

Reinterpreting sperm selection: evaluating the influence of sperm processing techniques on embryo euploidy through AI-based oocyte assessment

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INTRODUCTION

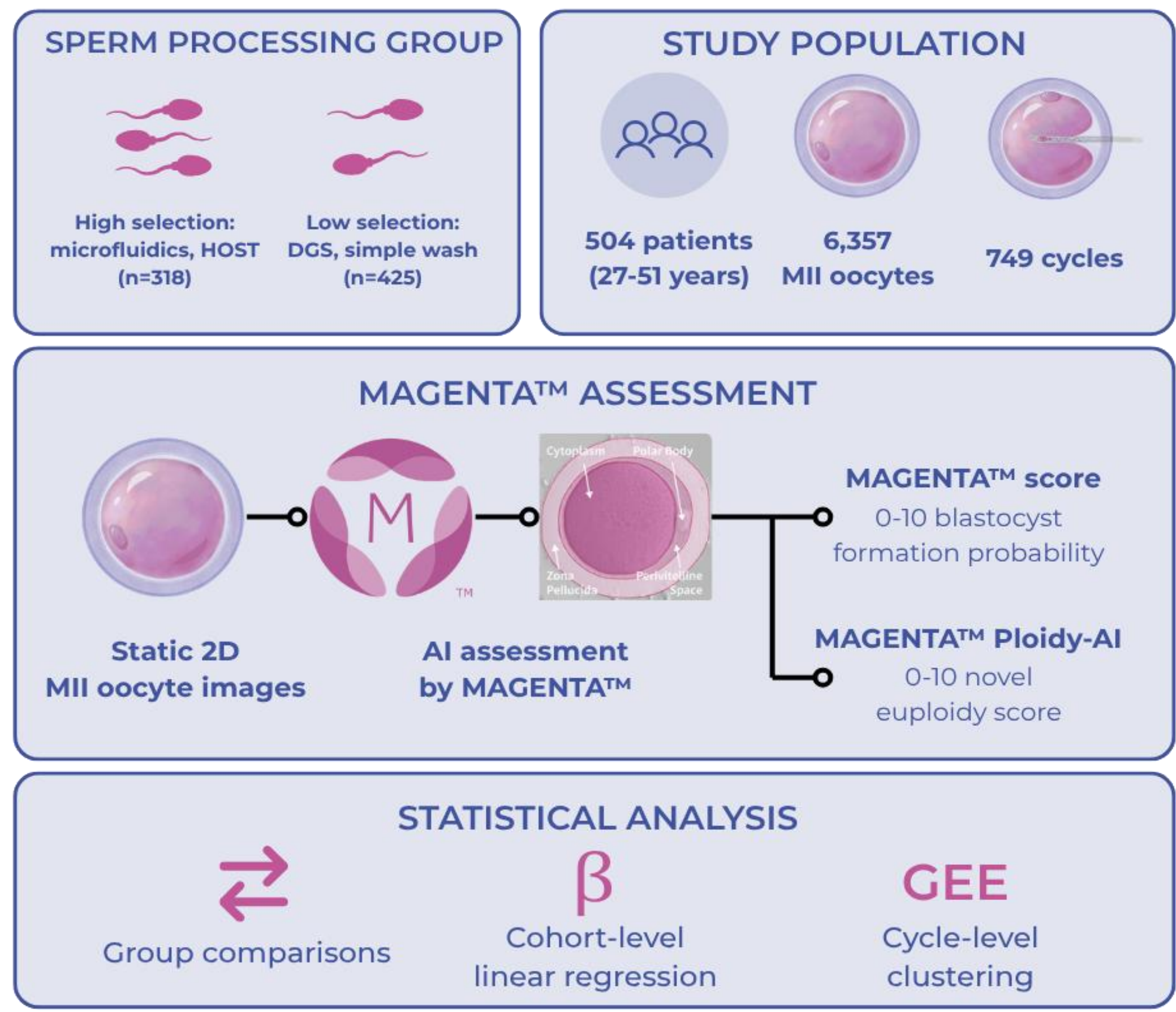
Sperm processing techniques in IVF range from standard centrifugation-based methods to advanced selection approaches such as microfluidics. Although these methods aim to improve sperm selection, their impact on blastulation and embryo euploidy remains unclear.

Because embryo chromosomal status is largely driven by oocyte quality and maternal age, the influence of sperm preparation may be difficult to detect without accounting for the oocyte contribution. MAGENTA™ Ploidy-AI provides a non-invasive, oocyte-centered assessment of euploidy likelihood from MII oocyte images, offering a framework to evaluate whether sperm processing independently contributes to chromosomal outcomes.

