The effect of *Staphylococcus capitis* growth rate on the effectiveness of bacteriophage K

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INTRODUCTION

Phage parameters are key for optimizing bacteriophage production and evaluating phage therapy. The **adsorption constant (k_a) mL/(CFU·h)]** quantifies phage attachment to bacteria, based on the decline in phage concentration over time. **The latent period (LP) [h]** is the time from infection to lysis, while the **burst size (BS)** measures viruses released per cell. These values depend on the host's physiological state, regulated by adjusting the dilution rate in a chemostat. Bacteriophage replication, relies on this state, utilizing the host's metabolism and components [1, 2]. To prevent bacterial washout, the dilution rate D [h^{-1}] must not exceed the maximum growth rate μmax [h^{-1}] [3].

METHOD

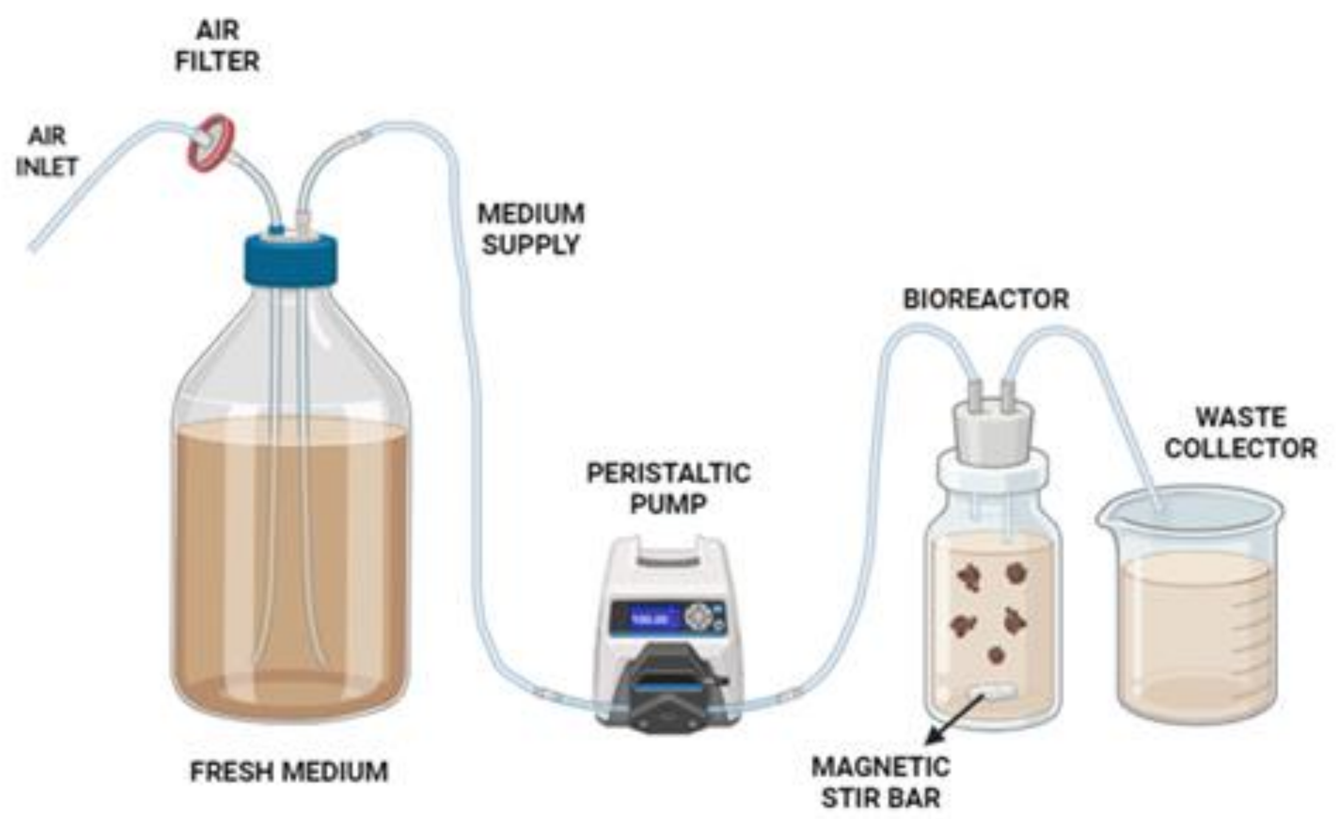

Figure 1: A schematic representation of a chemostat,which enables stationary growth of microorganisms by regulating the inflow of medium.

