The role of oxidative stress in the effects mediated by a garlic constituent (diallyl trisulfide) in cancer cell lines

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Introduction

Cervical and prostate cancer are among some of the most commonly diagnosed cancer in women and men. Diallyl trisulphide (DATS) is an organosulfur compound found in garlic that exerts antiproliferative- and antimitotic activity in tumourigenic cell lines. The aim of this study is to investigate if DATS exerts antiproliferative activity, antimitotic activity and induces cell death in tumourigenic cervical and prostate cancer cells and to determine if these above-mentioned effects are dependent on reactive oxygen species (ROS) production.

Materials and Methods

- Tumourigenic cervical cancer cell line (HeLa) and prostate cancer cell line (DU145)
- **Compound:** Diallyl trisulfide (DATS) (Sigma Chemical Co. (Missouri, United States of America)
  - **Cell proliferation:** Crystal violet staining and spectrophotometry
    - **Cell morphology**: Light microscopy
      - **Cell cycle:** Flow cytometry

Aim

The aim of this study is to investigate if DATS exerts antiproliferative activity, antimitotic activity and induce cell death in cervical- and prostate cancer cells and to determine if these above-mentioned effects are dependent on ROS production.

Results and discussion

Data showed that 150 µM DATS exposure for 48- and 72 hours decreased cell growth to 65% and 39% (figure 1) in the HeLa cell line and 53% and 26% (figure 3) in the DU cell line; however, the antiproliferative effect was completely abrogated by NAC (figure 2 & 4). Light microscopy revealed that DATS decreases cell density and increases cell rounding in a dose-dependent manner. After a 48 hour exposure, there were 8- and 42 rounded cells at 10- and 150 µM DATS in the HeLa cell line (figure 5). Furthermore, these effects on cell rounding induced by DATS were completely abrogated by NAC (figure 5). In addition to this, flow cytometry results showed that DATS induces cell death and a G_2M block in both cell lines at 48- and 72 hours. These effects were completely abrogated by NAC.
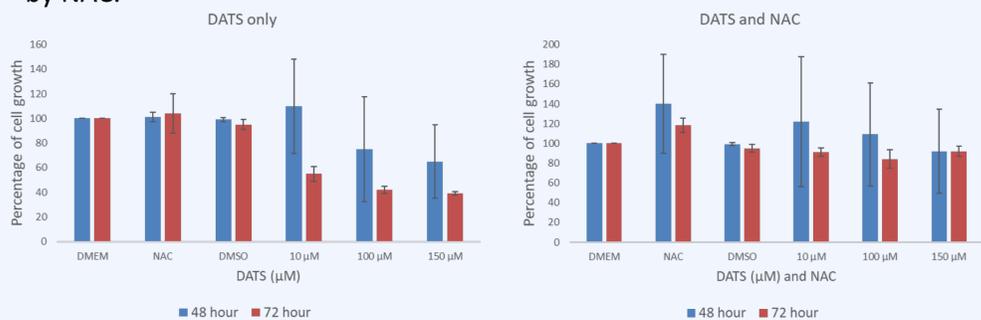

Figure 1 & 2: The percentage of cell growth when HeLa cells were exposed to DATS (10 µM – 150 µM) in the presence and absence of NAC (2 mM) for 48- (blue) and 72 hours (red).
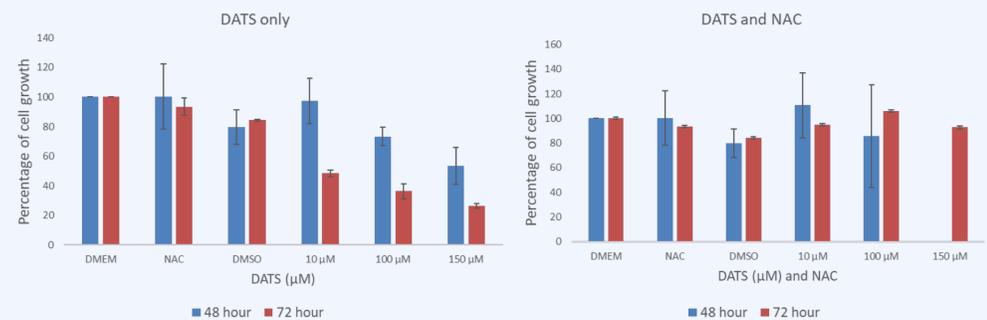

