

Introduction

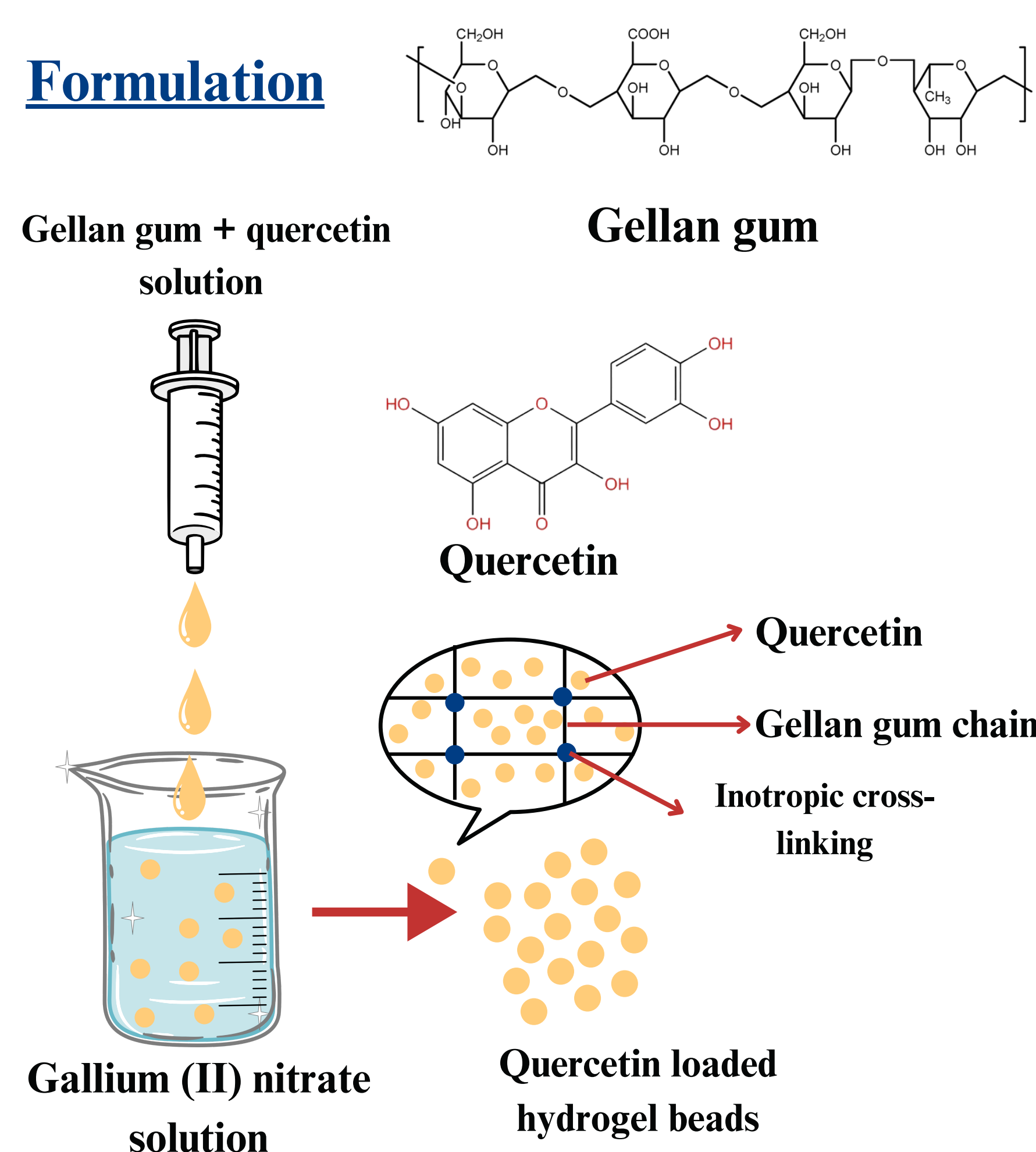
The current challenges faced in wound treatment include delayed healing process, limited capability to absorb wound exudate, and the inability to maintain a moist wound environment (1). Hence, it is essential to develop the advanced bioactive wound dressings. Hydrogel is defined as a three-dimensional (3D) network structure that is constructed by hydrophilic polymer chains (2). Examples of the application include scaffolds for wound dressings, drug delivery system and tissue engineering (2). Hydrogels are commonly applied in wound dressing owing to the unique characteristics, such as providing moist environment, debriding agent, biocompatibility, non-immunogenic and biodegradable. Gellan gum (GG) can serve as the candidate to produce hydrogel due to its biodegradable and biocompatible capability. Gellan gum also exhibited minimal toxicity and exceptional gelling property; however, the pure GG possess poor antibacterial and antioxidant property as well as insufficient mechanical strength (3). These shortcomings can be overcome by the addition of the phytochemical. Quercetin, which is a bioactive plant flavonoid groups of polyphenols. It has exhibited a diverse array of features including antimicrobial and antioxidant which can enhance the wound healing process (4).

