



INFOGRAPHIC

ĐÁNH GIÁ GIÁ TRỊ TỎI ĐEN VÀ KHẢO SÁT ẢNH HƯỞNG CỦA THỜI GIAN NGÂM ĐẾN HOẠT TÍNH SINH HỌC CỦA RƯỢU TỎI ĐEN VÀ RƯỢU TỎI TRẮNG

Tác giả:

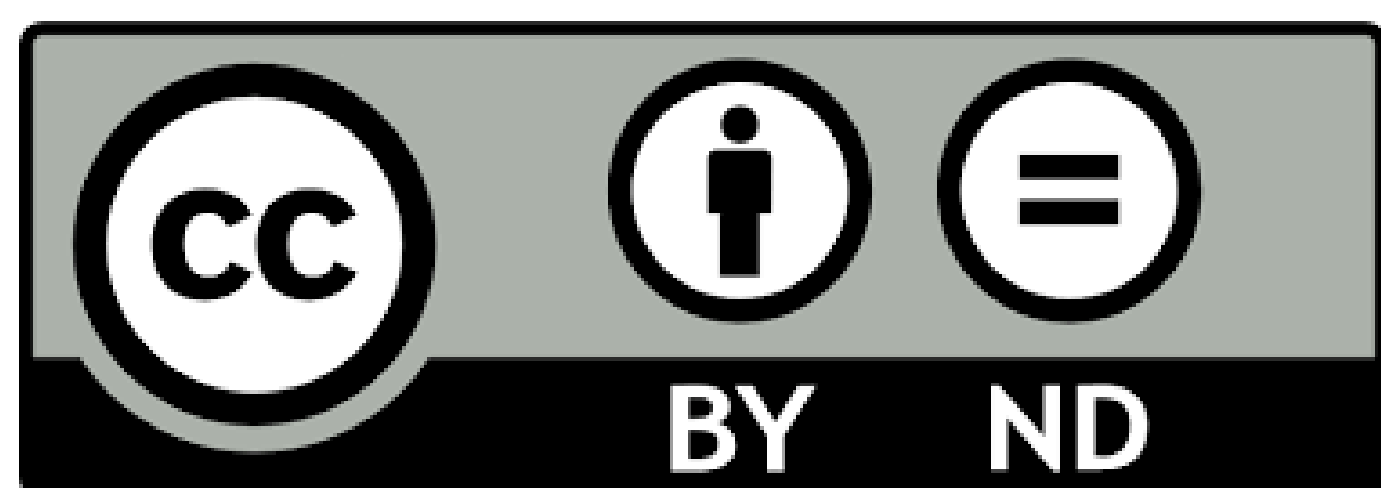
Đào Chí Nam

Đơn vị:

Khoa Khoa học Ứng dụng & Công nghệ

Năm xuất bản:

2026



Đánh giá giá trị tỏi đen và khảo sát ảnh hưởng của thời gian ngâm đến hoạt tính sinh học của rượu tỏi đen và rượu tỏi trắng © 2026 bởi **Đào Chí Nam** được cấp phép theo **CC BY-ND 4.0**.

Evaluation of Black Garlic and Investigation of the Effects of Soaking Time on the Biological Activities of Black Garlic Wine and White Garlic Wine

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Abstract

This study investigated the bioactive properties and quality characteristics of liquor infused with white and black garlic, including single-clove and garlic cloves. Garlic samples were infused in 40% (v/v) white rice liquor at a 1:5 ratio (100 g:500 mL) for six weeks. TPC, TFC, antibacterial activity against *Escherichia coli* and *Salmonella enterica*, and pH were evaluated. TPC and antibacterial activity were highest at week 4, while TFC reached its maximum at week 5. White single-clove garlic liquor showed the highest TPC (144.99 ± 11.37 mg GAE/L) and antibacterial activity, whereas black garlic-clove liquor had the highest TFC (528.17 ± 63.22 mg QE/L). The pH ranged from 3.93 ± 0.02 to 4.82 ± 0.01 . These findings demonstrate that garlic type and infusion time influenced the bioactive properties and quality characteristics of garlic-infused liquor.

