I. INTRODUCTION

1.1 Background

Rats have long been used as model organisms in scientific research due to their physiological, behavioral, and neuroanatomical similarities to humans. Early studies involving rats contributed significantly to the understanding of diet, behavior, and brain organization (Coleman & Schapiro, 2021). Although rats possess lower binocular acuity and reduced stereoscopic overlap compared to humans, they have a broader visual field and greater sensitivity to variations in light intensity (Burn, 2008; Winnicker *et al*., 2012). Their visual system is also two to three times more sensitive to motion compared to humans, allowing rats to orient themselves in space and detect moving objects even with limited high-acuity vision.

Research on visual discrimination in rats began to expand in the 1960s through classic behavioral experiments. Sutherland and colleagues demonstrated that rats could be trained to distinguish between vertical and horizontal rectangles, establishing the foundation for the use of shape discrimination tasks in behavioral neuroscience (Sutherland, 1962). Subsequent investigations confirmed that rats initially respond more readily to horizontal shapes, prefer more open shapes during early training phases, and show increased accuracy when discriminating open versus closed figures (Pungor & Niell, 2023). Shape discrimination tests are now widely recognized as visual cognitive tasks used to examine perceptual abilities, relying on the animal's capacity to detect and differentiate geometric forms (Vasquez *et al*., 2018).

Blood plays a central role in vertebrate physiology as the transport medium for oxygen, carbon dioxide, nutrients, hormones, and metabolic waste products (Azhari *et al*., 2020). Hematological parameters provide essential information about metabolic activity, organ function, immune status, and overall physiological condition. Blood components, including erythrocytes, leukocytes, and plasma, support critical biological processes throughout the body, including tissues involved in sensory perception such as the eyes and brain (Rousdy & Linda, 2018). Adequate oxygen delivery is vital for retinal function, and severe disturbances in hematological status, such as iron-deficiency anemia which can lead to retinal vascular complications or optic neuropathy in rare cases. Although such effects are uncommon, they indicate that hematological balance contributes to maintaining visual system function.

Hematology is also an important diagnostic and monitoring tool in both preclinical and clinical studies. Hematological values are widely used to detect systemic disturbances, evaluate toxicity, and characterize disease conditions (Ihedioha *et al*., 2004). In experimental research, hematological assessments provide baseline and post-treatment indicators of physiological change, making them crucial for interpreting the biological impact of interventions or behavioral procedures.

Rodents, including rats, possess a more sophisticated visual system than previously assumed, enabling them to perform complex tasks such as object recognition and shape discrimination. Recent evidence shows that rodents possess more advanced visual processing capabilities than previously assumed, making them suitable models for studying perceptual and cognitive functions. Rats can perform complex visual tasks, including feature detection and object recognition, supported by structured cortical processing and experience-dependent modulation of visual pathways (Chou *et al*., 2023). They also demonstrate perceptual stability across changes in size or orientation, indicating robust shape-based recognition abilities (Lee *et al*., 2025).

Behavioral studies further reveal that rodents actively apply information-seeking strategies during visual discrimination tasks (Moura *et al*., 2024). Comparisons between rodents and humans show distinct, yet biologically informative, object-recognition mechanisms (Zoccolan *et al*., 2023). Therefore, shape discrimination is not merely a basic perceptual test but a validated paradigm for assessing visual–cognitive function in laboratory rats.

Although numerous studies have examined rodent visual processing,including orientation discrimination, contrast detection, and shape recognition, which these works predominantly focus on behavioral performance and neural mechanisms rather than systemic physiological responses (Sutherland, 1962; Prusky & Douglas, 2004; Busse *et al*., 2011; Pungor & Niell, 2023). Conversely, hematological studies in laboratory animals generally address metabolic status, toxicity, systemic health, or disease conditions, without integrating behavioral or cognitive tasks as variables influencing blood parameters (Ihedioha *et al*., 2004; Patel *et al*., 2024). To date, there is a clear lack of research investigating whether cognitively demanding visual tasks, such as shape discrimination, can induce measurable changes in hematological indices such as erythrocyte and leukocyte parameters. This gap highlights the need to bridge behavioral neuroscience and physiological assessment by examining whether visual discrimination activity elicits subtle hematological shifts that may reflect underlying physiological responses.

1.2 Research Problems

Based on the background, the research problem is what is the effect of the shape discrimination related to the formed elements of the hematological parameters.

1.3 Research Objectives

This research aims to assess the response of the shape discrimination test on rat hematological parameters, focusing on changes in erythrogram and leukogram indices.

1.4 Research Benefits

1. Help scientists to know the hematological profile after shape discrimination test
2. To serve as a reference material for future research, particularly studies examining the physiological impacts of cognitive tasks or the integration of hematological parametßers in behavioral assessments.
3. Provides scientific information regarding the hematological profile in rats