Figure 3 & 4: The percentage of cell growth when DU145 cells were exposed to DATS (10 µM – 150 µM) in the presence and absence of NAC (2 mM) for 48- (blue) and 72 hours (red).
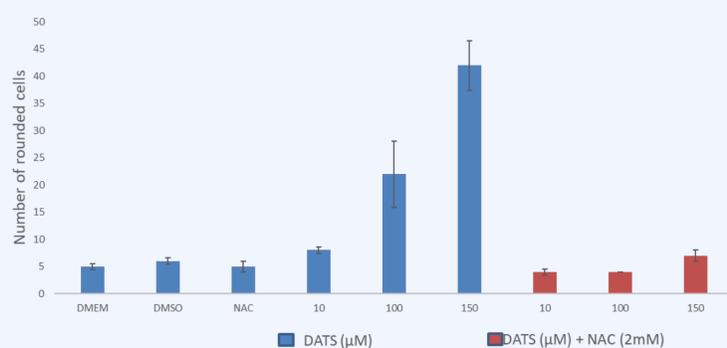

Figure 5: The number of rounded HeLa cells when exposed to DATS concentrations (10 µM – 150 µM) without (blue) and with (red) NAC (2 mM) for 48 hours.
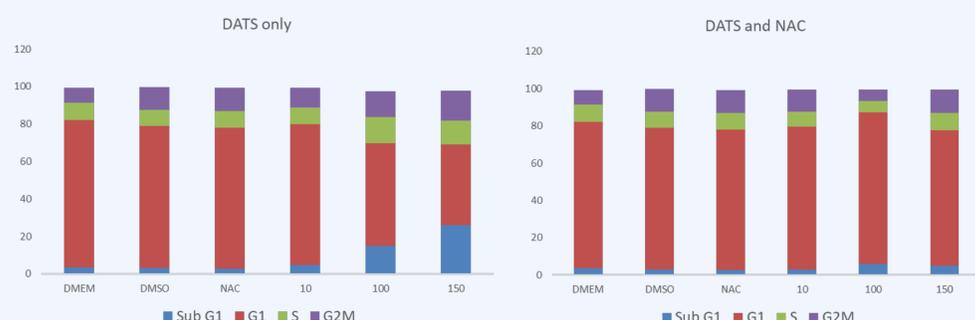

Figure 6: The number of rounded HeLa cells when exposed to DATS (10 µM – 150 µM) for 48 hours.

Figure 7: The percentage of HeLa cells that occupy the different phases of the cell cycle after exposure to DATS (10 µM – 150 µM) in the presence and absence of NAC (2 mM).
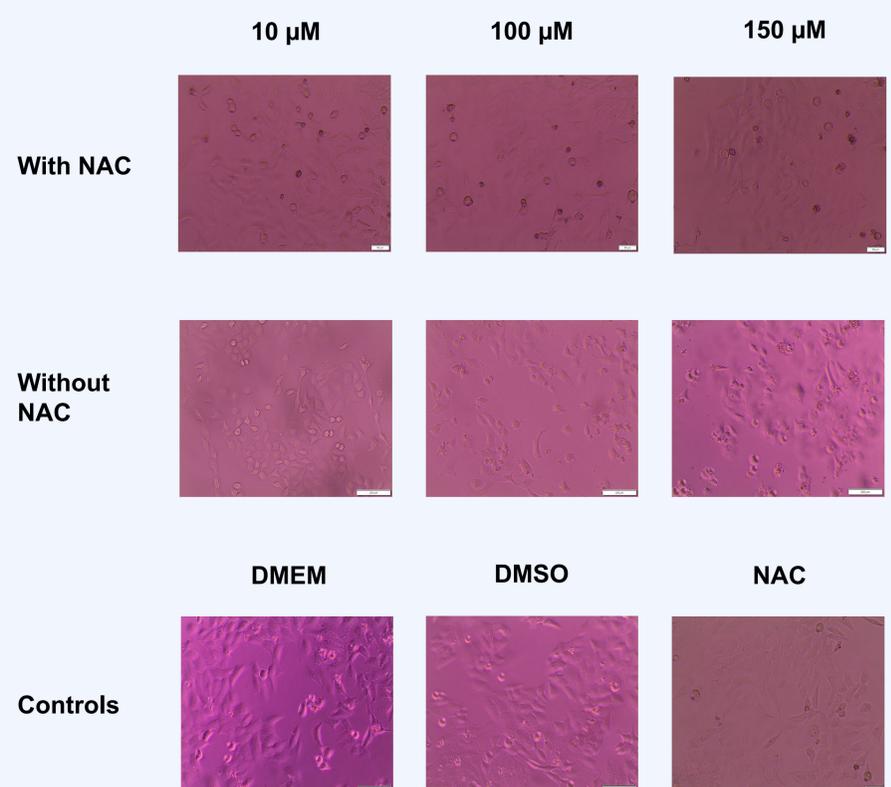
Discussion and conclusion

This study shows that the effects of DATS on proliferation, cell rounding and cell death are inhibited by NAC in the HeLa and DU145 cell line, which suggests that DATS exerts a ROS-dependent mode of action. This study adds to what is currently known about the role of oxidative stress in the effects induced by DATS in cervical and prostate cancer cell lines.

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