Objectives

- To prepare gellan gum hydrogels containing quercetin via ionic gelation and lyophilisation
- To examine the physicochemical properties, antioxidant, antibacterial activity and biocompatibility of gellan gum hydrogels containing quercetin.

Methodology

Formulation



Characterisation

- Gel fraction determination
- Swelling analysis
- Degradation analysis
- Antioxidant activity
- Antibacterial activity
- Cytocompatibility test

Results

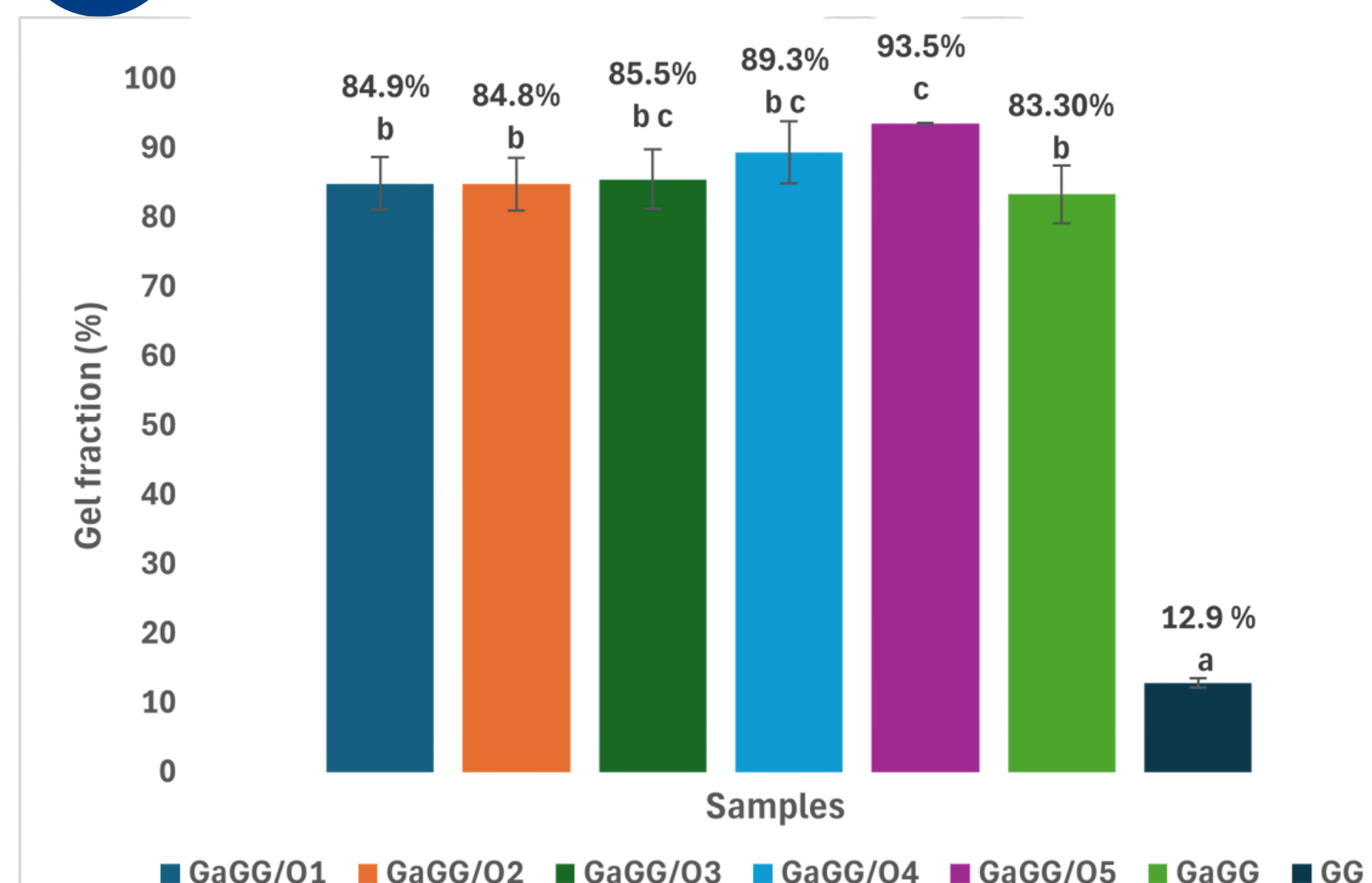


