# The Effects of Glucose Supplementation on Development of *Acinetobacter baumannii* Biofilms

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## Introduction

- *Acinetobacter baumannii* is an opportunistic pathogen causing nosocomial infections with high mortality rates due to multidrug resistance[1].
- *A. baumannii* biofilm infections associated with medical equipment, pose significant challenges in treatment[2].
- Biofilm growth in glucose-rich media triggers extracellular polymeric substances (EPS) production, crucial for biofilm adhesion[3].
- The aim of this study was to investigate the effects of glucose supplementation on clinical and wild type isolates of *A. baumannii.*

## Methods

- Five *Acinetobacter baumannii* isolates were used in this study - NCTC 12156 (wild type), ATCC BAA-1710 (human isolate), SM37212 (clinical isolate), SM55869 (clinical isolate), SM52892 (clinical isolate).
- Susceptibility of isolates to antibiotics was assessed using the disc diffusion assay based on European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines[4].
- Glucose supplementation assays were conducted using a microtitre plate method and absorbance readings were taken hourly for 24 and 48 hours to construct growth curves[5].

## Results

- Antibiotic sensitivity screening showed that SM37212 and SM52892 are multidrug resistant (MDR) isolates (Table 1).

Table 1: Zones of inhibition (mm) of various *A. baumannii* isolates following exposure to gentamicin (Gen), imipenem (IPM), meropenem (MER) and ciprofloxacin (CIP).

| Isolates | GEN | S ≥ 17 R ≤ 17 | IPM | S ≥ 24 R ≤ 21 | MER | S ≥ 21 R ≤ 21 | CIP | S ≥ 50 R ≤ 21 |
|---|---|---|---|---|---|---|---|---|
| **NCTC 12156** | 7.11 | R | 31.78 | S | 27.78 | S | 25.11 | R |
| **BAA-1710** | 0.00 | R | 25.00 | S | 23.00 | S | 0.00 | R |
| **SM37212** | 0.00 | R | 24.89 | S | 19.67 | R | 0.00 | R |
| **SM55869** | 21.22 | S | 33.78 | S | 32.89 | S | 29.56 | R |
| **SM52892** | 0.00 | R | 14.67 | R | 12.11 | R | 0.00 | R |

## Results

- All isolates demonstrated the ability to form biofilms in both nutrient broth with and without glucose. *A. baumannii* SM52892 exhibited statistically significant greater biofilm density in response to glucose supplementation (Figure 1).

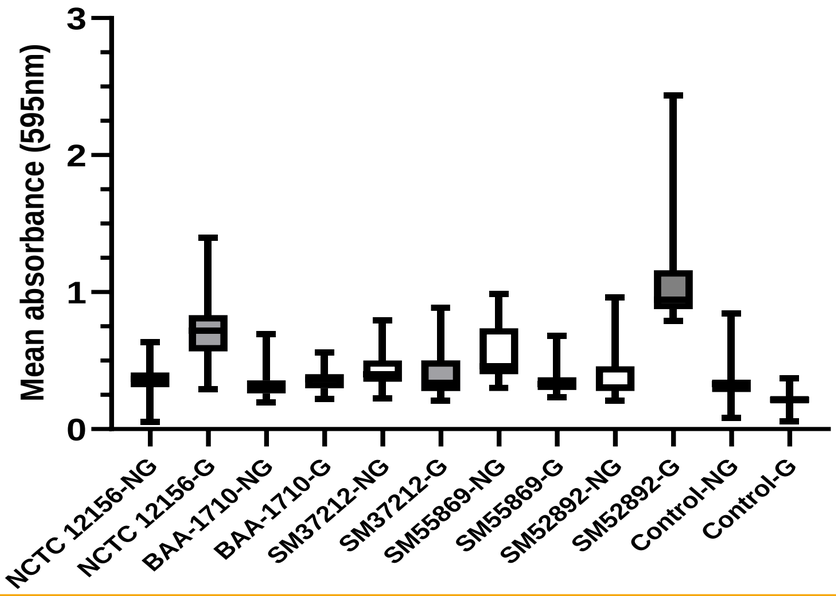


Figure 1: Comparison of biofilm formation (±SE) of various *A. baumannii* isolates grown in tryptic soy broth supplemented with (G) and without 1% glucose (NG) after 48 hours in microtitre wells. Control wells contained broth only. The experiment was performed on three separate occassions with multiple replicates.