RESULTS AND DISCUSION

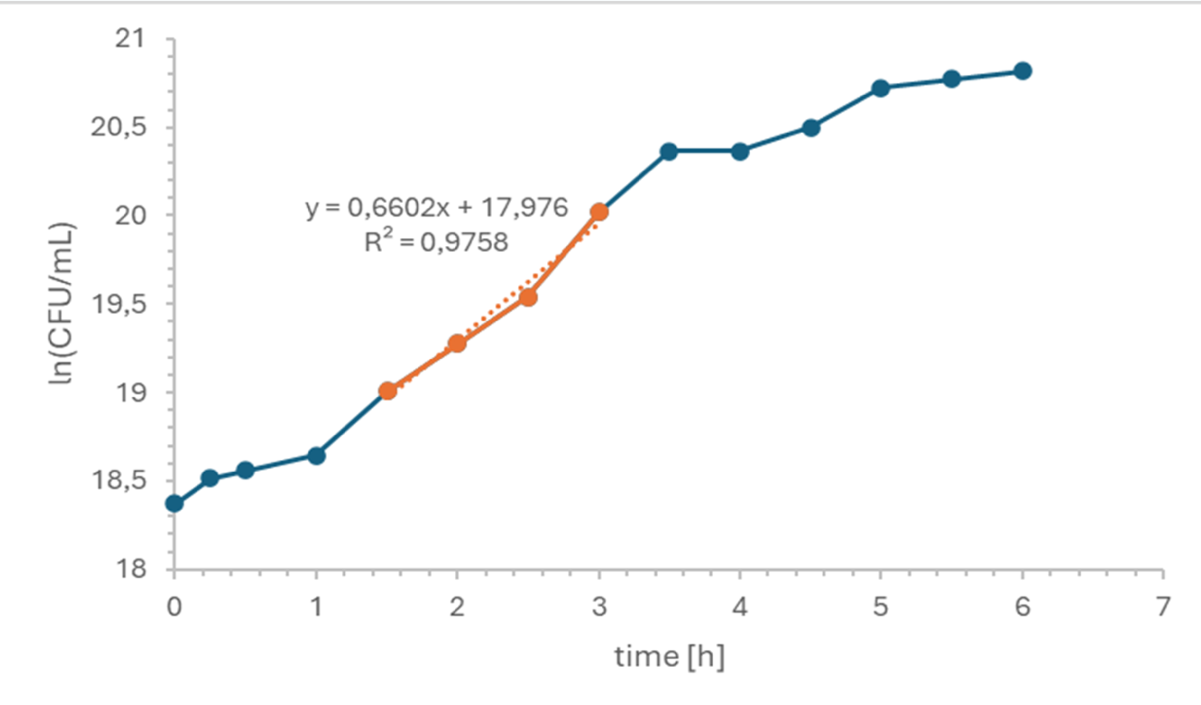

Figure 2: S. capitis growth curve with determination of μ_{max}

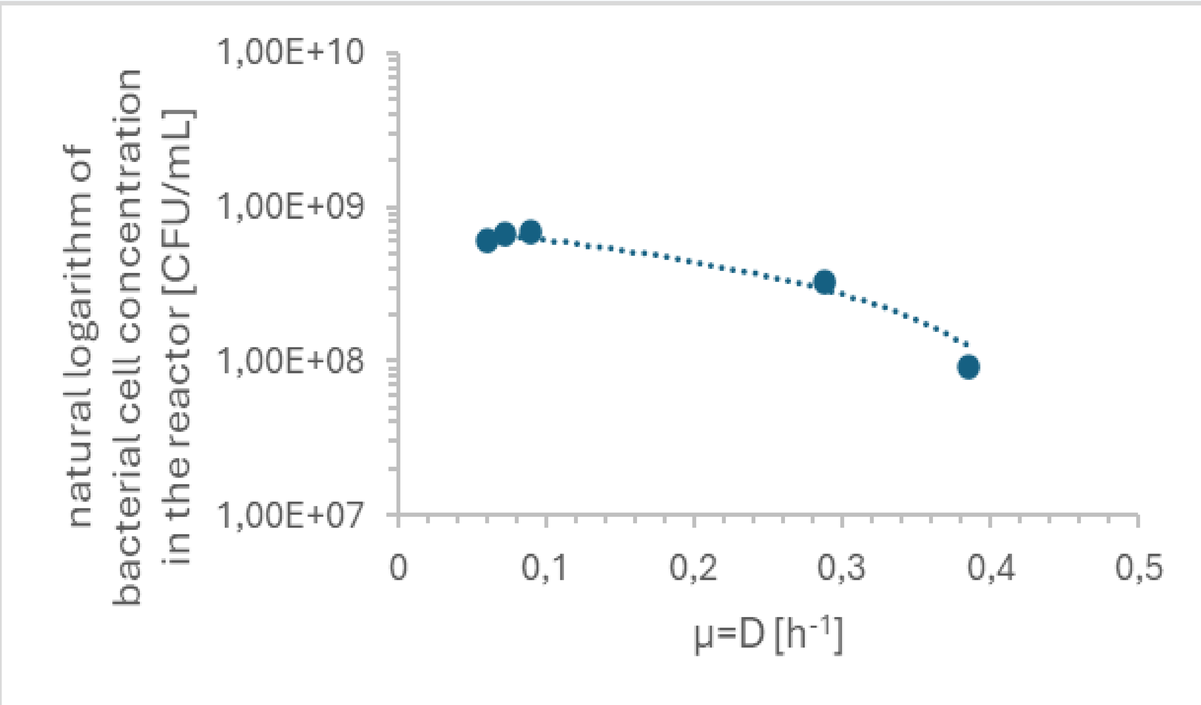

Figure 3: Physiological state of