Introduction

Garlic (*Allium sativum* L.) is a widely consumed plant containing sulfur compounds, polyphenols, and flavonoids with antioxidant and antibacterial properties. Black garlic, produced by controlled heating and aging of fresh garlic, exhibits distinct physicochemical and bioactive characteristics. Garlic maceration in alcoholic beverages offers potential for extracting these bioactive compounds and developing value-added products. However, limited research has compared different garlic types and maceration times in garlic-infused liquor. This study investigated the effects of garlic type (white and black garlic, clove and single-clove forms) and maceration time on pH, color, total polyphenol content (TPC), total flavonoid content (TFC), and antibacterial activity of 40% (v/v) white rice liquor.

Materials and Methods

White and black garlic, including garlic cloves and single-clove garlic, were used as raw materials. The garlic samples were infused in 40% (v/v) white rice liquor at a ratio of 1:5 (100 g garlic:500 mL liquor) for six weeks. Samples were collected weekly, and the experiment was performed in triplicate. Physicochemical and bioactive analyses included pH, CIELAB color (L^* , a^* , b^*), total phenolic content (TPC), total flavonoid content (TFC), and antibacterial activity against *Escherichia coli* and *Salmonella enterica*. Results were statistically analyzed to determine the effects of garlic type and infusion time on the quality and bioactive properties of garlic-infused liquor.

Results and Discussion

The garlic-infused liquors showed differences in pH and bioactive properties depending on garlic type and infusion time. The pH ranged from 3.93 to 4.82, with black-garlic liquors showing lower values than white-garlic liquors. The highest TPC was found in white single-clove garlic liquor (144.99 ± 11.37 mg GAE/L), while black garlic-clove liquor had the highest TFC (528.17 ± 63.22 mg QE/L) ($p < 0.001$). All samples showed antibacterial activity against *E. coli* and *Salmonella*. The highest inhibition zones were observed at week 4, with white single-clove garlic liquor reaching 25.20 ± 0.70 mm and 24.00 ± 0.60 mm, respectively. TFC reached its highest level at week 5, indicating different extraction and transformation rates of bioactive compounds during infusion.

Conclusion

The study demonstrated that garlic type and infusion time significantly affected the physicochemical and bioactive properties of garlic-infused liquor. The liquors prepared with 40% (v/v) white rice liquor at a garlic-to-liquor ratio of 1:5 (100 g:500 mL) showed pH values of 3.93–4.82 and contained measurable phenolic and flavonoid compounds. White single-clove garlic liquor exhibited the highest TPC and antibacterial activity, whereas black garlic-clove liquor showed the highest TFC. The fourth week was associated with the highest antibacterial activity, while the fifth week showed the highest TFC. Overall, the results indicate that infusion of different garlic types into alcoholic liquor can produce distinct bioactive profiles and provide a basis for further evaluation of garlic-infused alcoholic beverages.

