

# The interaction of *Schistosoma mansoni* infection with diabetes mellitus and obesity in mice

Alaa S. Amer<sup>1</sup>, Ahmad Othman<sup>1</sup>, Lamees M. Dawood<sup>2</sup>, Kholoud A. El-Nouby<sup>1</sup>, Geoffrey N. Gobert<sup>3</sup>, Dina M. Abou Rayia<sup>1</sup>

<sup>1</sup>Medical Parasitology Department, Faculty of Medicine, Tanta University, Tanta, Egypt; <sup>2</sup>Biochemistry Department, Faculty of Medicine, Tanta University, Tanta, Egypt; <sup>3</sup>School of Biological Sciences, Queen's University Belfast, Belfast, BT9 5DL, UK

## INTRODUCTION

**Human schistosomiasis** is one of the most prevalent parasitic diseases worldwide. Various host factors can affect the **host-parasite interactions**. These host factors can include changes in metabolism, immunological responses, and the genetic background. These changes to the host may lead to the disrupt of important parasite functions such as oviposition, worm development and the resulting pathology associated with the infection.

## AIM 1

To study the impact of the **metabolic disorders** DM1, DM2, and obesity on *Schistosoma mansoni* infection.

## METHOD

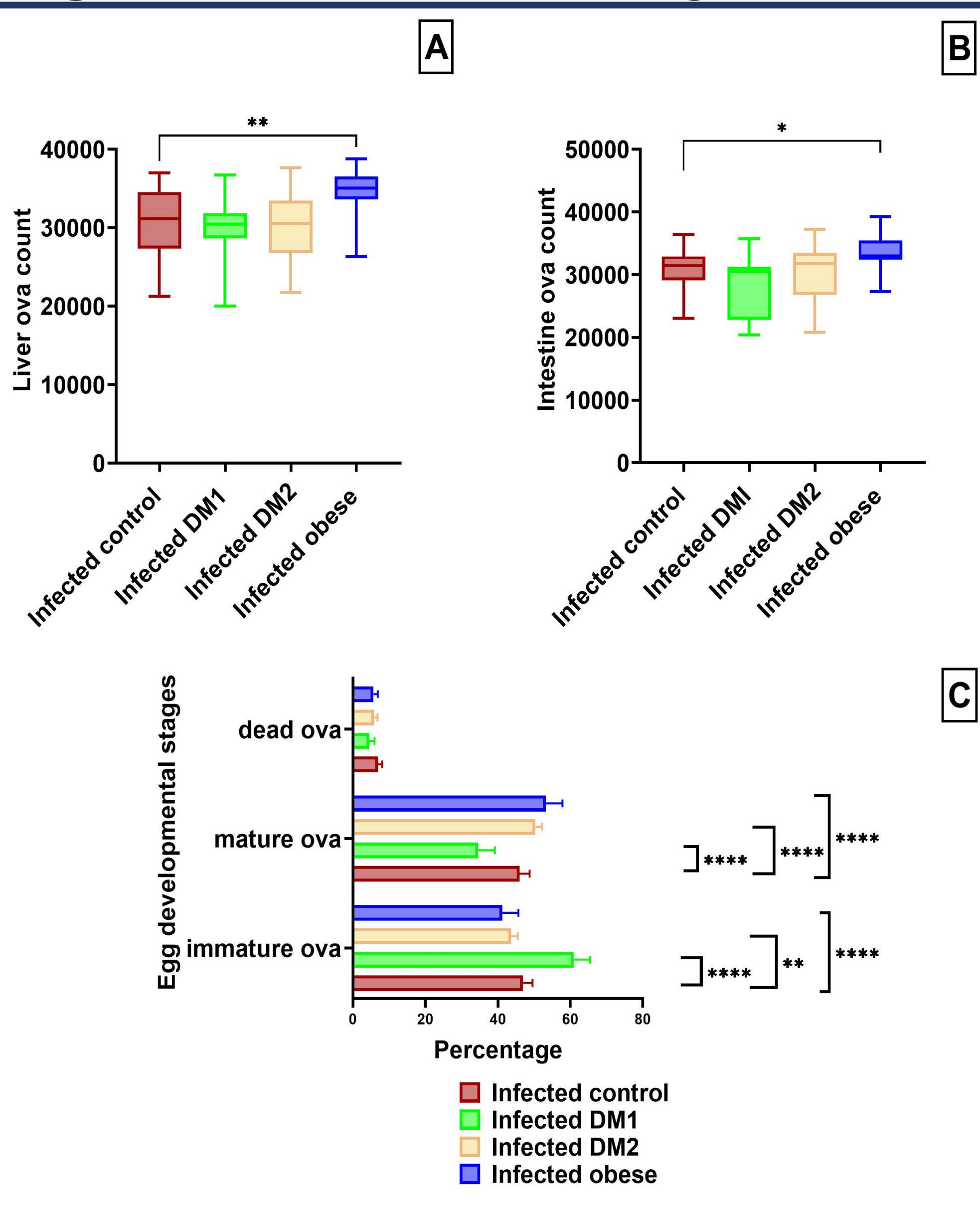
- **Tissue eggs counts** from the livers and intestine of eight-weeks infected male black mice (**C57BL/6**), were used as an indicator of pathology and potential disease transmission for the different animal models of schistosomiasis.
- **Quantitative oogram** was performed for different developmental egg stages to access the development and maturation of eggs.