Figure 1: Average of gel fraction determination of different samples. Data were presented as mean $\pm$ standard deviation of triplicates, where $p < 0.05$ in comparison to GG only.

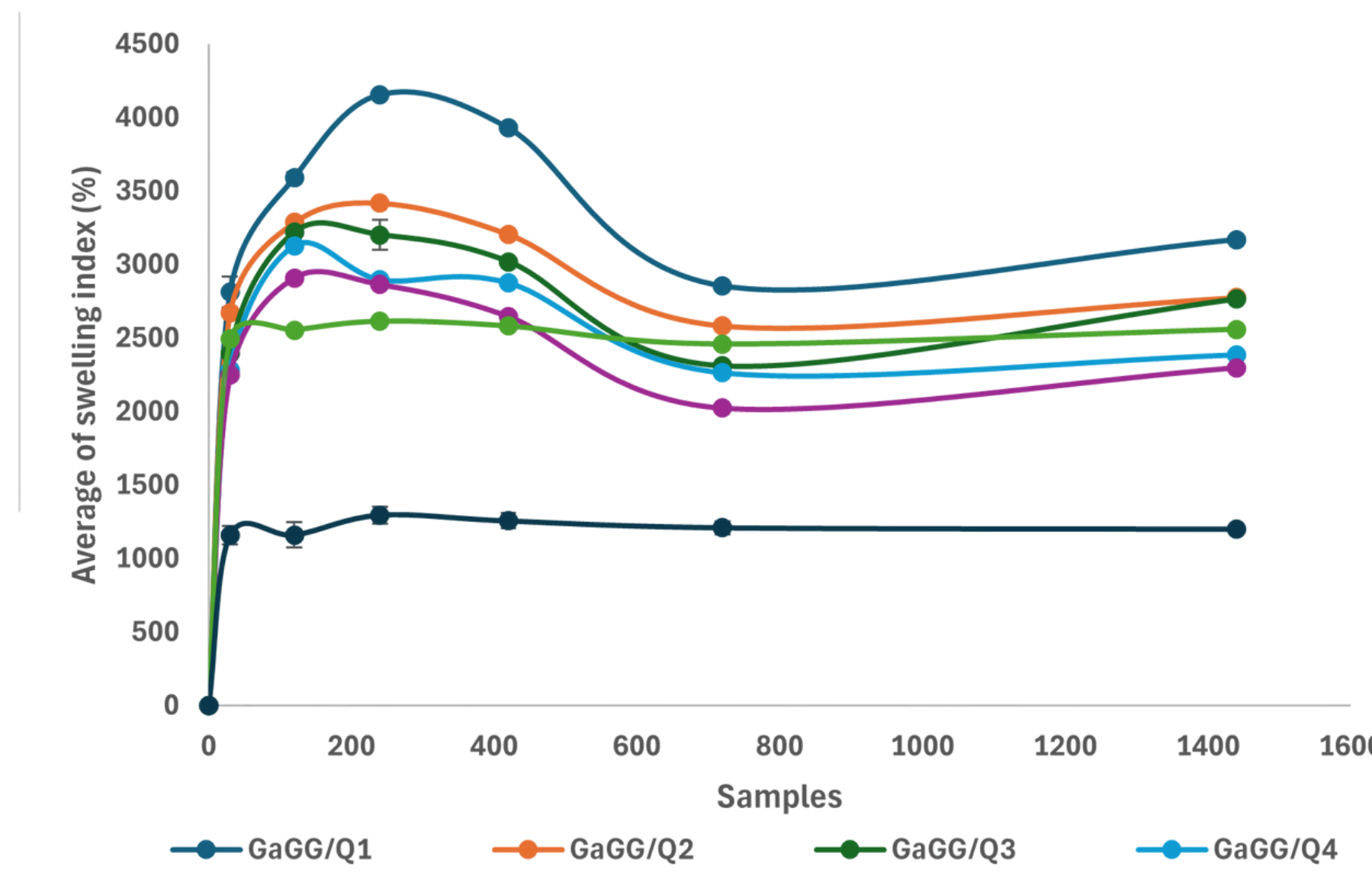


Figure 2: Graph of the average swelling index of different samples in phosphate buffer solution (pH 7.4) in different time intervals. Data were presented as mean $\pm$ standard deviation of triplicates, with $p < 0.001$ in comparison to GG/GN for the first 30 minutes and at 1440 minutes.

