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# Potential health benefits of optimised whole-wheat flour fermentation on intestinal cells

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## INTRODUCTION & AIM

Cereals contain valuable bioactive compounds whose bioavailability is limited by their binding to the cell wall matrix. Fermentation represents an effective biotechnological approach to release and enhance these compounds through microbial metabolism.

The use of selected consortia of lactic acid bacteria *(F. sanfranciscensis, E. faecium, P. pentosaceus, and L. Mesenteroides)* and yeast (*K. Humilis)* strains to ferment whole-wheat flour improved the content of phenolic compounds, as well as the *in vitro and ex vivo* antioxidant capacity of the fermented *vs* the unfermented flours [1].

Furthermore, given the correlation between oxidative stress and inflammation, this study aimed to investigate the antioxidant activity of fermented flour in human intestinal cells (HT-29) by the measuring intracellular ROS levels and the expression of key genes involved in inflammatory pathways.

## METHODS

MTT assay was performed on intestinal cells to evaluate the cytotoxic effects of fermented and unfermented wheat flour extracts and to identify the optimal treatment condition for gene expression.

Intracellular ROS levels quantification using 2′-7′-dichlorodihydrofluorescein diacetate (DCFH-DA) was performed to evaluate the antioxidant activity on intestinal cells.

The anti-inflammatory and antioxidant properties of the fermented and unfermented flour extracts were evaluated, by quantitative real-time PCR, studying the expression of CAT, GPX1, HMOX-1, IL-1, IL-6, IL-8 COX-2.

## REFERENCE

[1] Tomassi, E., Arouna, N., Brasca, M., Silvetti, T., de Pascale, S., Troise, A. D., Scaloni, A., & Pucci, L. (2025). Fermentation of Whole-Wheat Using Different Combinations of Lactic Acid Bacteria and Yeast: Impact on In Vitro and Ex Vivo Antioxidant Activity. Foods, 14(3), 421. https://doi.org/10.3390/foods14030421

## RESULTS & DISCUSSION

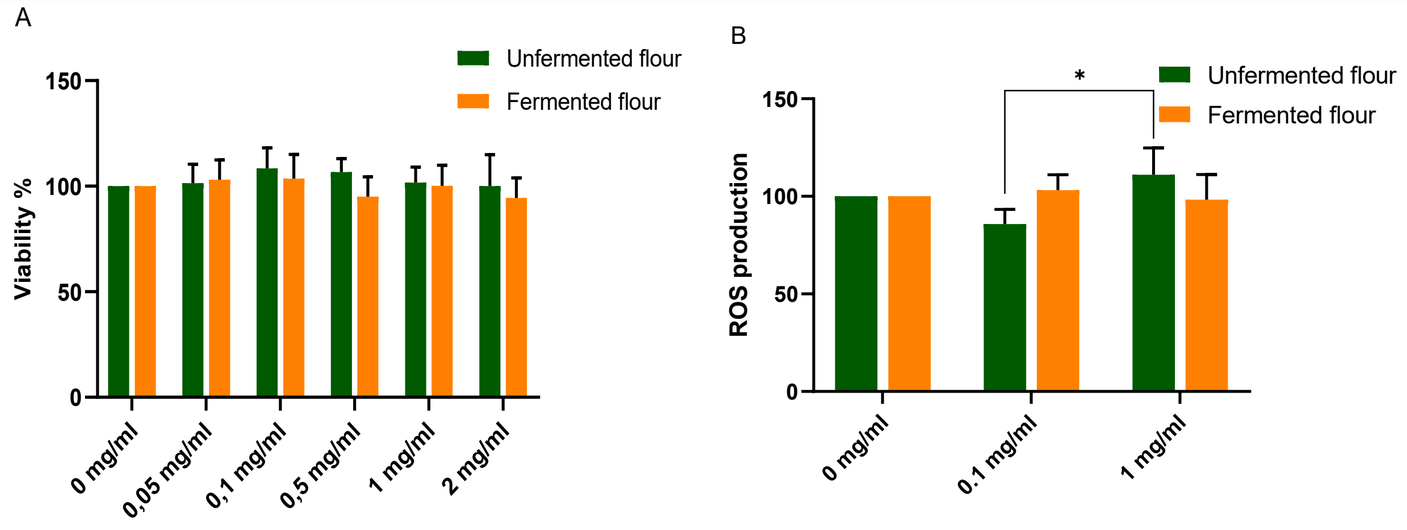


**Figure 1.** (a) MTT assay after 24h of treatment with unfermented and fermented flour extracts; (b) Intracellular ROS levels in HT-29 cells after 24 h treatment with unfermented and fermented flour extracts. One-Way ANOVA and Tukey's multiple comparisons test: *p<0.05.