- Determination of the following **immunological markers** were performed using plasma of all sacrificed mice by ELISA technique: **Tumor necrosis factor (TNF)** beta as a marker for T-helper 1 (Th1); **Interleukin-5 (IL-5)** and **IL-10** as markers for Th2; **Forkhead box P3 (Foxp3)** as a marker for T regulatory cell; **Pentraxin 3 (PTX3)** as an inflammatory marker.
- Image analysis of **Masson's trichrome stained liver sections** using **image j (Fiji)** software to determine the amount of fibrosis present were carried out.

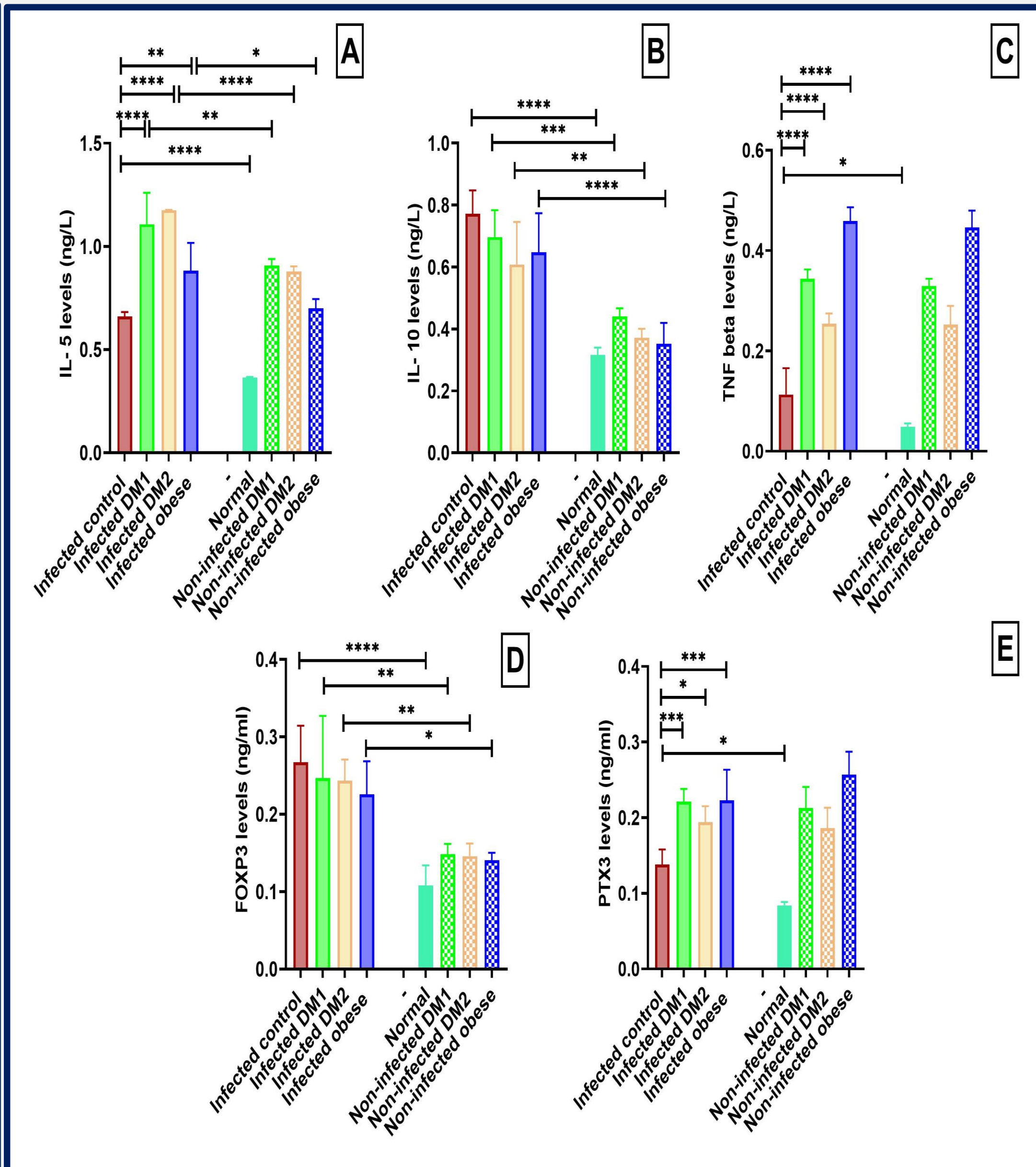
## RESULTS

- **Induction of DM2 and obesity** increased the body mass, egg count, and mature egg percentage.
- **Fibrosis area %** and integrated density increased significantly in the infected DM2 and obese groups. While **induction of DM1** exerted marginal effect on the liver pathology as evidenced by reduction of the liver fibrosis and collagen deposition.
- **Increased levels** of IL-5, IL-10 and FOXP3 **and shifting the immune response towards Th2 and Treg pathways**.
- **Increased PTX3 levels** in the infected diabetic and obese groups **as an evidence of increased systemic inflammation**