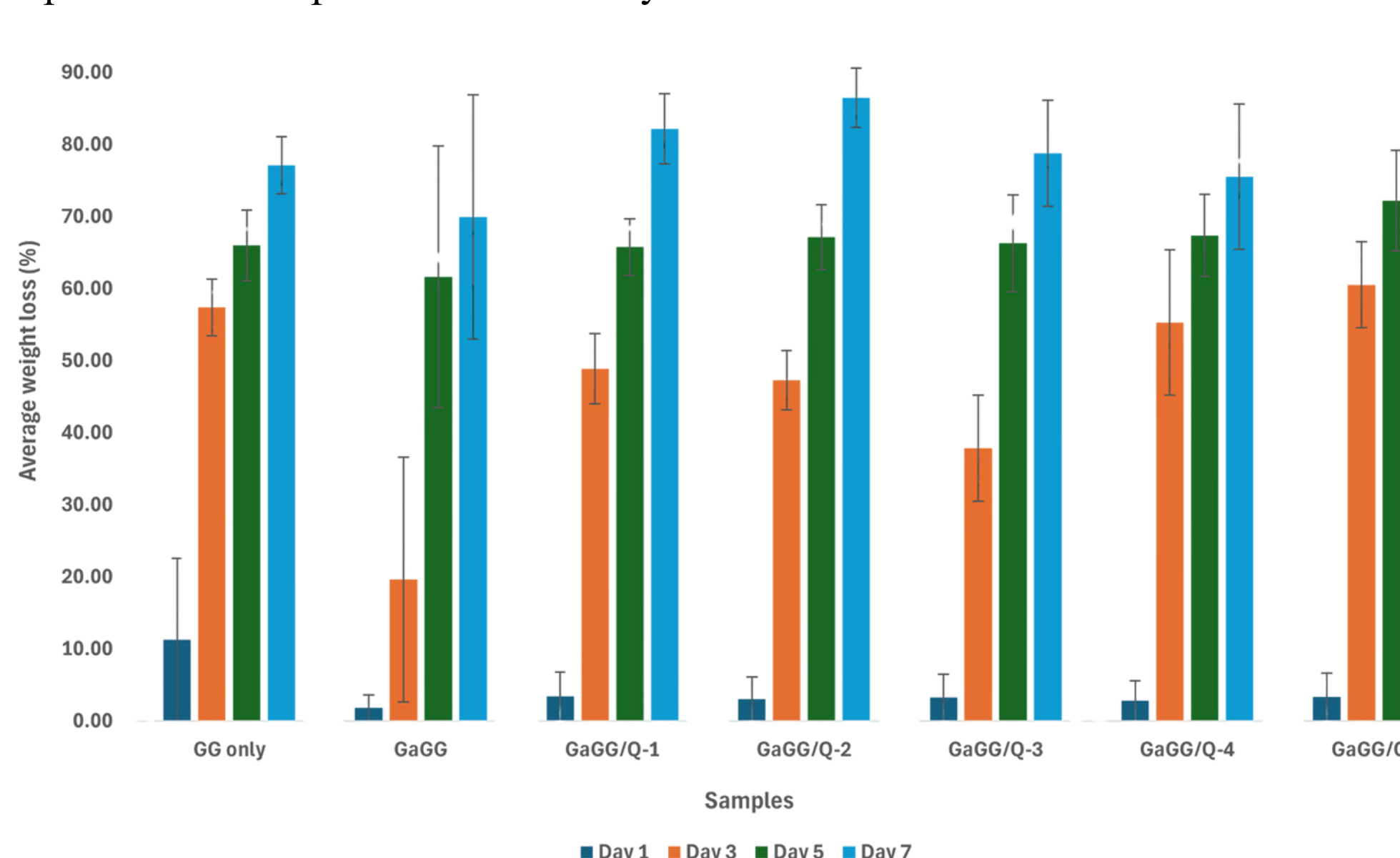


Figure 3: Average weight loss (%) of different samples over different time intervals. Data were presented as mean $\pm$ standard deviation of triplicates with $p < 0.05$ in comparison between GG only and others at day 1. At day 3, GG only is statistically significant to GaGG with $p < 0.05$ while GaGG is $p < 0.05$ to GG only, GaGG, GaGG/Q-4 and GaGG/Q-5.