Fig 1: General process flow chart for producing garlic-infused alcohol

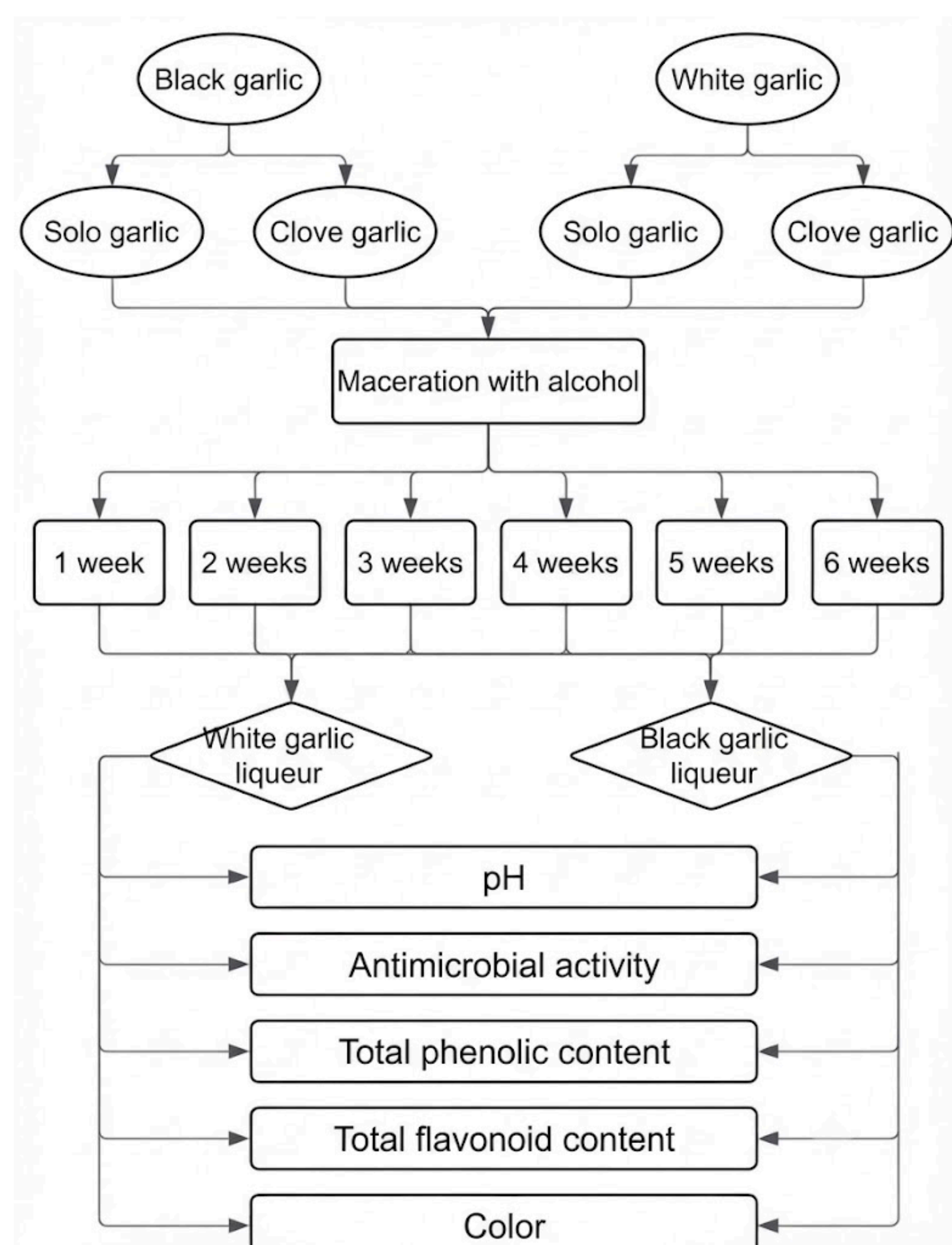
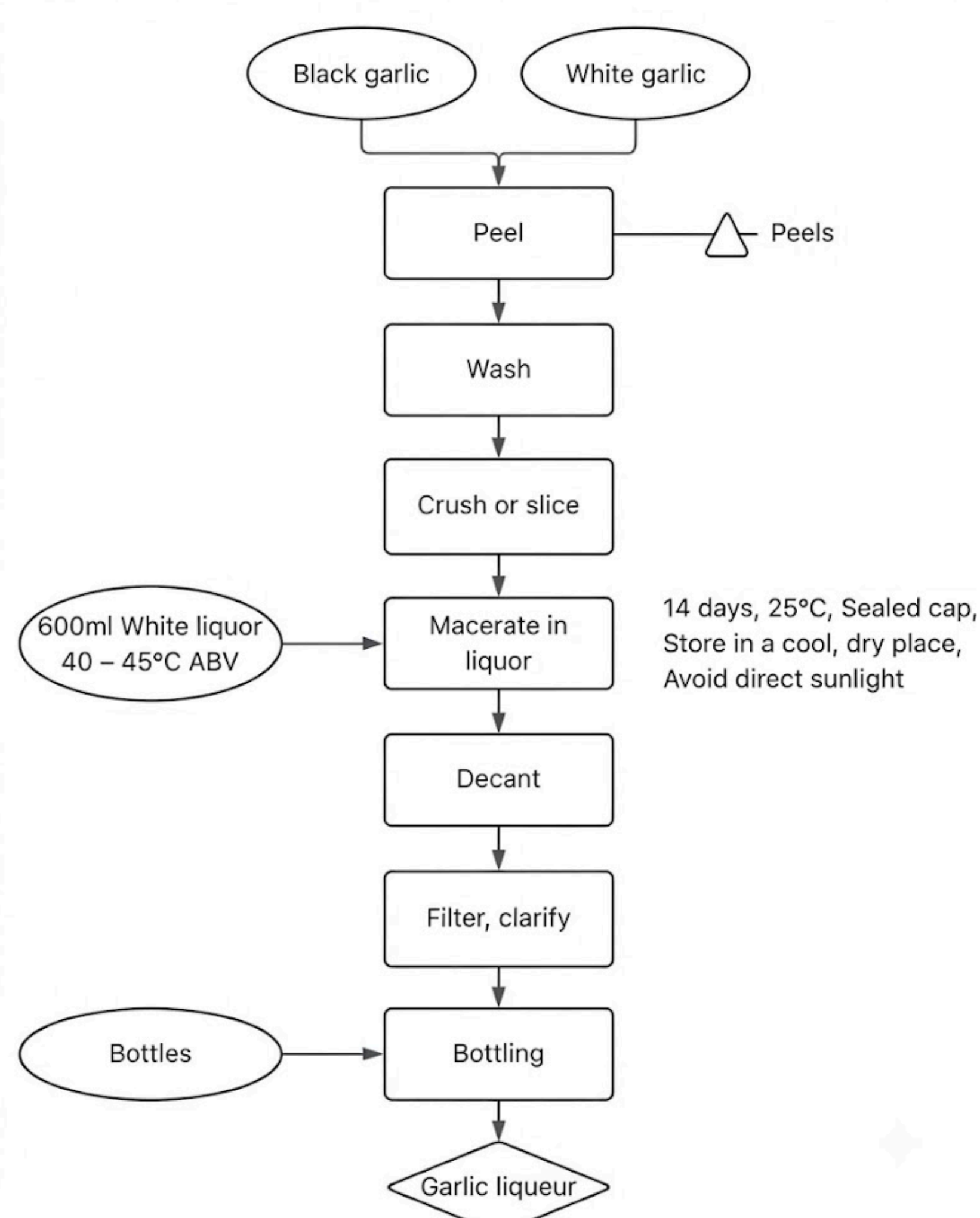