- Further testing was conducted to investigate if addition of different concentrations of glucose influences the growth of *A. baumannii* SM52892
- The growth curve illustrated a notable increase in the growth of *A. baumannii* SM52892 when cultured in nutrient media containing 0.13%-1% glucose, compared to media without glucose (Figure 2).

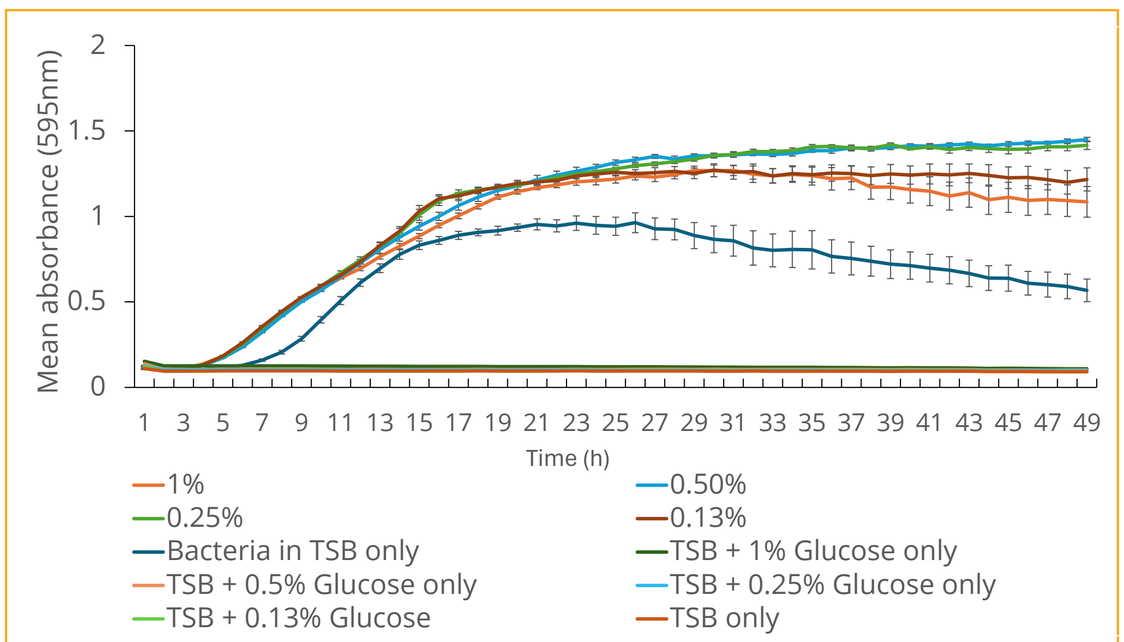


Figure 2: Growth curve of *A. baumannii* SM52892 in tryptic soy broth (TSB) supplemented with 1%, 0.5%, 0.25% and 0.13% of glucose after 48 hours. Control wells contained broth only. ±SE indicates standard error. The experiment was performed on three separate occassions with multiple replicates.

## Significance of the study and Future work

- Glucose is an important factor in understanding biofilm formation in *A. baumannii* in different environments and in body sites during host colonisation[3]. Studies have reported that elevated glucose levels enhance the expression of lipopolysaccharide production genes in *A. baumannii,* potentially exacerbating biofilm formation on medical devices such as IV-line catheters[6].
- Future studies will explore the impact of glucose supplementation on attachment to various medical surfaces.

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