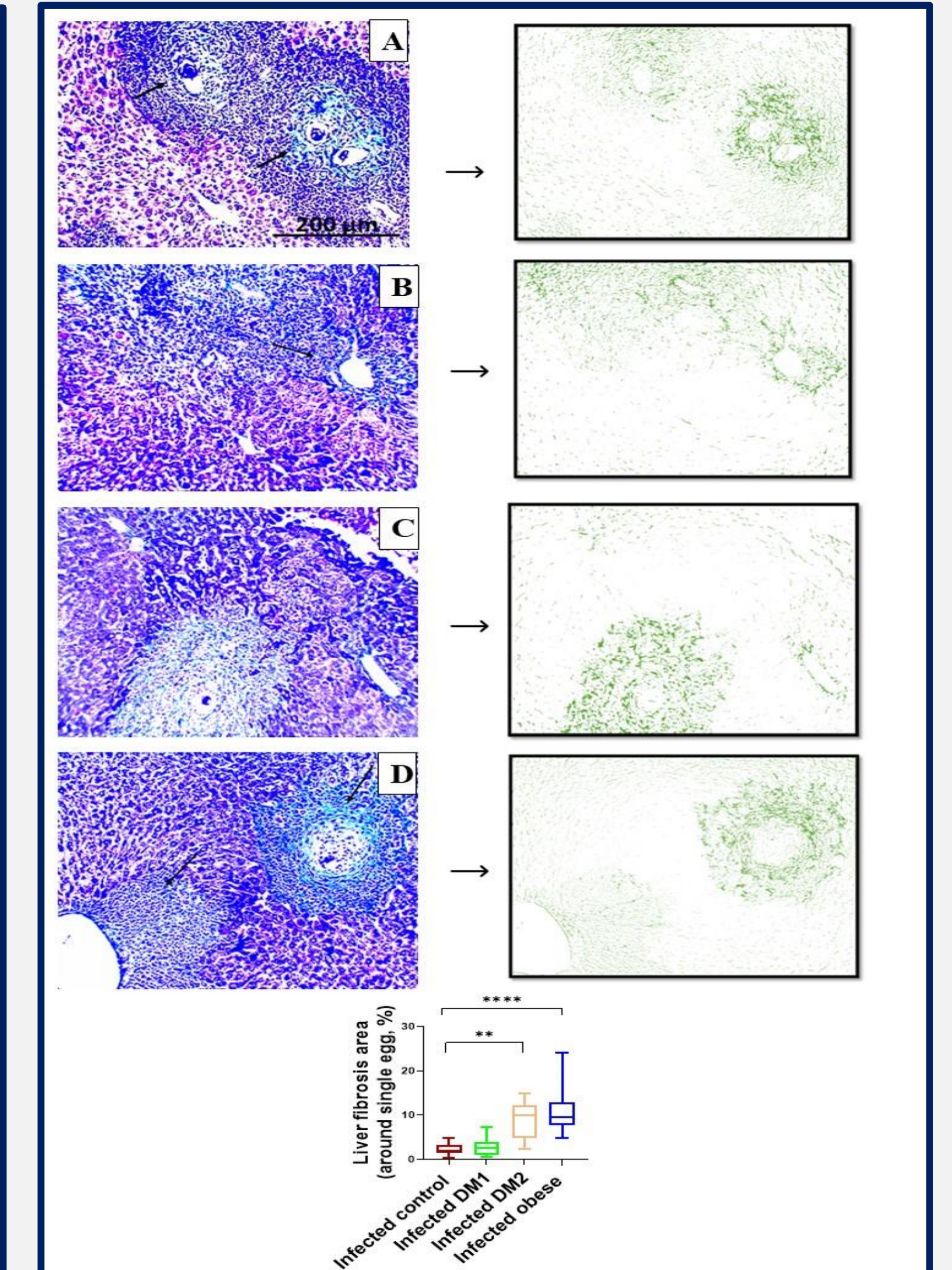
**Figure 1. Ova count and oogram**



**Figure 2. Immunological markers**



**Figure 3. Image analysis**



## AIM 2

To study the impact of *Schistosoma mansoni* infection on the **metabolic disorders** DM1, DM2, and obesity.