Fig 2: Flowchart of the process for investigating soaking time for white liquor and black liquor.

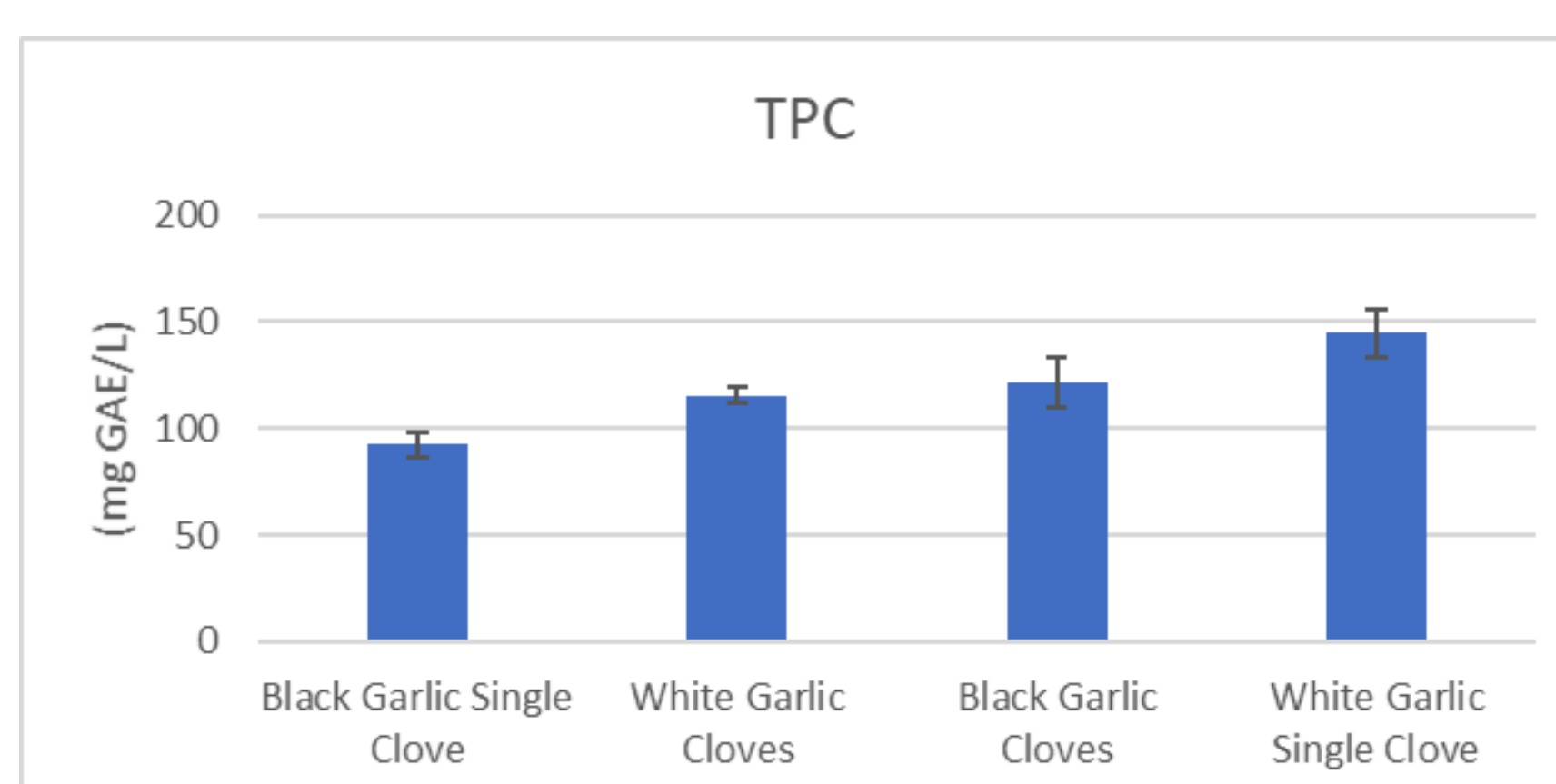


