Yellow mealworm larvae (*Tenebrio molitor*) are gaining popularity as a sustainable and nutritious alternative source of protein for both humans and animals. As the global population grows and environmental concerns intensify, edible insects like *T. molitor* offer a promising solution: they provide high-quality protein, essential nutrients, and can be farmed with a much lower environmental footprint than traditional livestock. In fact, about 2 billion people worldwide already consume insects, and the mealworm has been recognized as a "novel food" in the European Union, reflecting its growing importance in modern diets.

However, as the use of insects in food and feed increases, new questions about their safety are emerging. One major concern is the potential contamination of insect farms with antibiotics, especially doxycycline (a common veterinary drug used to treat bacterial infections in livestock). Doxycycline can enter insect-rearing systems through contaminated feed or cross-contamination, raising the risk that insects may absorb the drug, which could then end up in the food chain. This is particularly worrisome because the presence of antibiotics in food can contribute to the spread of antimicrobial resistance, a major public health threat.

Despite these concerns, there is little scientific data on how doxycycline affects *T. molitor*: How much of the drug do they absorb? Does it affect their health or nutritional value? Can *T. molitor* exposed to doxycycline become reservoirs for antibiotic resistance genes, potentially spreading them through the food chain? This project aims to answer these questions through a comprehensive investigation of doxycycline's effects on *T. molitor* larvae.

The aim of the project is to demonstrate how different doses and durations of doxycycline exposure influence the drug's absorption and elimination in *T. molitor*, as well as the levels of residues left in their bodies. The analysis will also examine the effect of doxycycline on the protein content in hemolymph, the overall nutritional value of larvae, microflora composition, and the presence of antibiotic resistance genes. Additionally, the project will investigate whether doxycycline exposure affects larval growth, weight gain, or mortality.

Preliminary results indicate that *T. molitor* larvae absorb part of the doxycycline from the feed; however, most of the drug is excreted, and only about 30% remains in the tissues. Interestingly, doxycycline exposure leads to a temporary decrease in the protein content of the larvae's haemolymph (the insect equivalent of blood), suggesting that the antibiotic may disrupt nutrient assimilation and insect homeostasis. However, this did not appear to affect the growth or survival of the larvae at the doses tested. The gut flora, which plays a key role in digestion and nutrient absorption, can also be disrupted by doxycycline, potentially leading to temporary deficiencies in protein or other nutrients.

Of particular concern is the finding that *T. molitor* larvae can harbor antibiotic resistance genes, such as those conferring resistance to tetracyclines (the drug family that includes doxycycline). These genes can persist in insect populations even in the absence of ongoing antibiotic use, likely due to past exposures or environmental contamination. *T. molitor* therefore act as reservoirs or vectors for the spread of resistance genes, emphasizing the need for careful antibiotic management in insect farming.

By providing the first comprehensive dataset on doxycycline's effects in *T. molitor*, this project will help fill critical knowledge gaps about the safety and quality of insect-derived protein. The results will be helpful in developing guidelines for the safe production and processing of edible insects, support food safety regulations, and contribute to the fight against the growing antimicrobial resistance. Ultimately, ensuring the responsible use of antibiotics in insect farming is crucial for maintaining the promise of edible insects as a safe, sustainable protein source for the future.