the bacterial culture at different dilution rates

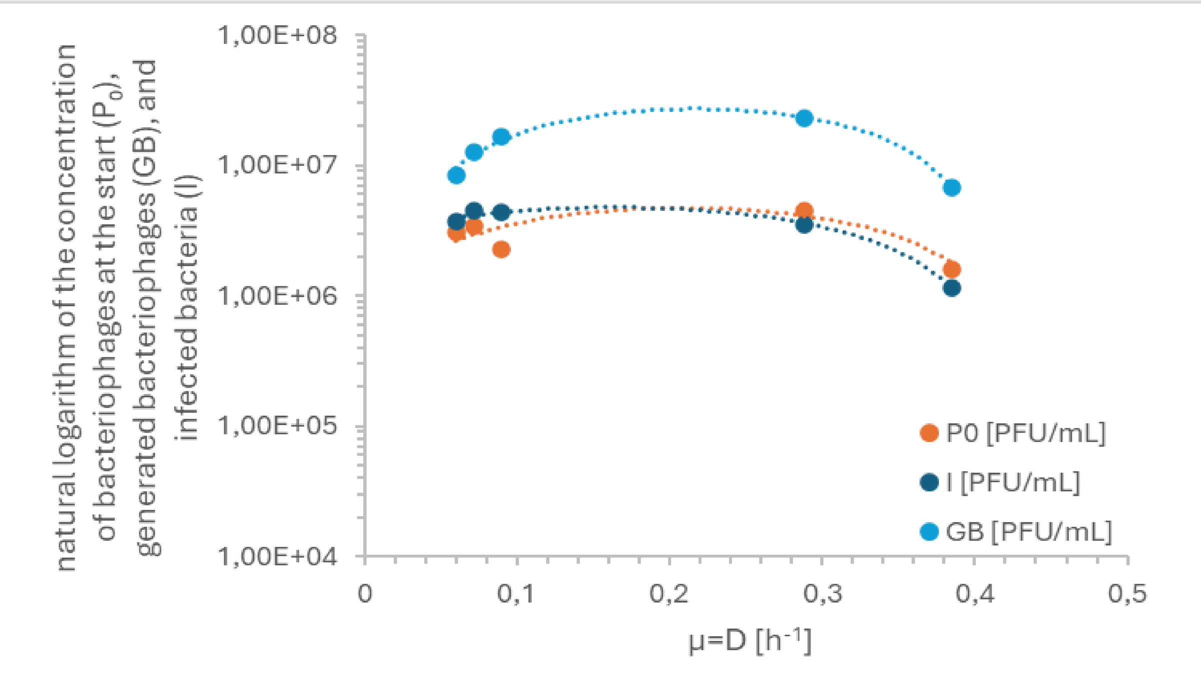

Figure 4: Equilibrium concentration of initial phage concentration, generated bacteriophages and infected bacteria