Fig 1: Total Phenolic Content of Garlic-Infused Liquor Samples at Week 4

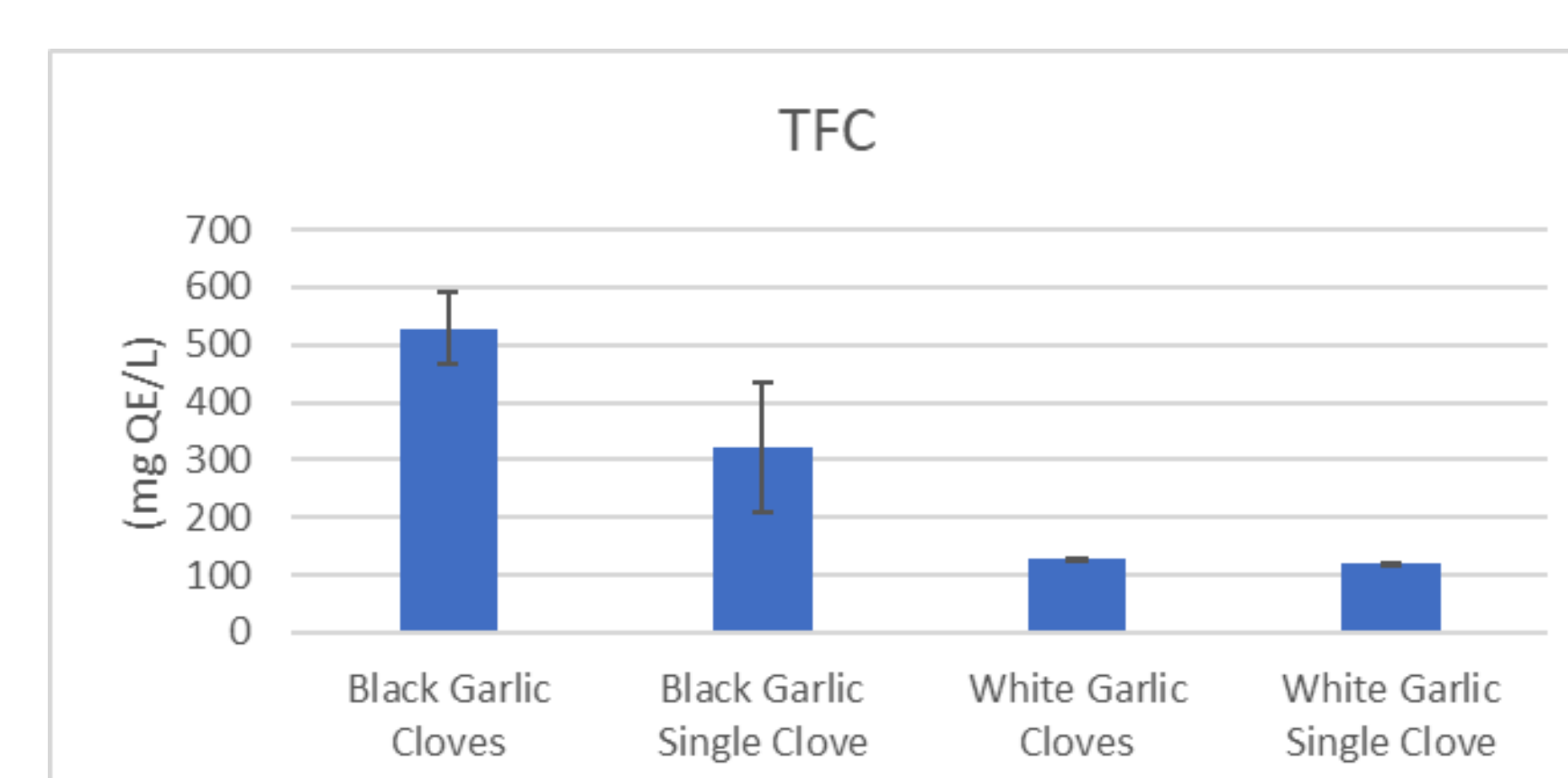


Fig 2: Total Flavonoid Content of Garlic-Infused Liquor Samples at Week 5