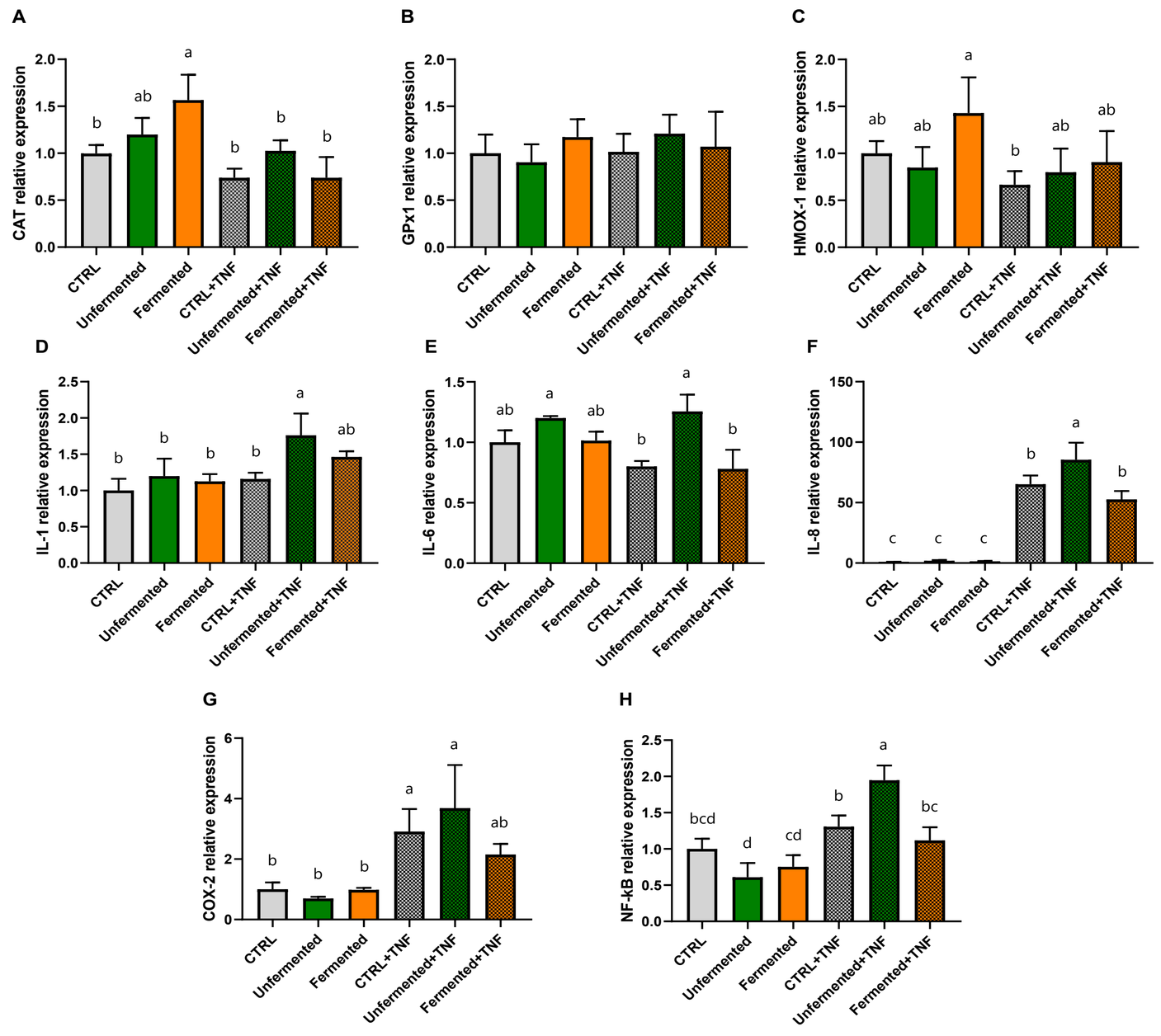


**Figure 3.** Quantitative Real-Time PCR analysis of CAT (a), GPX1 (b), HMOX-1 (c), IL-1 (d), IL-6 (e), IL-8 (f), COX-2 (g) and NF-kB (h) in HT-29 treated with or without 0.1 mg/mL of fermented and unfermented Whole-wheat flour extracts and subsequently exposed to an inflammatory insult (presence of TNF-α). Different letters indicate statistically significant differences among groups according to one-way ANOVA followed by Tukey's post hoc test ($p<0.05$).

## CONCLUSION

These results emphasize the key role of bioactive compounds released during fermentation in modulating oxidative stress and inflammation. Overall, the findings suggest that fermented whole-wheat flour may help mitigate oxidative stress and offer potential benefits in the prevention or management of inflammation-related diseases.