESULT		
WHITE BLOOD CELL MORPHOLOGY		1	2	3
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1			✓
	2			✓
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1			✓
	2			✓
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1		✓	
	2			✓
	3		✓	
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1			✓
	2			✓
	3			✓
RED BLOOD CELL MORPHOLOGY		1	2	3
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1			✓
	2			✓
	3			✓
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1			✓
	2			✓
	3			✓
		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1			✓
	2			✓
	3			✓
PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1			✓
	2			✓
	3			✓

ALDRIN PATRICK G. TECTO CAPU
Evaluator

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Title of the study: Hematology Utility of Ginger (Zingiber Officinale) - Anticoagulated Blood

Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

GINGER EXTRACT- ANTICOAGULATED BLOOD				
TEST	**RESULT**			
WHITE BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1		✓	
	2			✓
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1			✓
	2			✓
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1			✓
	2		✓	
	3			✓
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1			✓
	2			✓
	3			✓
RED BLOOD CELL MORPHOLOGY		**1**	**2**	**3**
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1	✓		
	2		✓	
	3		✓	
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1		✓	
	2	✓		
	3	✓		

		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1	/		
	2	/		
	3		/	
PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1		/	
	2	/		
	3	/		

Raeuche Ken G. Novero, RMT
LICENSE NO. 0120078
05/6/2025

Evaluator

Date: May 06, 2025

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EDTA- ANTICOAGULATED BLOOD

TEST	RESULT			
WHITE BLOOD CELL MORPHOLOGY		1	2	3
		Absence of granules	Granules are faint	Granules are prominent
a. Granulation	1			✓
	2			✓
	3			✓
		Hypersegmented or hyposegmented nuclei in neutrophils or abnormal lobulation in other leukocytes	Slight deviation from typical nuclear segmentation	Normal lobulation for the specific WBC type.
b. Lobulation	1			✓
	2			✓
	3			✓
		Numerous or large vacuoles are present	Few or small vacuoles, not affecting cell integrity	No vacuoles visible
c. Presence of Vaculation	1			✓
	2			✓
	3			✓
		Abnormal cytoplasmic color	Slight variations in cytoplasmic color	Normal, expected cytoplasmic color for the cell type
d. Color	1			✓
	2			✓
	3			✓
RED BLOOD CELL MORPHOLOGY		1	2	3
		Abnormal shape present	Mild irregularities (occasional irregular cells, but not significantly affecting interpretation)	Normal
a. shape	1			✓
	2			✓
	3			✓
		Significant anisocytosis (wide variation in RBC size)	Mild anisocytosis (occasional cells outside the normal range)	Uniform size
b. Size	1			✓
	2			✓
	3			✓
		Presence of hypochromic or hyperchromic cells	Slight color variations; minimal central pallor	Normal color (consistent central pallor and hemoglobin distribution)
c. Color	1			✓
	2			✓
	3			✓
PLATELET VIABILITY		1	2	3
		Numerous large clumps or prominent satellitism.	Minor clumping or mild satellitism	Platelets are evenly distributed with no clumping or satellitism
a. Clumping and Satellitism	1			✓
	2			✓
	3			

Raquelle Ken G. Novero, RMT
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Date: May 06, 2025

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GINGER EXTRACT- ANTICOAGULATED BLOOD

TEST	RESULT		
Replicate no.	1	2	3
HEMATOCRIT LEVEL	34	34	34
HEMOGLOBIN LEVEL	11.46 g/dL	11.51 g/dL	11.63 g/dL
RED BLOOD CELL COUNT	372	372	376
WHITE BLOOD CELL COUNT	65	75	70
PLATELET COUNT	175	176	176

WBC DIFFERENTIAL COUNT		NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS
	1	52	36	7	5	0
	2	53	38	6	3	0
	3	53	37	5	5	0

EDTA EXTRACT- ANTICOAGULATED BLOOD

TEST	RESULT		
Replicate no.	1	2	3
HEMATOCRIT LEVEL	46	46	45
HEMOGLOBIN LEVEL	15.23 g/dL	15.21 g/dL	15.57 g/dL
RED BLOOD CELL COUNT	487	487	487
WHITE BLOOD CELL COUNT	111	112	116
PLATELET COUNT	236	237	234