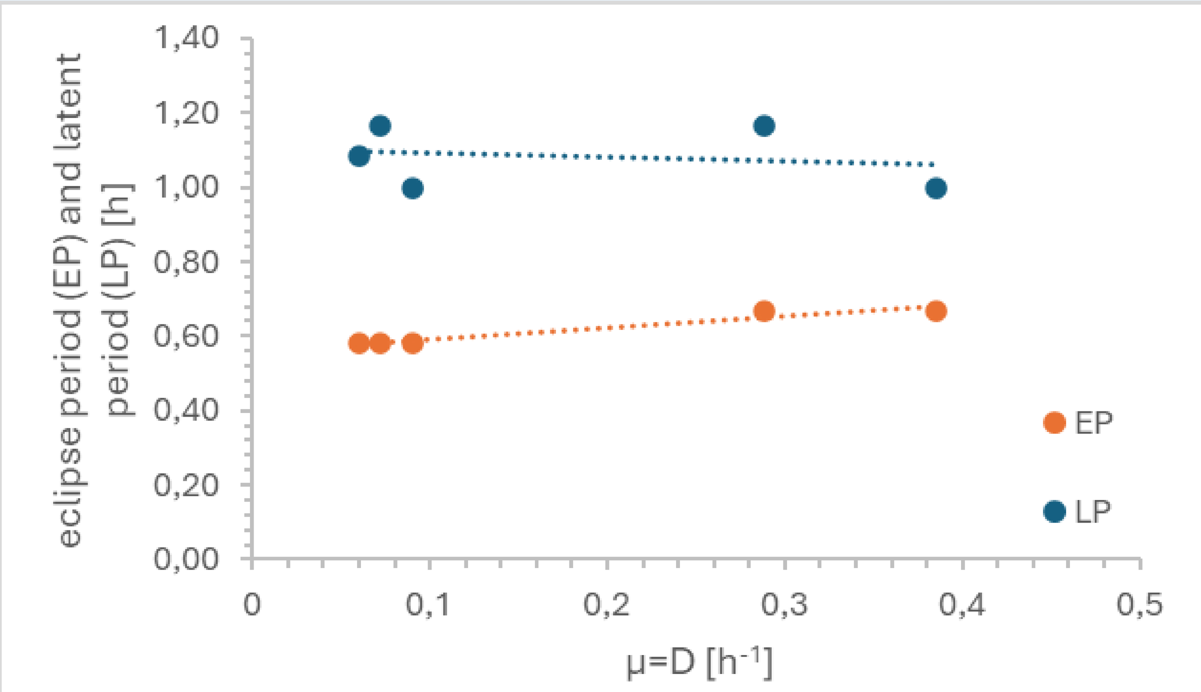

Figure 5: Eclipse and latent period during phage production

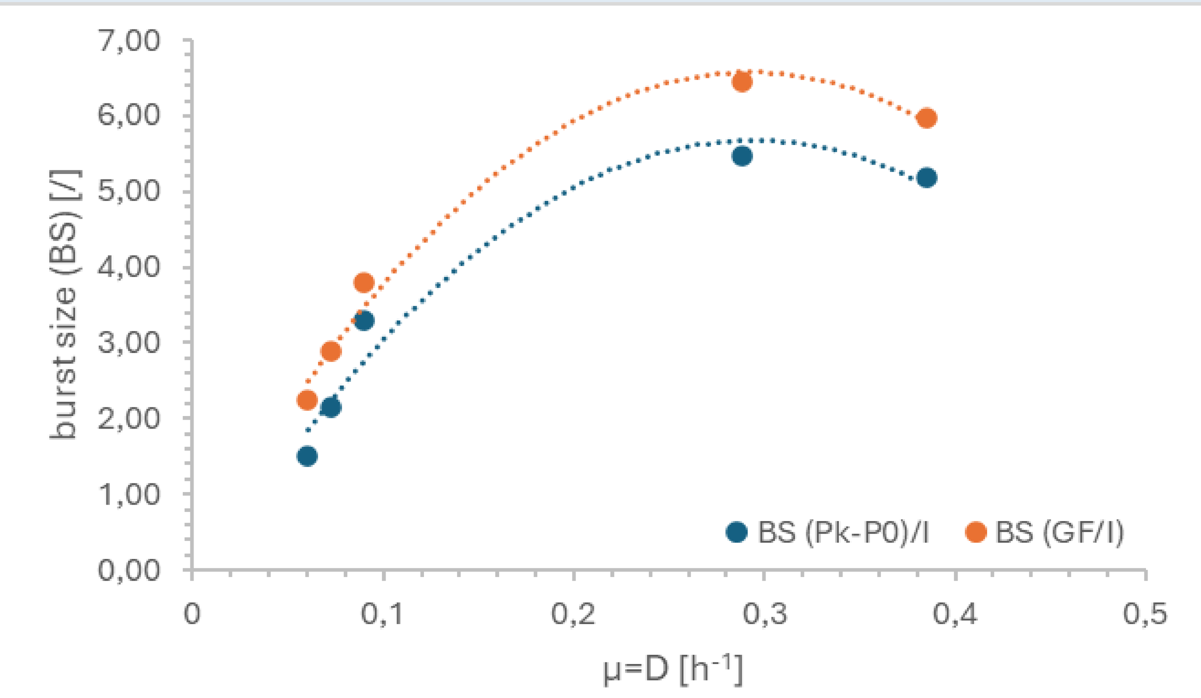

Figure 6: Burst size (calculated in two ways) at different dilution rates

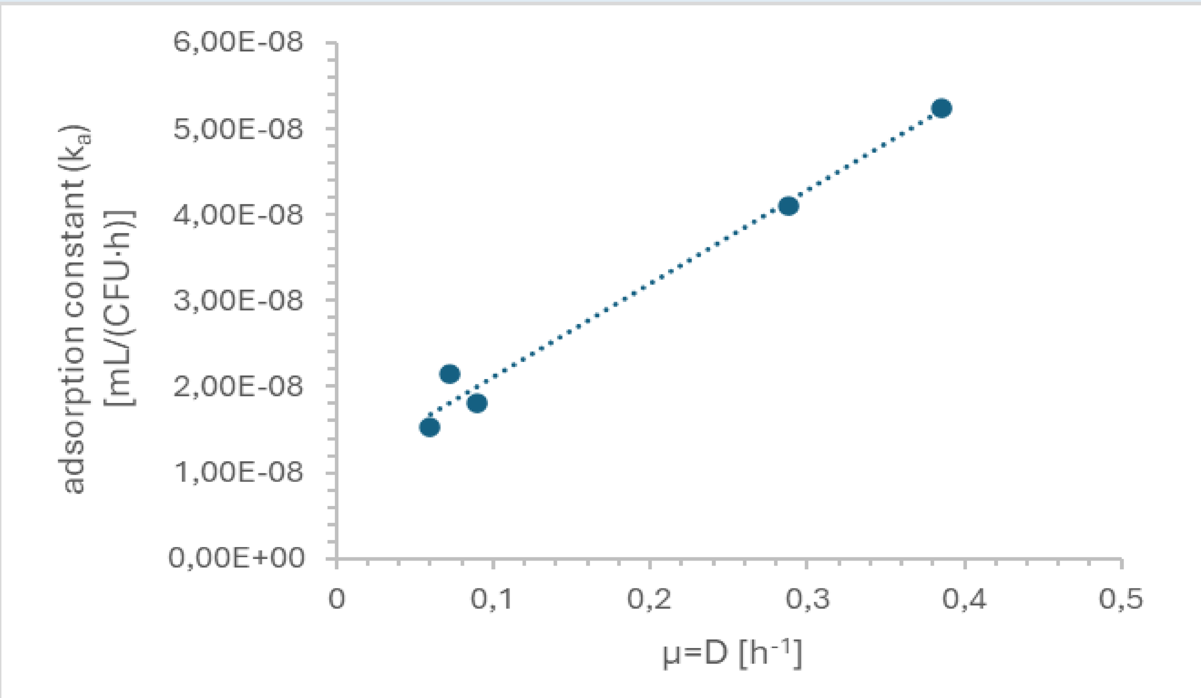

Figure 7: Adsorption constant of bacteriophage K at different growth rates of *S. capitis*

During the exponential growth phase, *S. capitis* exhibits a maximum specific growth rate of 0,6602 h^{-1} (Figure 2). At lower dilution rates, bacterial concentration remains stable (Figure 3), but as the dilution rate nears the maximum growth rate, it decreases, approaching washout conditions. Even in suboptimal states, *S. capitis* remains susceptible to phage infection, with phage concentration increasing up to a dilution rate of 0,288 h^{-1} (Figure 4). In the absence of infection, the initial phage concentration (P_0) would be equal to the generated phage concentration (GB). Both bacterial and phage dynamics remain relatively stable (Figure 5), despite changes in the physiological state. Improved bacterial conditions enhance phage production (BS) (Figure 6) and increase the adsorption constant at higher dilution rates (Figure 7).

CONCLUSION

Improved bacterial physiological states enhance phage production and adsorption rates, highlighting the critical role of growth conditions in optimizing phage therapy. Future experiments with intermediate dilution rates between 0,09 and 0,288 h^{-1} will be necessary to gather a more comprehensive dataset for better analysis.

REFERENCES

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