

In vitro influence of nutrient deprivation on chemotherapeutic effects in breast cancer cell lines

Michael Christopher Stark, Anna Margaret Joubert, Michelle Hellen Visagie

Department of Physiology, School of Medicine, Faculty of Health Sciences, University of Pretoria
Tuks Undergraduate Research Forum (TURF), Faculty of Health Sciences, University of Pretoria

Background

Breast cancer, one of the most common cancers in women worldwide accounted for 685 000 deaths in 2020. Literature indicates that fasting might be an effective intervention used to decrease blood glucose- and glutamine levels and offers breast cancer patients a possible manner to sensitize tumorigenic cells to chemotherapy. The effects of glucose- and glutamine deprivation were investigated in this study on the activity exerted by Papaverine (PPV) in breast tumorigenic cell lines.

Aim

The aim of this research project is to investigate the effect of physiological glucose- and glutamine deprivation on the activity exerted by PPV in MCF-7- and MDA-MB-231 cell lines.

Materials and Methods

Cell lines:

- MCF-7 tumorigenic cells (ER+, PR+, HER2-)
- MDA-MB-231 tumorigenic cells (triple negative)

Experimental mediums:

- **Complete growth medium (DMEM)** = 25.52 mM glucose and 4.00 mM glutamine
- **Starvation medium 1 (STARVE 1)** = 6.0 mM glucose and 0.6 mM glutamine
- **Starvation medium 2 (STARVE 2)** = 3.5 mM glucose and 0.6 mM glutamine
- **Starvation medium 3 (STARVE 3)** = 3.5 mM glucose and 0.0 mM glutamine

Cell proliferation: Spectrophotometry (crystal violet staining)