WBC DIFFERENTIAL COUNT		NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS
	1	59	34	4	5	0
	2	54	35	5	5	0
	3	53	35	7	5	0

COUNTED BY: PALAMING, JOMUEL THRIXIAN
DATE: May 6, 2025

VALIDATED BY: ALDRIN ESMOCARO
DATE: May 6, 2025

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Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

GINGER EXTRACT- ANTICOAGULATED BLOOD						
TEST	RESULT					
Replicate no.	1		2		3	
HEMATOCRIT LEVEL	34		34		34	
HEMOGLOBIN LEVEL	11.46 g/dL		11.51 g/dL		11.63 g/dL	
RED BLOOD CELL COUNT	382		370		385	
WHITE BLOOD CELL COUNT	68		77		70	
PLATELET COUNT	176		176		174	
WBC DIFFERENTIAL COUNT		NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS
	1	55	36	4	5	0
	2	52	38	5	5	0
	3	51	38	6	5	0

EDTA EXTRACT- ANTICOAGULATED BLOOD						
TEST	RESULT					
Replicate no.	1		2		3	
HEMATOCRIT LEVEL	46		46		45	
HEMOGLOBIN LEVEL	15.23 g/dL		15.21 g/dL		15.57 g/dL	
RED BLOOD CELL COUNT	484		486		486	
WHITE BLOOD CELL COUNT	105		120		111	
PLATELET COUNT	237		235		236	
WBC DIFFERENTIAL COUNT		NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS
	1	51	31	7	3	0
	2	56	34	6	4	0
	3	54	35	6	5	0

COUNTED BY: JALLORINA, ASHELEY I.
DATE: May 6, 2025

VALIDATED BY: ALDRIN ORTEGA ECTOCAPAW
DATE: May 6, 2025

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Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

GINGER EXTRACT- ANTICOAGULATED BLOOD						
TEST	**RESULT**					
Replicate no.	**1**		**2**		**3**	
HEMATOCRIT LEVEL	34		34		34	
HEMOGLOBIN LEVEL	11.46 g/dL		11.51 g/dL		1.63 g/dL	
RED BLOOD CELL COUNT	375		385		380	
WHITE BLOOD CELL COUNT	64		72		76	
PLATELET COUNT	175		174		175	
WBC DIFFERENTIAL COUNT	NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS	
1	54	35	6	5	0	
2	55	34	6	5	0	
3	53	36	6	5	0	

EDTA EXTRACT- ANTICOAGULATED BLOOD						
TEST	**RESULT**					
Replicate no.	**1**		**2**		**3**	
HEMATOCRIT LEVEL	46		46		45	
HEMOGLOBIN LEVEL	15.23 g/dL		15.21 g/dL		15.57 g/dL	
RED BLOOD CELL COUNT	486		485		483	
WHITE BLOOD CELL COUNT	110		118		115	
PLATELET COUNT	235		238		236	
WBC DIFFERENTIAL COUNT	NEUTROPHILS	LYMPHOCYTES	MONOCYTES	EOSINOPHILS	BASOPHILS	
1	53	34	6	5	0	
2	55	35	6	4	0	
3	53	36	6	5	0	

COUNTED BY: MANZANO, JORIC J.
DATE: May 6, 2025

VALIDATED BY: ALDRIN PEÑOCAMPO
DATE: May 6, 2025

APPENDIX H

Validation of tool for scoring cellular morphology

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Carlatan, City of San Fernando, La Union
COLLEGE OF MEDICAL LABORATORY SCIENCE

SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

1 – Strongly Disagree **2** – Disagree **3** – Undecided **4** – Agree **5** – Strongly Agree

