

Next-Generation Probiotics

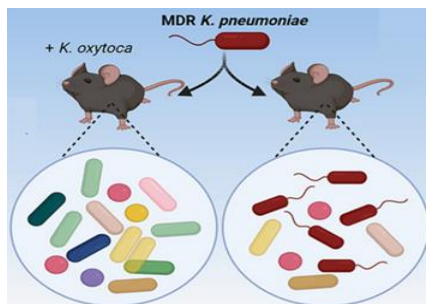
Keywords: intestinal microbiota, enteric infections, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, multidrug-resistant bacteria

INVENTION NOVELTY

The novel probiotic consists of special strains of *Klebsiella oxytoca* combined with at least three additional commensal bacteria. This probiotic composition can induce decolonization of multidrug-resistant (MDR) *K. pneumoniae* strains in the gut. In addition, the probiotic composition can help to establish colonization resistance by protecting the host from pathogen invasion thanks to the interaction between microbiota and pathogen. Both, decolonization and colonization resistance depend on the ability of *K. oxytoca* strains to use specific carbon sources and to cooperate with commensal bacteria to further occupy alternative niches of *K. pneumoniae*.

VALUE PROPOSITION

Gut colonization with multidrug-resistant bacteria enhances the risk of bloodstream infections in susceptible individuals. Therefore, alternative methods are needed to eliminate these pathogens. The *K. oxytoca* probiotic composition can be used in a therapeutic approach to induce gut decolonization of MDR *K. pneumoniae*. Additionally, the probiotic composition can be applied in a preventive approach e.g., after antibiotic treatment to pave the way for establishing a healthy microbiome and colonization resistance. Future rationale design of probiotics will lead to compositions to prevent or treat colonization with a broad range of MDR *Enterobacteriaceae*.



Klebsiella oxytoca causes colonization resistance against multidrug-resistant *K. pneumoniae*. Source: L Osbelt et al., *Cell Host & Microbe*, 2021, <https://doi.org/10.1016/j.chom.2021.09.003>

TECHNOLOGY DESCRIPTION

Diverse commensal *K. oxytoca* strains were isolated from protected individuals. These *K. oxytoca* strains convey protective as well as curative effects. These effects are based on *K. oxytoca* ability to metabolize specific carbohydrates, namely aromatic beta-glucosides, significantly better compared to MDR *K. pneumoniae*. Moreover, cooperation of *K. oxytoca* with additional commensals is required to complete the promising novel probiotic composition.

COMMERCIAL OPPORTUNITY

The technology is available for licensing and co-development.

DEVELOPMENT STATUS

Preventive and therapeutic effects of *K. oxytoca* as a probiotic were shown in *in vivo* studies in mice. *K. oxytoca* strains were detected in protected human donors.

PATENT SITUATION

A Patent Family was filed with priority in December 2020: EP4011384A1, WO2022122825A1, EP4259171A1 & US20240041950A1.

FURTHER READING

Lisa Osbelt et al., *Klebsiella oxytoca* inhibits *Salmonella* infection through multiple microbiota-context-dependent mechanisms. *Nature microbiology*, 9(7), 1792–1811, 2024, <https://doi.org/10.1038/s41564-024-01710-0>.