Feasibility of Integrating Tripterygium wilfordii into Modern Cancer Therapy for Increased Efficacy and Minimal Toxicity

Ngoc T. Vo
Virginia Commonwealth University, vont2@vcu.edu

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Feasibility of Integrating *T. wilfordii* into Modern Cancer Therapy for Increased Efficacy and Minimal Toxicity

Ngoc Vo, Biomedical Engineering – Prof. Mary Boyes, VCU Honors College

### Introduction

- Diseases are becoming more resistance to the drugs that be used in the market today. Current solution to such problems is to develop strong and more powerful drugs to combat the disease.
- However, accompanying these powerful drugs are adverse side effects that is proportional to the effectiveness of the drug.
- According to the CDC, cancer is the second leading cause of death in the U.S, and the American Cancer Society reported that millions of new cancer cases are being diagnosed each year.
- Current cancer treatments are chemotherapy and ionizing radiation.
- Adverse effects are hair loss, extraneous damage to healthy cells, decreased immunity, etc.
- In order to find alternative treatment methods with less side effects, we turn to Eastern medicine.

### Findings

#### Therapeutic Effects of Triptolide
- Inhibits growth of 4 solid tumors (B16 mouse melanoma, MDA-435 human breast cancer, TSU bladder cancer, and MGC80-3 gastric cancer). Individual effects varies between cell lines, showing cell specificity (Yang et al.).
- Kiviharju et al. had similar results when studying triptolide in prostatic epithelial tumors.
- Inhibit vessel formation by nearly 50% at 1.2 μM (He et al.).
- Yang et al. also found that after 3 days of treatment, there was a significant reduction in proteins and molecules for cell cycle progression.
- Kiviharju et al. found similar results in prostatic cancer cells. Triptolide increased apoptosis rate slightly after 24h and significantly after 48h.

#### Therapeutic Effects of Celastrol
- Celastrol cause cell cycle arrest at low concentration and quickly induce apoptosis at higher concentrations above 800 nM (Peng et al.).
- Peng et al. also found that celastrol increased numbers of cell in G0/G1 starting at concentration of 400 nM.
- Celastrol inhibits VEGF in HUVECs cells at concentration of 1-2 μM (Pang et al.).

**Synergy**
- Other studies have also found that triptolide and celastrol can potentiate the effects of current cancer treatment (chemotherapy and IR) at low dosages, thus lessening the adverse effects.

### Proposed Solution

**Hypothesis:** Since *T. wilfordii* is not known to induce the multitude of adverse effects that triptolide and celastrol has and yet still contains triptolide and celastrol, *T. wilfordii* can be an alternative herbal treatment for cancer.

**Methods:**
- 95% ethanol extract from the roots of *T. wilfordii* at varying dosages
- **In vitro study:**
  - Measure proliferation of cell, cell vitality, cell survival/apoptosis, and cell cycle arrest.
  - Perform cell toxicity assay.
- **In vivo study:**
  - Inject different cancer cell types into zebrafish and white mice.
  - Measure anti-angiogenic property in zebrafish embryos.
  - Observe indications of adverse effects in mice. Weekly blood tests and weighing for 8 weeks.
  - Sacrifice mice at the end of the study to examine internal organs.

**Should the Experiment Fail:**
- If fail in terms of efficacy (and safety), research should turn to natural products and combination drugs.
- If fails in term of safety alone, then research combinations of herbs that may have been used with *T. wilfordii*.

### Conclusion

- Potent drugs are being developed to combat diseases with growing resistance for current prescription, and adverse effects induced are proportional to strength of drug.
- The approach taken to rectify this problem is to look for alternative treatment methods in Eastern medicine. This study is conducted on *T. wilfordii* and its anti-cancer effects.
- The bioactive compounds within the plant roots have demonstrated strong anti-cancer effects, but they can induce detrimental side effects.
- Proposed solution is to use a crude extract of the roots as a treatment for cancer.
- If the results are undesirable, then research should be taken in the direction of producing combination drugs containing triptolide and/or celastrol with selected non-bioactive compounds in the plant.

### Acknowledgements

I would like to thank Professor Boyes and my TAs for helping me with the research and writing process, and Dr. Zhang from the Department of Medicinal Chemistry in the School of Pharmacy for helping me to design my proposed experiment.

### Table 1. Eastern Medicine vs. Western Medicine

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Note: From “Consumers’ Perceptions of Chinese Vs. Western Medicine” by Piron, F., Ching, C., Peng, E., Peng, Ch., H., 2000, Advances in Consumer Research, 27.

**Figure 1.** "thunder god vine"

**Figure 2.** Triptolide (C₁₅H₂₀O₅) MW: 360.484

**Figure 3.** Celastrol (C₁₅H₁₅O₅) MW: 450.6152

### References