Criteria					
The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
The instrument has an appropriate sample of items for the construct being measured.	1	2	3	4	5
The items and their alternatives are neither too narrow nor limited in its content.	1	2	3	4	5
The items in the instrument are stated clearly.	1	2	3	4	5
The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	1	2	3	4	5
The terms adapted in the scale are culturally appropriate.	1	2	3	4	5
The layout or format of the instrument is technically sound.	1	2	3	4	5
The responses on the scale show a reasonable range of variation.	1	2	3	4	5
The instrument is not too short or long enough that the participants will be able to answer it within a given time.	1	2	3	4	5
The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	1	2	3	4	5
The instrument as a whole could answer the basic purpose for which it is designed.	1	2	3	4	5
The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5

Comments and Suggestions:

N/A

Signature over Printed Name
Rachelle Ann G. Novero, RMT

SURVEY INSTRUMENT VALIDATION RATING SCALE by Ryan Michael F. Oducado
West Visayas State University, College of Nursing

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SURVEY INSTRUMENT VALIDATION RATING SCALE

Instruction: Please indicate your degree of agreement or disagreement on the statements provided below by encircling the number which corresponds to your best to your judgment.

Criteria					
The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
The instrument has an appropriate sample of items for the construct being measured.	1	2	3	4	5
The items and their alternatives are neither too narrow nor limited in its content.	1	2	3	4	5
The items in the instrument are stated clearly.	1	2	3	4	5
The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	1	2	3	4	5
The terms adapted in the scale are culturally appropriate.	1	2	3	4	5
The layout or format of the instrument is technically sound.	1	2	3	4	5
The responses on the scale show a reasonable range of variation.	1	2	3	4	5
The instrument is not too short or long enough that the participants will be able to answer it within a given time.	1	2	3	4	5
The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	1	2	3	4	5
The instrument as a whole could answer the basic purpose for which it is designed.	1	2	3	4	5
The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5

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Comments and Suggestions:

_____
_____
_____
_____
_____

Signature over Printed Name
_____

SURVEY INSTRUMENT VALIDATION RATING SCALE by Ryan Michael F. Oducado
West Visayas State University, College of Nursing

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1 – Strongly Disagree **2** – Disagree **3** – Undecided **4** – Agree **5** – Strongly Agree

Criteria					
The items in the instrument are relevant to answer the objectives of the study.	1	2	3	4	5
The items in the instrument can obtain depth to constructs being measured.	1	2	3	4	5
The instrument has an appropriate sample of items for the construct being measured.	1	2	3	4	5
The items and their alternatives are neither too narrow nor limited in its content.	1	2	3	4	5
The items in the instrument are stated clearly.	1	2	3	4	5
The items on the instrument can elicit responses which are stable, definite, consistent and not conflicting.	1	2	3	4	5
The terms adapted in the scale are culturally appropriate.	1	2	3	4	5
The layout or format of the instrument is technically sound.	1	2	3	4	5
The responses on the scale show a reasonable range of variation.	1	2	3	4	5
The instrument is not too short or long enough that the participants will be able to answer it within a given time.	1	2	3	4	5
The instrument is interesting such that participants will be induced to respond to it and accomplish it fully.	1	2	3	4	5
The instrument as a whole could answer the basic purpose for which it is designed.	1	2	3	4	5
The instrument is culturally acceptable when administered in the local setting.	1	2	3	4	5

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Comments and Suggestions:

_____
_____
_____
_____
_____

Signature over Printed Name
ALDRIN PATRICK TECTUCARIO

SURVEY INSTRUMENT VALIDATION RATING SCALE by Ryan Michael F. Oducado
West Visayas State University, College of Nursing

