Exploration of the Anti-Cancer Potential of Actinomycetes Strains on Triple-Negative Breast Cancer

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Abstract:

Breast cancer remains the leading cause of cancer-related mortality among women worldwide. Among its subtypes, triple-negative breast cancer (TNBC) represents the most aggressive and therapeutically challenging form, characterized by the absence of estrogen, progesterone, and HER2 receptors. This lack of molecular targets, coupled with its high metastatic potential and propensity for early relapse, leaves chemotherapy as the mainstay treatment. However, drug resistance and severe adverse effects highlight the urgent need for safer and more effective therapeutic alternatives.

Recent research has shed light on the role of the gut–breast axis, demonstrating that the gut microbiota and its metabolites can influence breast cancer initiation, progression, and therapeutic response. In parallel, environmental and host-associated microbial communities, particularly Actinobacteria, have emerged as prolific producers of bioactive secondary metabolites with potent antimicrobial and antitumor activities. Leveraging the metabolic richness of these microorganisms offers an innovative avenue for discovering new compounds to target hard-to-treat cancers such as TNBC.

This dissertation investigates the anticancer potential of three Actinobacteria strains isolated from the unique ecosystem of the Tunisian desert, with a focus on their effects against the TNBC cell line MDA-MB-231. The study assessed their cytotoxicity, anti-proliferative activity, inhibition of cancer cell migration, and the mechanisms of cell death induced by their crude extracts.

Notably, extracts from strains E.G23 and E.G1 demonstrated significant anticancer effects, reducing proliferation and migration while inducing cell death in TNBC cells. These findings not only reinforce the therapeutic promise of microbial metabolites but also open new perspectives for integrating microbiota-derived compounds into innovative strategies for the treatment of aggressive breast cancers.

Keywords: Triple-negative breast cancer, MDA-MB-231, Actinobacteria, Chemotherapy, Anticancer potential, microbiota, gut–breast axis