AIM

To evaluate whether sperm processing selection intensity is associated with blastulation and embryo euploidy rates, and to assess the predictive value of MAGENTA™ Ploidy-AI for PGT-A outcomes.

METHOD



RESULTS

Baseline characteristics were comparable between sperm processing groups: number of oocytes per cycle (8.42 ± 6.10 vs 8.54 ± 6.40 ; $p=0.81$) and mean MAGENTA™ scores (5.06 vs 5.05 , $p=0.97$) did not differ. However, maternal age was higher in High Selection cycles (39.32 ± 3.64 vs 38.66 ± 3.62 years; $p=0.01$).

Sperm processing group was not associated with blastulation or euploidy rates. Blastulation rate, euploidy per biopsied blastocyst, and euploidy per informative oocyte were comparable between High and Low Selection cycles; only the Ploidy-AI score differed between groups (**Figure 1**).

At the cohort level (one value per cycle, averaging all oocytes in that cycle), mean Ploidy-AI score was positively associated with blastulation rate ($\beta=0.076$; $p<0.001$), euploidy rate per biopsied blastocyst ($\beta=0.040$; $p<0.01$), and euploidy rate per oocyte ($\beta=0.037$; $p<0.001$) after adjusting for maternal age.

In the oocyte-level GEE model (each individual oocyte analysed separately, accounting for clustering within cycles), the Ploidy-AI score significantly predicted euploidy in both High and Low Selection groups, and maternal age was a significant negative predictor. Sperm processing group and the score $\times$ group interaction were not significant, indicating that the predictive value of the Ploidy-AI score was independent of sperm processing technique (**Figure 2**).

Outcomes by sperm processing group (mean per cycle $\pm$ SE)

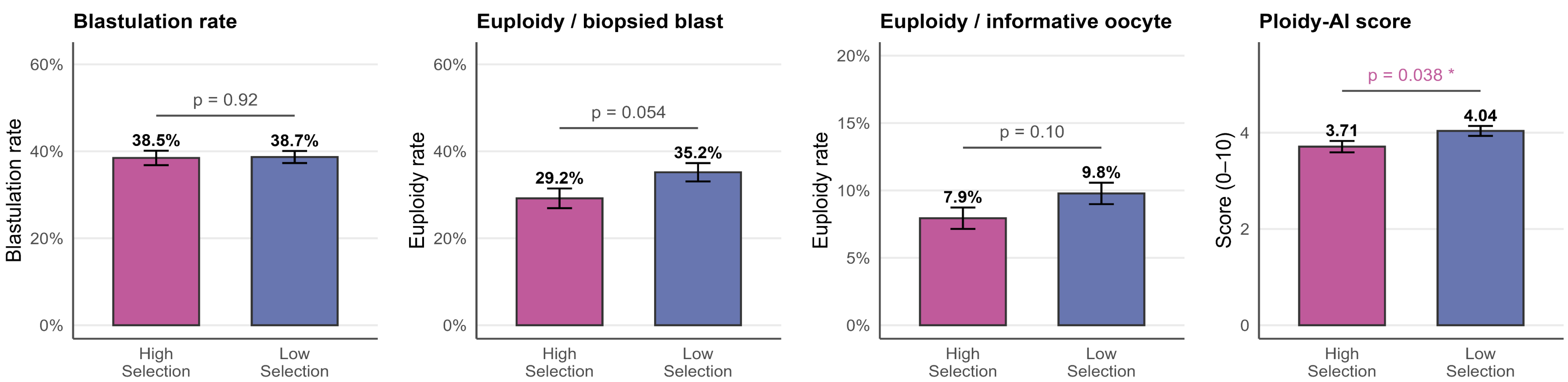


Figure 1. Reproductive outcomes and MAGENTA™ Ploidy-AI score by sperm processing group.

Bars show mean per-cycle blastulation rate, euploidy rate per biopsied blastocyst, euploidy rate per informative oocyte, and mean MAGENTA™ Ploidy-AI score in High Selection and Low Selection cycles. Error bars represent SE.

Blastulation and euploidy outcomes were not significantly different between groups, although euploidy rates trended higher in Low Selection cycles. Low Selection cycles showed significantly higher mean Ploidy-AI scores, while maternal age was slightly higher in the High Selection group.