APPENDIX I

Pictures of Experimental Set-ups

Aqueous extract preparation



Blood collection



Preparation of treatments

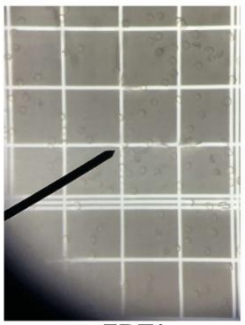


EDTA 1

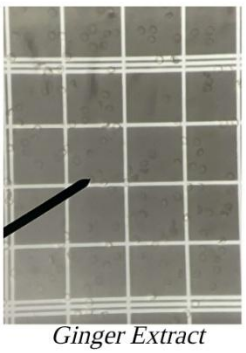
EDTA 2

EDTA 3

RBC count

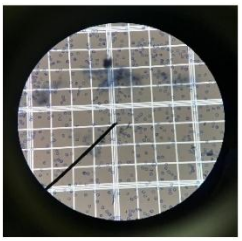


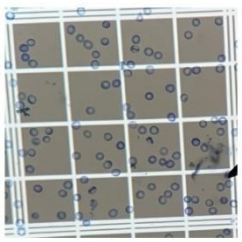
EDTA



Ginger Extract

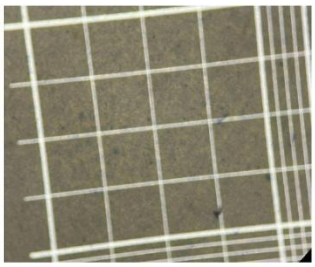
Platelet Count

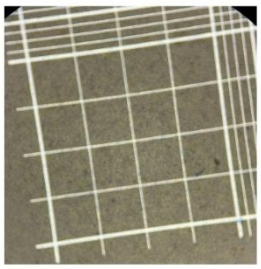




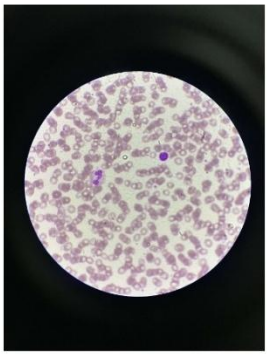
EDTA *Ginger Extract*

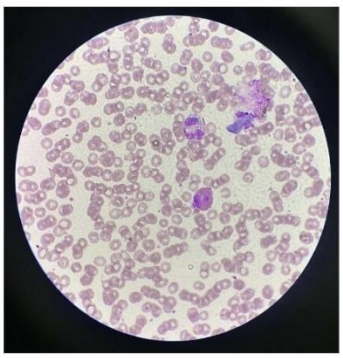
WBC count





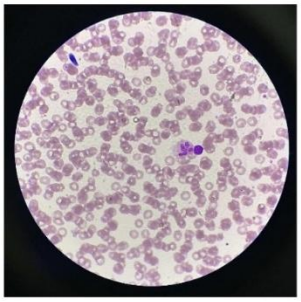
WBC differential count

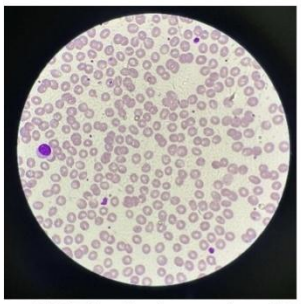


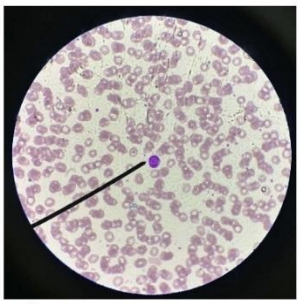


EDTA *Ginger Extract*

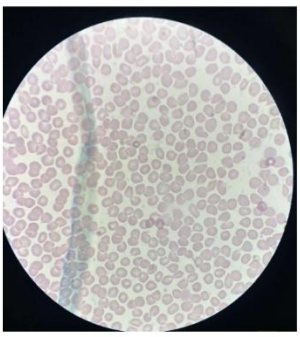
Validation and Evaluation of Cellular Morphologies

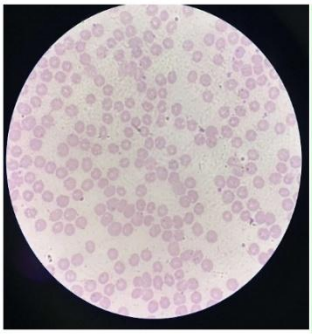


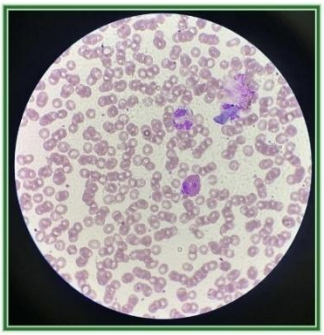




EDTA- Anticoagulated Blood







Ginger Extract- Anticoagulated Blood

APPENDIX J.