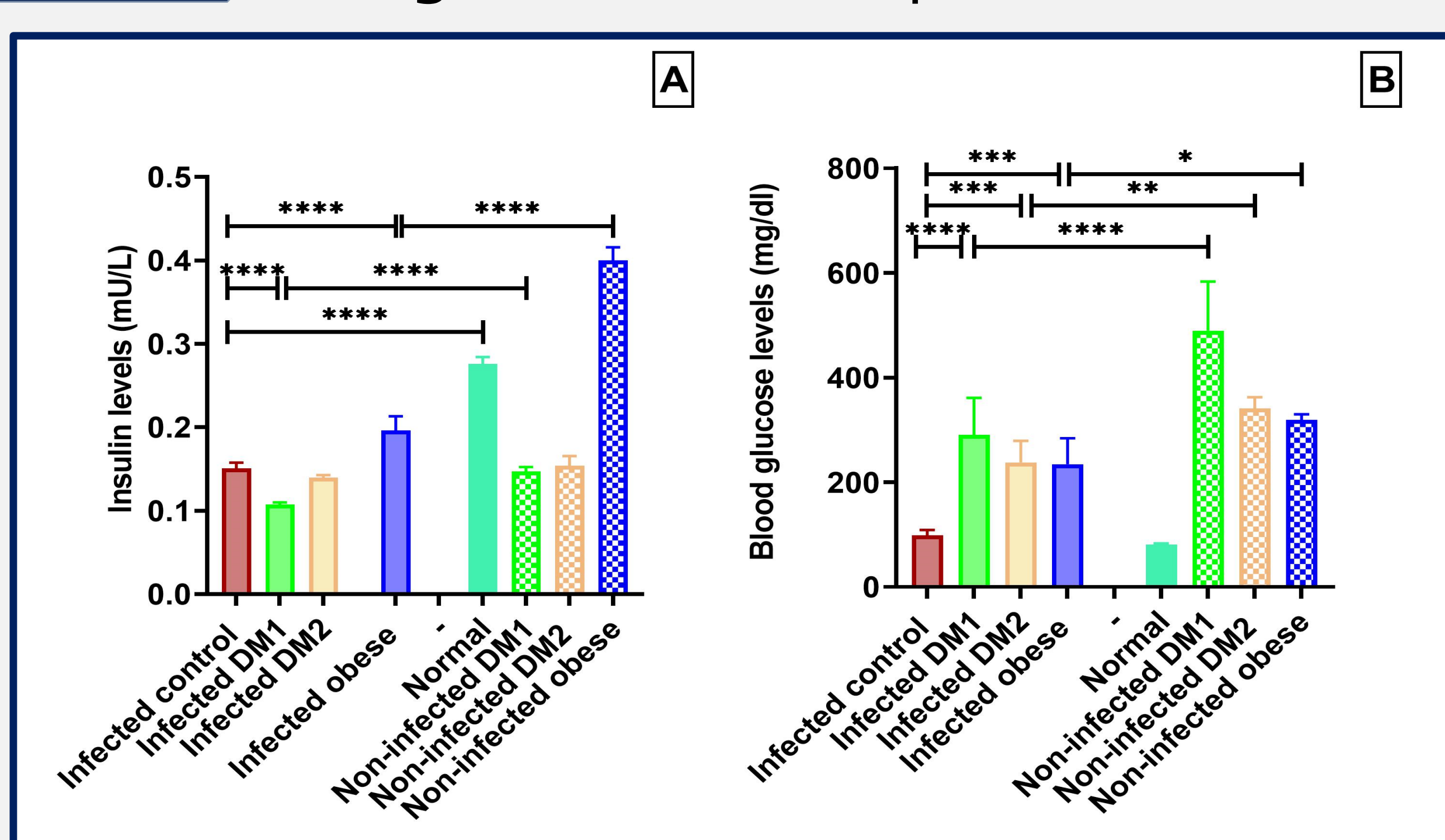
## METHOD

**Blood glucose, Insulin levels** and **lipid profile** were measured from plasma of all mice groups.

## RESULTS

- Infected diabetic and obese mice had significantly **higher blood glucose levels** and **lipid profile** than infected control mice.
- **Insulin levels** had significant decreases in the infected DM1 group and significant increases in the infected obese group compared to the infected control group.
- **Schistosome infection** improved the lipid profile, glucose, and insulin levels in the infected diabetic, and obese groups compared to non-infected controls.

**Figure 4. Metabolic parameters**



## CONCLUSION

Our study has contributed to the unravelling of the between schistosome infection and **mechanisms of the interaction** metabolic disorders of the host. DM1, DM2, as well as obesity-infected mice were examined for parasitological, immunological, biochemical, and histopathological parameters of the host. These differences may **aid therapeutic and vaccine studies** to better controlling these diseases and **improving outcomes** in endemic regions. By better understanding the complexities of host parasite interactions efforts to reduce the burden of these debilitating diseases can be improved.