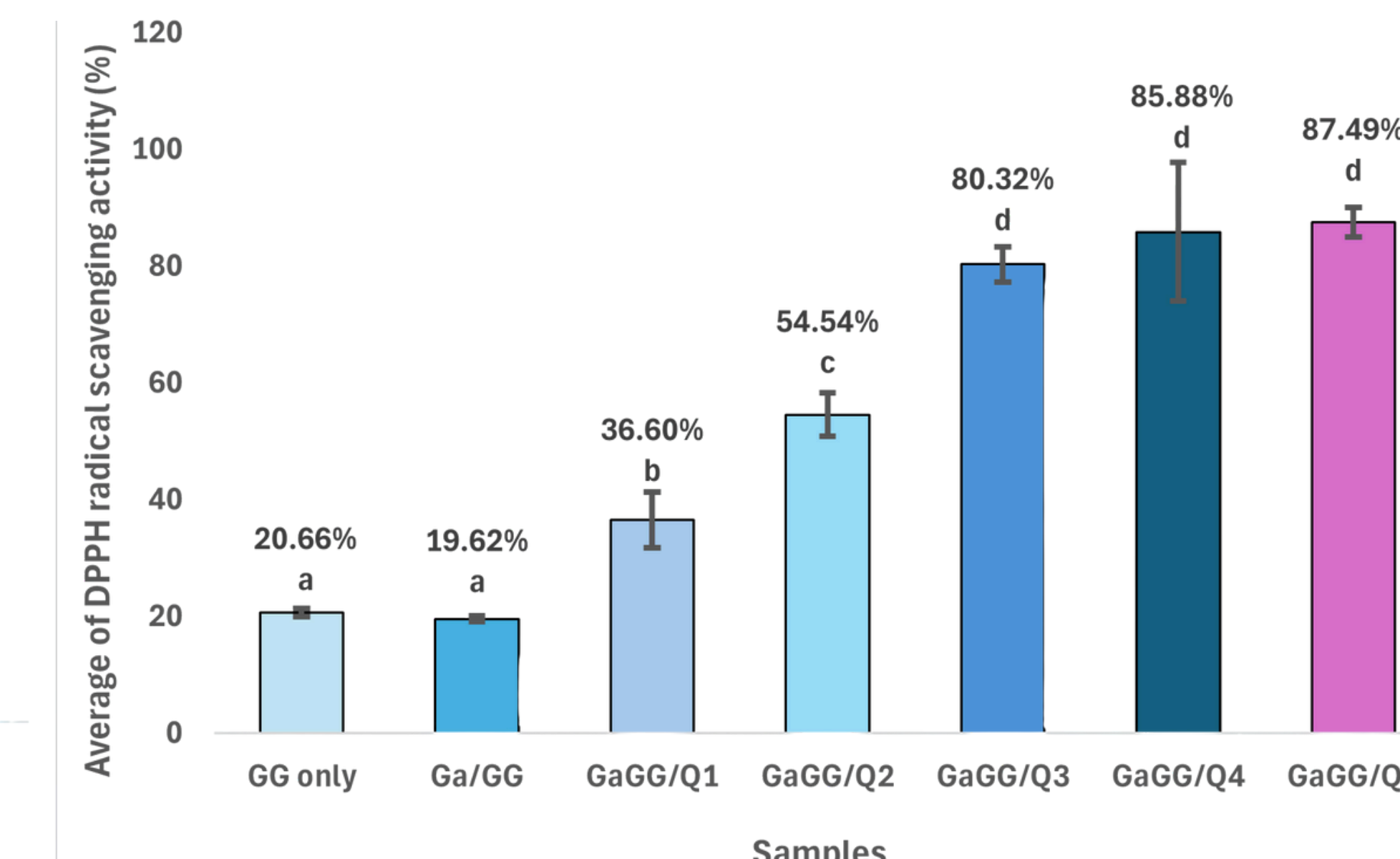


Figure 4: Average of DPPH radical scavenging activity (%) of different samples. Data were presented as mean $\pm$ standard deviation of triplicates, where $p \leq 0.05$ in comparison with GaGG, except GG only.