Statistical Output

HEMATOCRIT

Ginger	EDTA	
34	46	
34	46	
34	45	
0	0.333333	VAR E
0	0.57735	SD

t-Test: Two-Sample Assuming Equal Variances

	Ginger	*EDTA*
Mean	34	45.66667
Variance	0	0.333333
Observations	3	3
Pooled Variance	0.166667	
Hypothesized Mean Difference	0	
df	4	
t Stat	-35	
P(T<=t) one-tail	1.99E-06	
t Critical one-tail	2.131847	
P(T<=t) two-tail	3.98E-06	
t Critical two-tail	2.776445	

HEMOGLOBIN

Ginger	EDTA	
11.46	15.23	
11.51	15.21	
11.63	15.57	
0.007633333	0.04093333	VAR E
0.087368949	0.20231988	SD

t-Test: Two-Sample Assuming Equal Variances

	Ginger	*EDTA*
Mean	11.5333333	15.33667
Variance	0.00763333	0.040933
Observations	3	3
Pooled Variance	0.02428333	
Hypothesized Mean Difference	0	
df	4	
t Stat	-29.892062	
P(T<=t) one-tail	3.7296E-06	
t Critical one-tail	2.13184679	
P(T<=t) two-tail	7.4592E-06	
t Critical two-tail	2.77644511	

RBC Count

Ginger	EDTA	
3.82	4.84	
3.75	4.86	
3.72	4.87	
3.7	4.86	
3.85	4.85	
3.72	4.87	
3.85	4.84	
3.8	4.83	
3.76	4.87	
0.003302778	0.000228	VAR E
0.057469799	0.015092	SD

t-Test: Two-Sample Assuming Equal Variances

	Ginger	*EDTA*
Mean	3.774444	4.854444
Variance	0.003303	0.000228
Observations	9	9
Pooled Variance	0.001765	
Hypothesized Mean Difference	0	
df	16	
t Stat	-54.5285	
P(T<=t) one-tail	6.63E-20	
t Critical one-tail	1.745884	
P(T<=t) two-tail	1.33E-19	
t Critical two-tail	2.119905	

WBC Count

Ginger	EDTA	
3.4	5.25	
3.2	5.5	
3.25	5.55	
3.85	6	
3.6	5.9	
3.74	5.6	
3.5	5.55	
3.8	5.75	
3.5	5.8	
0.053719444	0.052778	VAR E
0.231774555	0.229734	SD

t-Test: Two-Sample Assuming Equal Variances

	Ginger	*EDTA*
Mean	3.537778	5.655556
Variance	0.053719	0.052778
Observations	9	9
Pooled Variance	0.053249	
Hypothesized Mean Difference	0	
df	16	
t Stat	-19.4685	
P(T<=t) one-tail	7.24E-13	
t Critical one-tail	1.745884	
P(T<=t) two-tail	1.45E-12	
t Critical two-tail	2.119905	

PLATELET Count

Ginger	EDTA	
176	237	
175	235	
175	236	
176	235	
174	238	
176	237	
174	235	
175	236	
176	236	
0.694444444	1.1111111	VAR E
0.833333333	1.0540926	SD

t-Test: Two-Sample Assuming Equal Variances

	Ginger	*EDTA*
Mean	175.22222	236.111
Variance	0.6944444	1.11111
Observations	9	9
Pooled Variance	0.9027778	
Hypothesized Mean Difference	0	
df	16	
t Stat	-135.9421	
P(T<=t) one-tail	3.08E-26	
t Critical one-tail	1.7458837	
P(T<=t) two-tail	6.16E-26	
t Critical two-tail	2.1199053	

