High-Throughput Detection of Non-BRCA Germline Variants in Breast Cancer Using NGS and Automated Magnetic Bead DNA Extraction

MagPurix® extraction from blood samples provides high quality DNA for NGS detection of BRCA variant on Illumina technology

Executive Summary

Hereditary breast cancer risk is often associated with BRCA1/2 mutations; however, a significant proportion of patients carry pathogenic variants in other cancer susceptibility genes. In this study, 232 breast cancer patients or individuals with a family history of breast cancer, but negative for BRCA1/2, underwent multigene panel testing using next-generation sequencing (NGS).

Genomic DNA for all samples was extracted using the **MagPurix® Blood DNA Extraction Kit** (Zinexts, Taiwan), providing high-purity DNA suitable for downstream library preparation and sequencing, ensuring reliable germline variant identification.

The study found a 10.34% prevalence of pathogenic/likely-pathogenic variants in non-BRCA genes, with the highest frequencies observed in CHEK2, ATM, and MUTYH. These findings highlight the clinical importance of multigene testing and reinforce the need for reproducible nucleic acid extraction workflows for oncology genetics.

Key Findings

Study Focus	Outcome
Study population	232 BRCA-negative individuals with breast cancer and/or relevant family history
DNA extraction method	MagPurix® Blood DNA Extraction Kit used for all samples
Sequencing platform	Illumina NextSeq 500 with multigene cancer panels
Variant detection rate	10.34% (24/232) pathogenic / likely pathogenic non-BRCA variants
Most affected genes	CHEK2 (29%), ATM (20.8%), MUTYH (12.5%)
Clinical implications	Early diagnosis and risk-guided surveillance strategies strengthened through broader gene analysis

Role of MagPurix® System in Study Performance

- Consistent DNA yield and purity: Only samples with A260/280 = 1.8–2.0 were accepted for sequencing, demonstrating the system's capability to provide reliable, high-quality DNA for NGS workflows.
- Automated magnetic bead workflow minimized manual variability, improving reproducibility across all 232 samples.
- The extraction system also enabled easy re-extraction of low-quality samples from stored blood, supporting efficient laboratory operations.

These advantages are critical in clinical genetics, where downstream sequencing success depends on DNA integrity.

Conclusion

This study demonstrates that non-BRCA pathogenic germline variants account for a meaningful proportion (10.34%) of hereditary breast cancer risk, emphasizing the necessity of multigene panel testing in clinical evaluation.

The MagPurix® Blood DNA Extraction Kit played a decisive role in ensuring accurate and consistent sequencing results, by delivering high-purity DNA suitable for NGS analysis. For laboratories conducting hereditary cancer screening, the MagPurix® platform offers a robust, automated, and standardized solution that enhances diagnostic confidence and workflow efficiency.

Reference

Ayaz, A., Yalcintepe, S., Seyhan, S., & Gezen, F. C. (2022). Importance of diagnosis in breast cancer with non-BRCA pathogenic germline variants of cancer susceptibility genes using high-throughput sequencing analysis. *EJMO*, *6*(1), 30–42. https://doi.org/10.14744/ejmo.2022.88057