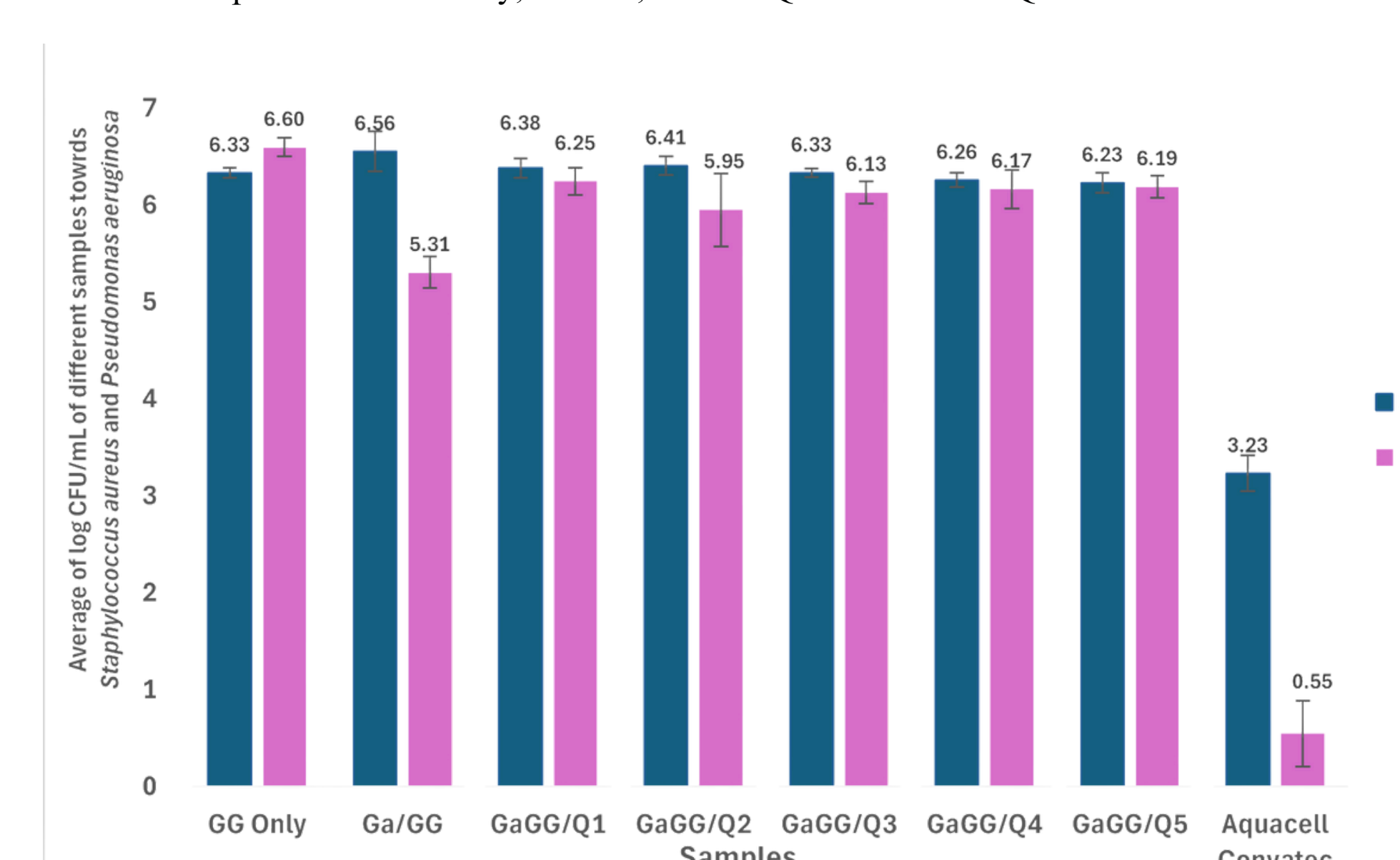


Figure 5: Average of log CFU/mL of different samples towards *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Data were presented as mean $\pm$ standard deviation of triplicates, where $p < 0.05$ in comparison with aquacell convatec for *S.aureus*, and $p < 0.05$ in comparison with GaGG and aquacell convatec for *P.aeruginosa*.