WBC Differential Count												
Ginger							EDTA					
N	L	M	E	B			N	L	M	E	B	
55	36	4	5	0			51	39	7	3	0	
54	35	6	5	0			53	36	6	5	0	
52	36	7	5	0			55	36	4	5	0	
52	38	5	5	0			56	34	6	4	0	
55	34	6	5	0			55	35	6	4	0	
53	38	6	3	0			55	35	5	5	0	
51	38	6	5	0			54	35	6	5	0	
53	36	6	5	0			53	36	6	5	0	
53	37	5	5	0			53	35	7	5	0	
1.861111111	2.027778	0.75	0.444444	0			2.361111	2	0.861111	0.527778	0	
1.364225462	1.424001	0.86603	0.666667	0	SD		1.536591	1.414214	0.927961	0.726483	0	SD
VARE	VARE	VARE	VARE									

NEUTROPHILS

t-Test: Two-Sample Assuming Equal Variances

Neutrophils	*Ginger*	*EDTA*
Mean	53.11111	53.8889
Variance	1.861111	2.3611
Observations	9	9
Pooled Variance	2.111111	
Hypothesized Mean Difference	0	
df	16	
t Stat	-1.13555	
P(T<=t) one-tail	0.136435	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.272869	
t Critical two-tail	2.119905	

MONOCYTES

t-Test: Two-Sample Assuming Equal Variances

Monocytes	*Ginger*	*EDTA*
Mean	5.666667	5.88888
Variance	0.75	0.86111
Observations	9	9
Pooled Variance	0.805556	
Hypothesized Mean Difference	0	
df	16	
t Stat	-0.52523	
P(T<=t) one-tail	0.303314	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.606629	
t Critical two-tail	2.119905	

LYMPHOCYTES

t-Test: Two-Sample Assuming Equal Variances

Lymphocytes	*Ginger*	*EDTA*
Mean	36.44444	35.6667
Variance	2.027778	2
Observations	9	9
Pooled Variance	2.013889	
Hypothesized Mean Difference	0	
df	16	
t Stat	1.162637	
P(T<=t) one-tail	0.131013	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.262025	
t Critical two-tail	2.119905	

EOSINPHILS

t-Test: Two-Sample Assuming Equal Variances

Eosinophils	*Ginger*	*EDTA*
Mean	4.777778	4.55555
Variance	0.444444	0.52777
Observations	9	9
Pooled Variance	0.486111	
Hypothesized Mean Difference	0	
df	16	
t Stat	0.676123	
P(T<=t) one-tail	0.254309	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.508618	
t Critical two-tail	2.119905	

WBC MORPHOLOGY										
Ginger						EDTA				
G	L	P	C			G	L	P	C	
2	3	3	3			3	3	3	3	
2	2	2	3			3	3	2	3	
2	2	3	2			3	3	3	3	
3	3	2	3			3	3	3	3	
2	2	2	2			3	3	3	3	
3	2	2	3			3	2	3	3	
3	3	3	3			3	3	3	3	
3	3	2	2			3	3	2	3	
3	3	3	3			3	3	3	3	
0.277777778	0.277778	0.277778	0.25			0	0.111111	0.194444	0	
VAR E	VAR E	VAR E	VAR E							
0.527046277	0.527046	0.527046	0.5	SD		0	0.333333	0.440959	0	SD

GRANULATION

t-Test: Two-Sample Assuming Equal Variances

Granulation	*Ginger*	*EDTA*
Mean	2.555556	3
Variance	0.277778	0
Observations	9	9
Pooled Variance	0.138889	
Hypothesized Mean Difference	0	
df	16	
t Stat	-2.52982	
P(T<=t) one-tail	0.011147	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.022294	
t Critical two-tail	2.119905	

PRESENCE OF VACUOLATION

t-Test: Two-Sample Assuming Equal Variances

Presence of Vacuolation	*Ginger*	*EDTA*
Mean	2.444444444	2.777778
Variance	0.277777778	0.194444
Observations	9	9
Pooled Variance	0.236111111	
Hypothesized Mean Difference	0	
df	16	
t Stat	-1.45521375	
P(T<=t) one-tail	0.082474638	
t Critical one-tail	1.745883676	
P(T<=t) two-tail	0.164949276	
t Critical two-tail	2.119905299	