GEE model: predictions of oocyte level euploid

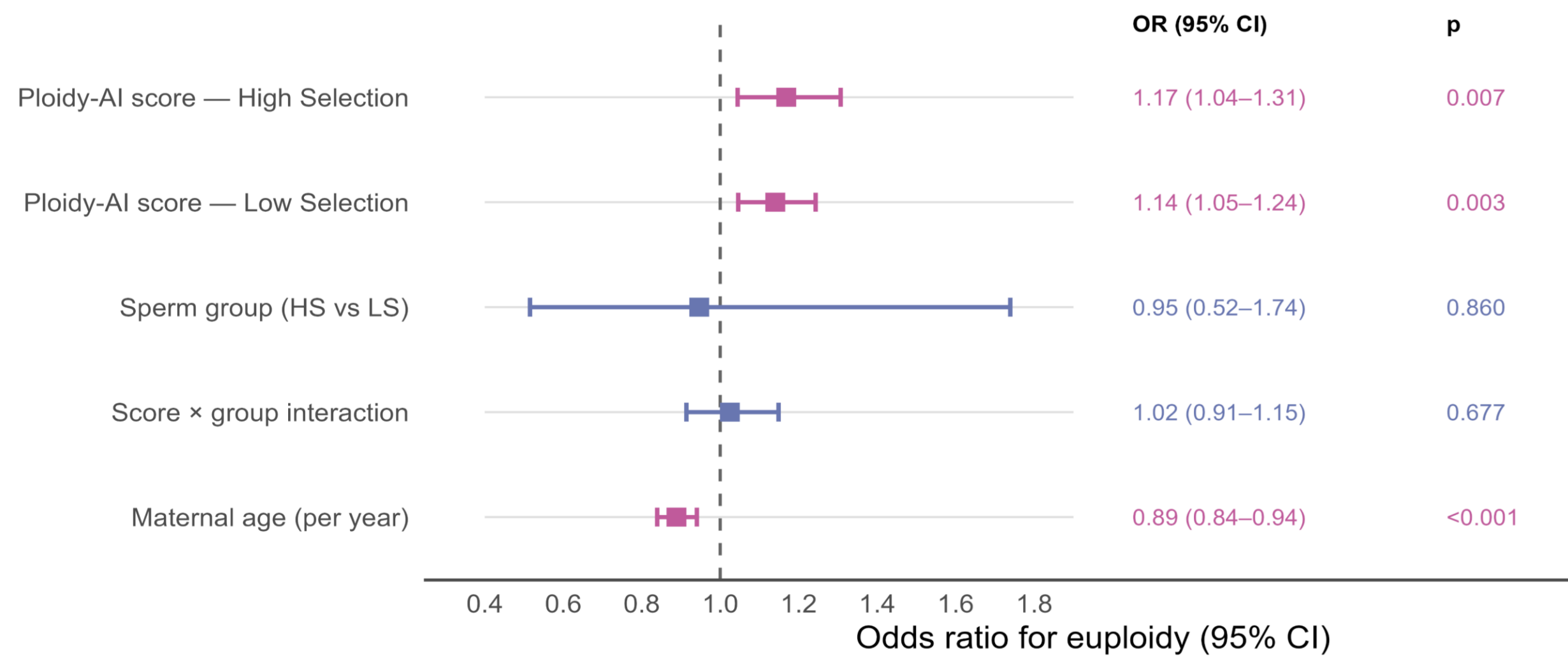


Figure 2. Adjusted predictors of oocyte-level euploidy. Forest plot showing ORs and 95% confidence intervals from an oocyte-level GEE model clustered by cycle.

Each 1-point increase in MAGENTA™ Ploidy-AI score was independently associated with higher odds of euploidy in both High and Low Selection cycles. Sperm processing group and the Ploidy-AI score $\times$ group interaction were not significantly associated with euploidy. Maternal age was negatively associated with euploidy.

CONCLUSIONS

Sperm processing selection intensity was not independently associated with blastulation or euploidy outcomes, with observed trends likely attributable to differences in maternal age and oocyte quality rather than processing technique.

The MAGENTA™ Ploidy-AI score was independently predictive of euploidy after adjustment for maternal age, with consistent performance across both sperm processing groups.

These findings suggest that **oocyte quality, as captured by MAGENTA™ Ploidy-AI, is a stronger determinant of euploidy than sperm processing methods** – reframing the contribution of sperm selection in IVF.

ACKNOWLEDGEMENTS

The authors wish to thank the patients and laboratories at Fertility Medical Group, Brazil and the scientific team at Science for EveryMind for this collaboration.

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