Cell morphology: Light microscopy

Cell Proliferation

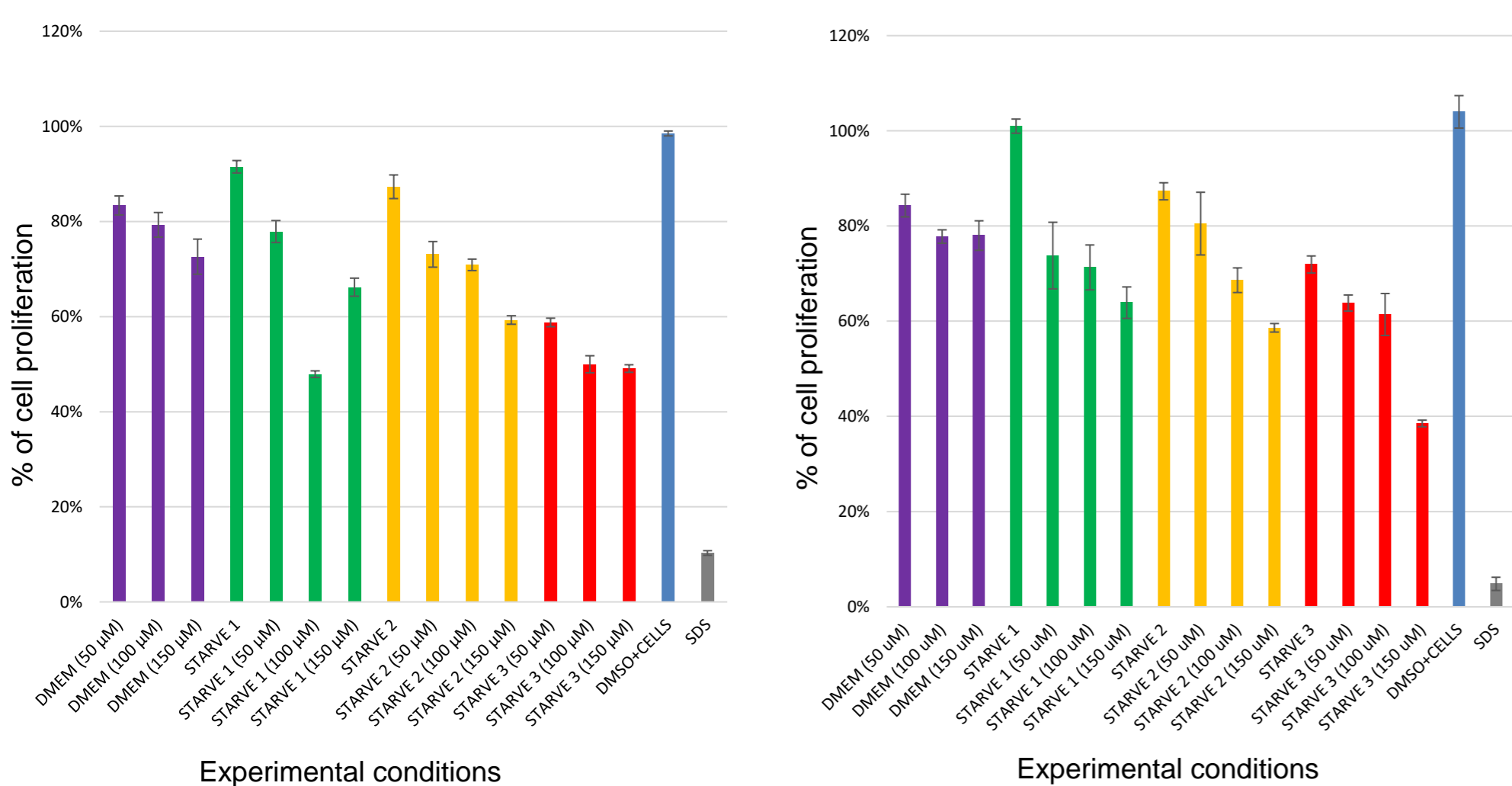


Figure 1: Bar graph illustrating the percentage of cell proliferation in MCF-7 cells in response to different experimental mediums and PPV concentrations.

Figure 2: Bar graph illustrating the percentage of cell proliferation in MDA-MB-231 cells in response to different experimental mediums and PPV concentrations.