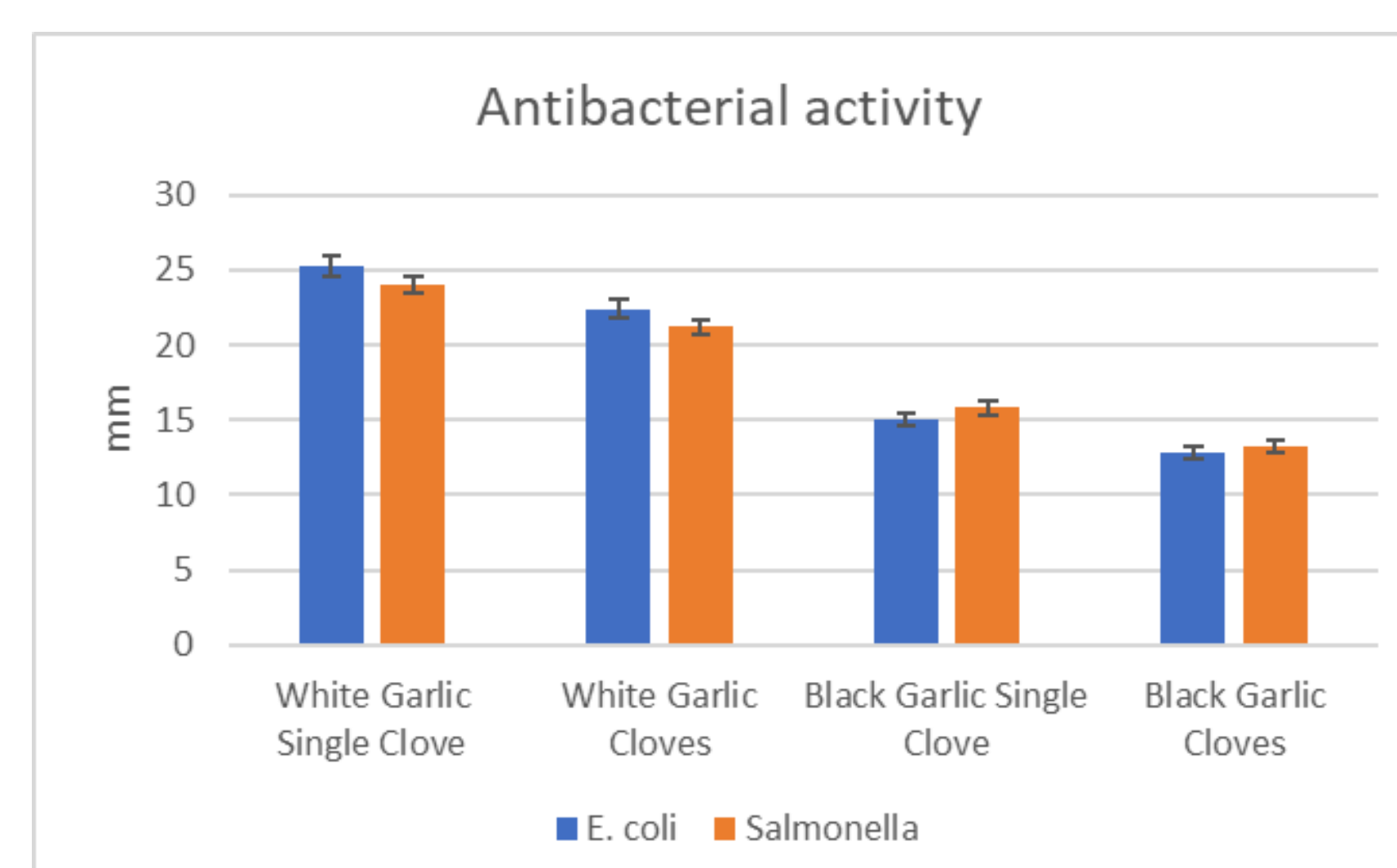


Fig 3: Antibacterial Activity of Garlic-Infused Liquor Samples at Week 4 Against *Escherichia coli* and *Salmonella*