LOBULATION

t-Test: Two-Sample Assuming Equal Variances

Lobulation	*Ginger*	*EDTA*
Mean	2.555556	2.888889
Variance	0.277778	0.111111
Observations	9	9
Pooled Variance	0.194444	
Hypothesized Mean Difference	0	
df	16	
t Stat	-1.60357	
P(T<=t) one-tail	0.064182	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.128364	
t Critical two-tail	2.119905	

COLOR

t-Test: Two-Sample Assuming Equal Variances

Color	*Ginger*	*EDTA*
Mean	2.666666667	3
Variance	0.25	0
Observations	9	9
Pooled Variance	0.125	
Hypothesized Mean Difference	0	
df	16	
t Stat	-2	
P(T<=t) one-tail	0.031385982	
t Critical one-tail	1.745883676	
P(T<=t) two-tail	0.062771964	
t Critical two-tail	2.119905299	

RBC MORPHOLOGY							
Ginger				EDTA			
Sh	Si	C		Sh	Si	C	
1	2	1		3	3	3	
2	2	2		3	3	3	
2	2	2		3	3	3	
2	1	1		3	3	3	
2	2	2		3	3	3	
3	3	2		2	3	3	
2	1	2		3	3	3	
2	3	3		3	3	3	
3	3	2		3	2	3	
0.361111111	0.611111	0.361111		0.111111111	0.111111	0	
VAR E	VAR E	VAR E					
0.600925213	0.781736	0.600925	SD	0.333333333	0.333333	0	SD

SHAPE

t-Test: Two-Sample Assuming Equal Variances

Shape	*Ginger*	*EDTA*
Mean	2.111111	2.888889
Variance	0.361111	0.111111
Observations	9	9
Pooled Variance	0.236111	
Hypothesized Mean Difference	0	
df	16	
t Stat	-3.3955	
P(T<=t) one-tail	0.001848	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.003695	
t Critical two-tail	2.119905	

SIZE

t-Test: Two-Sample Assuming Equal Variances

Size	*Ginger*	*EDTA*
Mean	2.111111	2.888889
Variance	0.611111	0.111111
Observations	9	9
Pooled Variance	0.361111	
Hypothesized Mean Difference	0	
df	16	
t Stat	-2.74563	
P(T<=t) one-tail	0.007181	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.014363	
t Critical two-tail	2.119905	

COLOR

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	1.888889	3
Variance	0.361111	0
Observations	9	9
Pooled Variance	0.180556	
Hypothesized Mean Difference	0	
df	16	
t Stat	-5.547	
P(T<=t) one-tail	2.21E-05	
t Critical one-tail	1.745884	
P(T<=t) two-tail	4.42E-05	
t Critical two-tail	2.119905	

PLATELET VIABILITY

Ginger	EDTA	
2	3	
3	3	
3	3	
1	3	
3	3	
3	3	
1	3	
3	3	
3	3	
0.777777778	0	VAR E
0.881917104	0	SD

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	2.444444	3
Variance	0.777778	0
Observations	9	9
Pooled Variance	0.388889	
Hypothesized Mean Difference	0	
df	16	
t Stat	-1.88982	
P(T<=t) one-tail	0.03852	
t Critical one-tail	1.745884	
P(T<=t) two-tail	0.077039	
t Critical two-tail	2.119905	

Appendix K

Grammar and Plagiarism Result

Report: MANUSCRIPT

MANUSCRIPT

by ziri

General metrics

85,607	12,289	981	49 min 9 sec	1 hr 34 min
characters	words	sentences	reading time	speaking time

Score

This text scores better than 92% of all texts checked by Grammarly

Writing Issues

319	46	273
Issues left	Critical	Advanced

Plagiarism

92 sources

4% of your text matches 92 sources on the web or in archives of academic publications

Appendix L

Research Time Table

GENERAL RESEARCH
TIMETABLE/GANTT CHART

Title of the study: Hematology Utility of Ginger (*Zingiber Officinale*)-Anticoagulated Blood

Proponent: Irish Marie C. Balao, Paulo Miguel L. Deleña, Asheley I. Jallorina, Joric J. Manzano, Jomuel Thrixian M. Palaming, John Philip A. Sanson