Cell Morphology

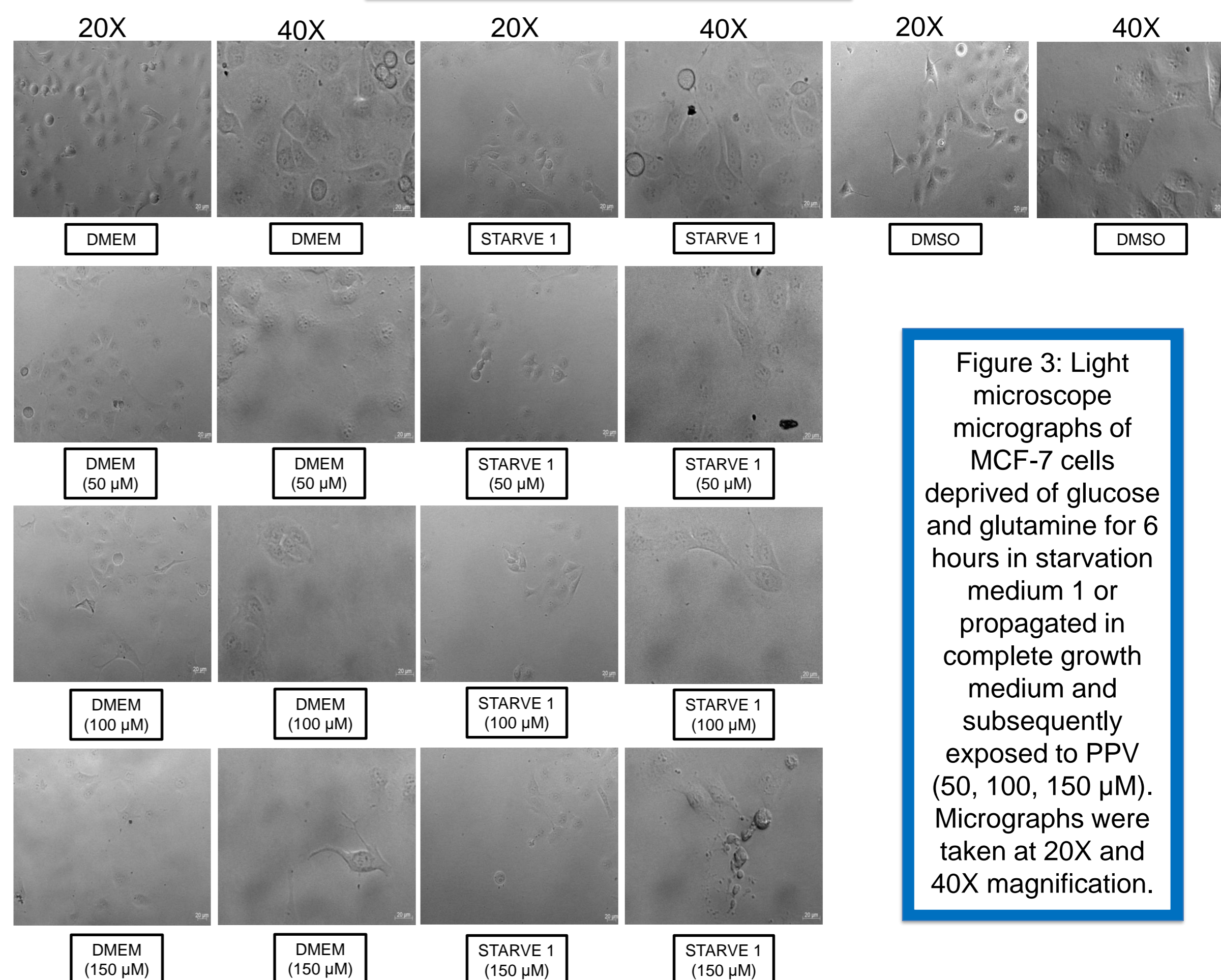
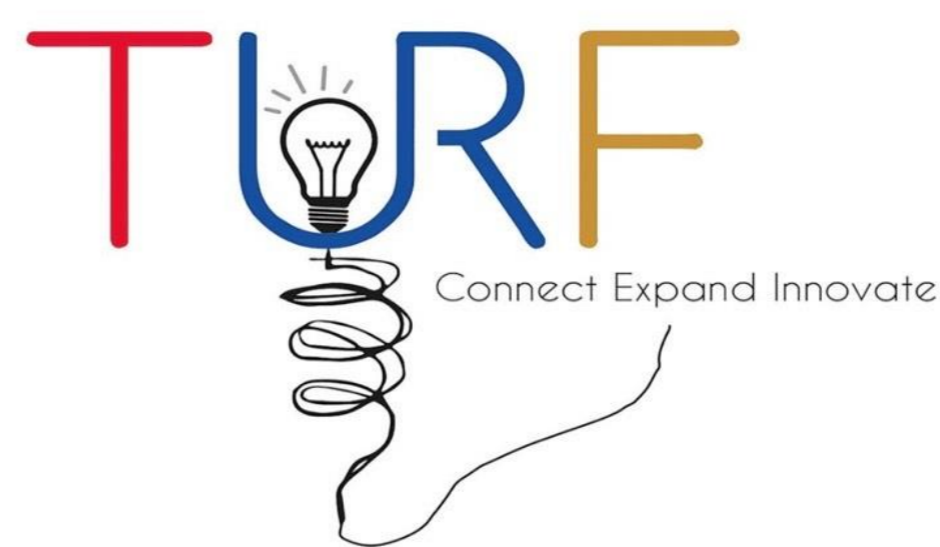
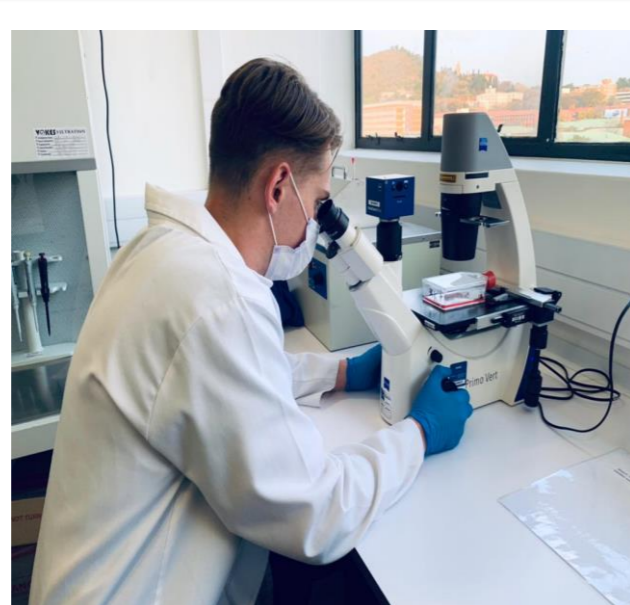


Figure 3: Light microscope micrographs of MCF-7 cells deprived of glucose and glutamine for 6 hours in starvation medium 1 or propagated in complete growth medium and subsequently exposed to PPV (50, 100, 150 µM). Micrographs were taken at 20X and 40X magnification.

Conclusion

This study suggests that glucose- and glutamine deprivation do increase the efficacy of PPV in MCF-7- and MDA-MB-231 cell lines and this was evident in spectrophotometry. Light microscopy in MCF-7 cells further corroborated the above-mentioned statement. This study provides further insight into how fasting can offer an alternative chemotherapy treatment that increases the overall efficacy of the chemotherapeutic drug.



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