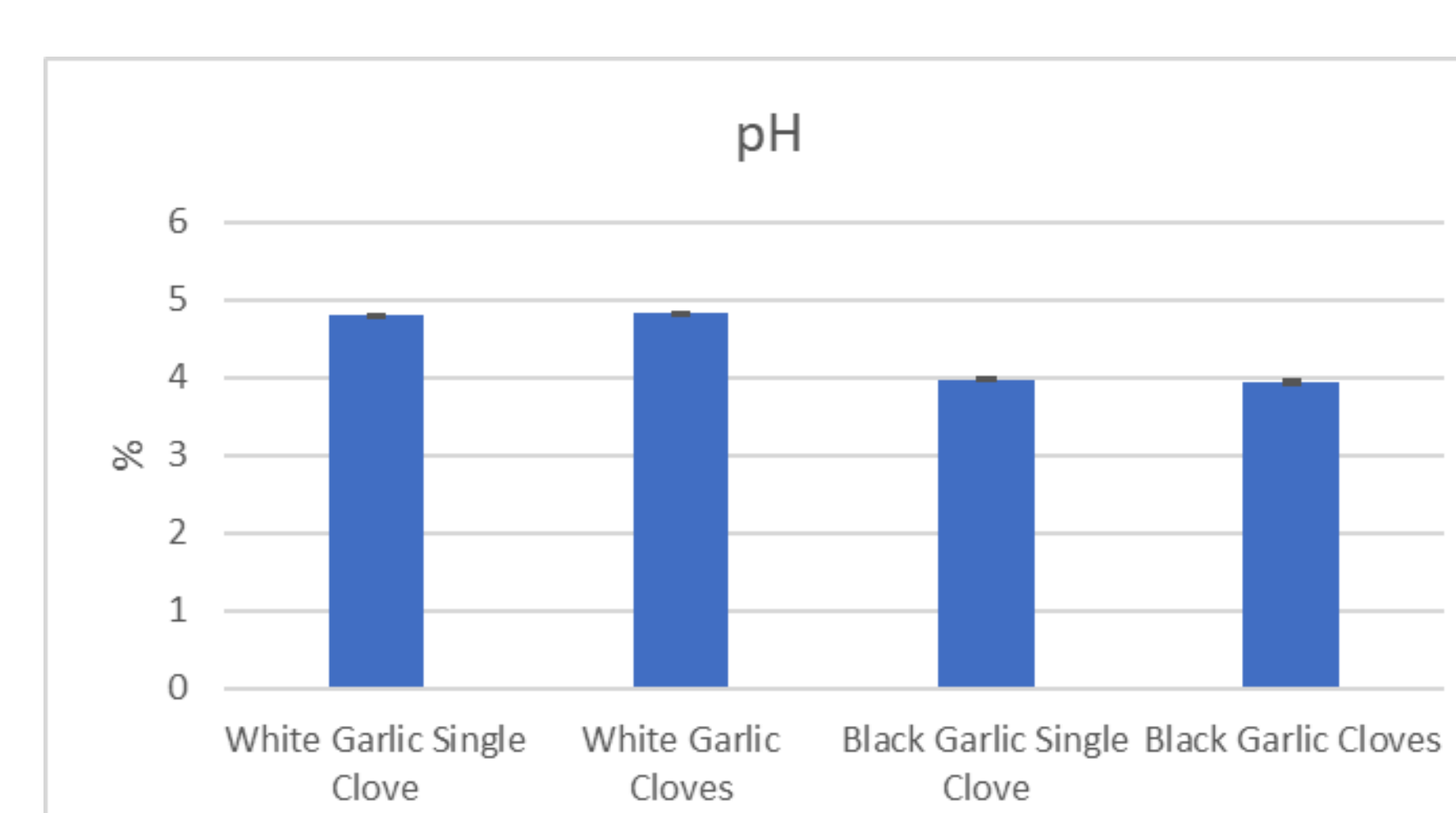


Fig 4: pH of Garlic-Infused Liquor Samples at Week 4

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