Timetable	Research Tasks	Status
August 2024	1. Construction of the research title ▪ Literature review, Journal/Article review ▪ Recognition of research gaps and objectives ▪ Formulation of research titles	Completed
September 2024	1. Presentation of Research title ▪ Formulation of research process ▪ Recognition of research gaps and objectives	Completed
October 2024	1. Revision of Research title 2. Formulation of Letter for research adviser ▪ Encoding of letter through electronic devices ▪ Signing of the letter on campus 3. Accomplishment of Chapter 1 and 2 ▪ Journal Review, and other Literary Review ▪ Encoding through electronic devices	Completed
November 2024	1. First Review of Chapter 1 and 2 ▪ Research adviser review 2. Revision of Chapter 1 and 2	Completed

	▪ Revisions based on the research adviser's suggestions 3. Formulation of letter addressed to the statistician 4. Revision of Chapter 1 and 2	
December 2024	1. Preparation of research copies for the research proposal defense panelists 2. Formulation of powerpoint presentation for the proposal defense 3. Mock defense through google meet 4. Research proposal defense proper ▪ Presentation of the research proposal to the panelists ▪ Question and answer ▪ Panelists give suggestions and recommendations for revisions	Completed
December 2024-January 2025	1. Revision of research as suggested by the panelists 2. Submission of Revised Research Paper for endorsement to REC.	Completed
February 2025	1. Approval of the Research Paper by the REC 2. Planning and preparation on the experimentation proper 3. Formulation of letters for evaluators	Completed
March 9, 2025	1. Purchasing of Ginger 2. Air-drying of ginger	Completed
March 1, 2025	1. Experimentation proper and data gathering Grinding of Ginger Preparation of aqueous solution	Completed
March 12, 2025	1. Experimentation proper and data gathering 1st Blood collection (10 ml of blood) Preparation of Treatments Determination of hematocrit level Determination of hemoglobin level Red Blood Cell count White Blood cell count	Completed

	Platelet count	
March 13, 2025	1. Experimentation proper and data gathering 2nd blood collection (10 ml of blood) Preparation of Treatments White blood cell morphology examination White blood cell differential count Red blood cell morphology examination Platelet viability	Completed
March 17, 2025	1. Consultation with Statistician	Completed
March 2025 - April 2025	1. Accomplishment of Chapter 3 and Chapter 4 2. Revisions based on the comments and suggestions of faculty advisers. 3. Finalization of Whole Research Paper for Final Defense	Completed
May 12, 2025	1. Final Research Defense	Completed

9. **Author(s) Biodata**

Irish Marie C. Balao

A resident of Ilocos Sur**, Irish Marie C. Balao** is 21 years old and currently taking up Medical Laboratory Science. She is driven by a passion for laboratory work and public health.

Paulo Miguel L. Deleña

Paulo Miguel Deleña is a 21-year-old student from San Fernando La union, taking up Bachelor of Medical Laboratory Science. His goal is to help advance healthcare through accurate and reliable lab work.

Asheley I. Jallorina

Asheley I. Jallorina, 21, studies Medical Laboratory Science at Lorma Colleges. Hailing from Candon City Ilocos Sur, she is dedicated to learning and contributing to medical research and practice.

Joric J. Manzano

Joric J. Manzano, 21, is a Medical Laboratory Science student at Lorma Colleges from Talogtog, Candon City, Ilocos Sur. He is passionate about laboratory diagnostics and aims to contribute to better healthcare through his studies

Jomuel Thrixian M. Palaming

Jomuel Thrixian Palaming, 21, was born in Legleg, San Juan, La Union. He is currently a third-year Medical Laboratory Science student at Lorma Colleges. Driven by a strong passion for the medical field, Jomuel has chosen to focus his research on exploring natural alternatives for hematologic applications. His dedication to experimental research reflects his commitment to contributing innovative and sustainable solutions in clinical laboratory science.

John Philip A. Sanson

John Philip A. Sanson is a 21-year-old Medical Laboratory Science student from San Fernando La Union. With a keen interest in diagnostics, he hopes to make a positive impact in the healthcare field**.**