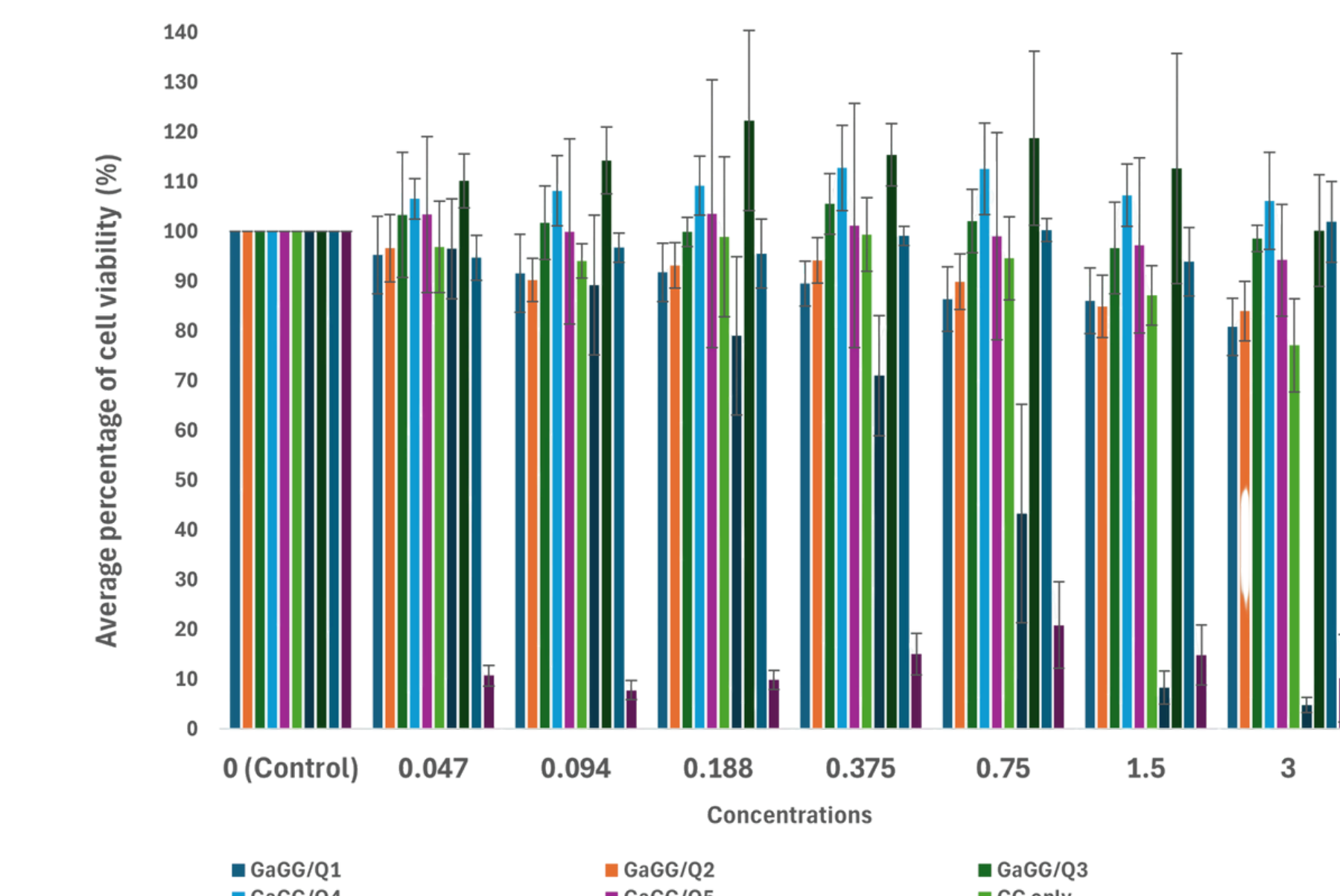
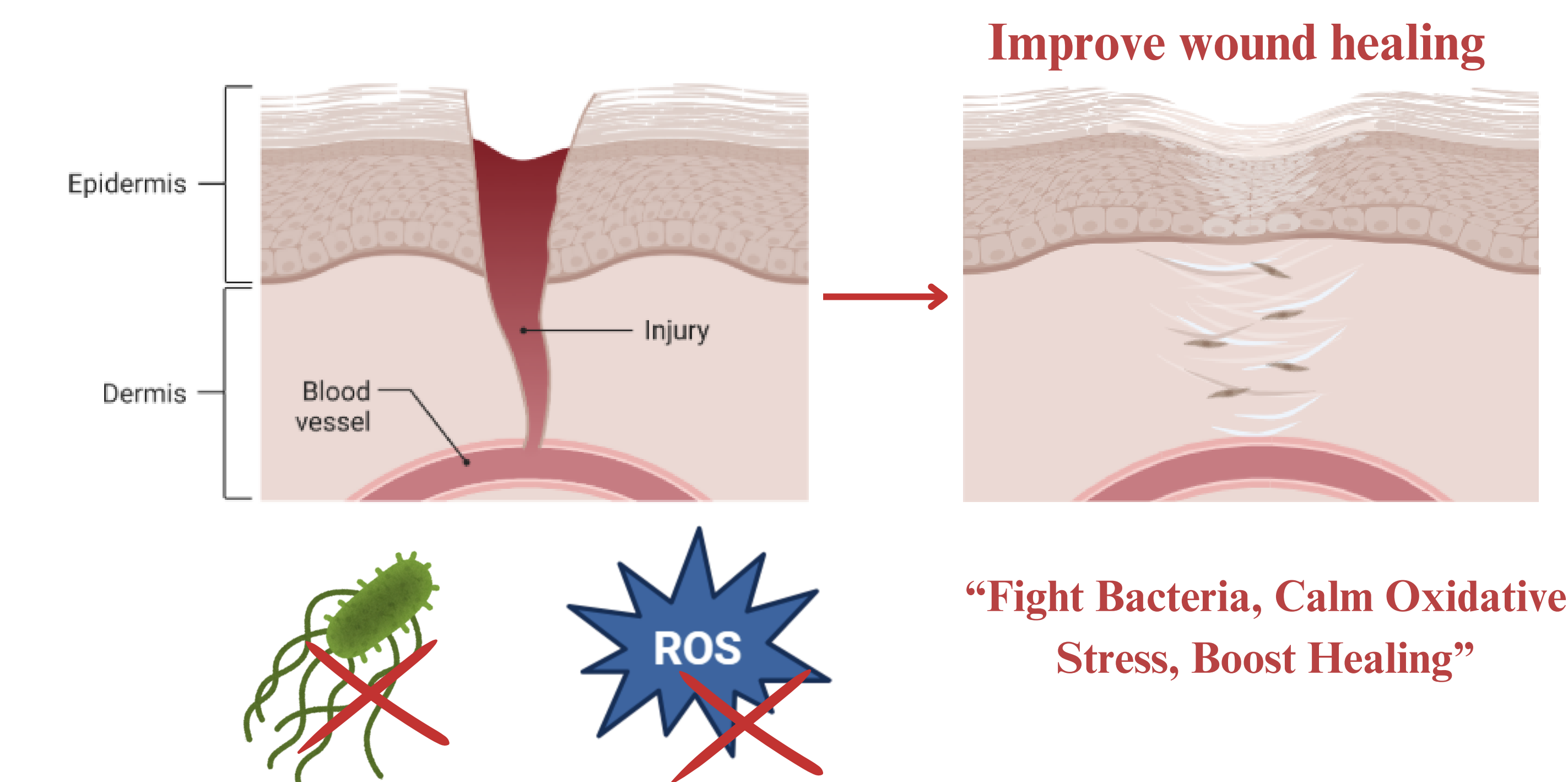


Figure 6: Average percentage of HaCaT cells viability for different samples. Data were presented as mean $\pm$ standard deviation of triplicates, where $p \leq 0.05$ in comparison with aquacell convatec at concentrations ranged from 0.75 mg/ml to 3mg/ml.

Discussion

- Addition of gallium (iii) nitrate able to $\uparrow$ the degree of cross linking. Hence, $\uparrow$ gel fraction, thereby $\downarrow$ swelling index.
- Quercetin loaded hydrogel able to degrade gradually over the time in the presence of lysozyme.
- Quercetin had proven to have antioxidant and effect is dose dependent.
- Quercetin is more susceptible towards gram positive bacteria and is not cytotoxic to HaCaT cells.

Impact



Conclusion

- Able to prepare hydrogel containing quercetin through ionic gelation and lyophilisation.
- The GaGG loaded quercetin hydrogel able to improve the physicochemical properties such as gel fraction (%), exhibited antioxidant activity, antibacterial activity and also is biocompatible to HaCaT cells
- Overall, quercetin loaded gellan gum scaffolds are able to demonstrate promising multifunctional characteristics that make them suitable for wound healing applications.

References

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