Cultivating Interdepartmental Collaboration with the Ancient Practice of Pharmacognosy

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SUMMARY

- Clinical problems stemming from daily practice often have laboratory-based solutions. We present a patient case that led to collaboration between faculty members of the Department of Pharmacy Practice and Department of Pharmaceutical Sciences and resulted in a pharmacy student research project.

BACKGROUND

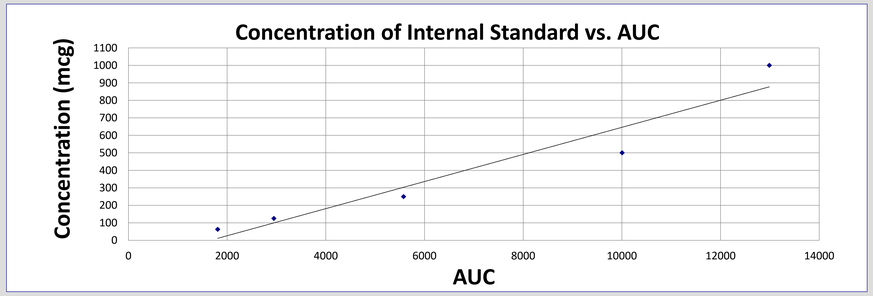
- Brodifacoum is a long acting anticoagulant rodenticide (LAAR) that causes prolonged morbidity and possible mortality following intentional ingestion. Clinical management of LAAR toxicity requires supportive care including long-term doses of vitamin K1 (VK) to treat and prevent coagulopathy. [1]
- Commercial VK can be prohibitively expensive at more than $5,000 per week. Furthermore, VK may not be covered by insurance plans. [2]
- A practice faculty member encountered a patient with LAAR toxicity experiencing significant morbidity requiring several hospitalizations due to inability to afford prescription VK.
- Leafy green vegetables such as kale, spinach, swiss chard, and parsley have high VK content. Laboratory techniques have shown that kale has a variable VK content ranging from 3mcg/g to 18.5 mcg/g. [3]
- A science faculty member and a pharmacy student designed a protocol to extract VK from food products and explore the feasibility of a patient using leafy vegetables in the long-term management of LAAR toxicity.

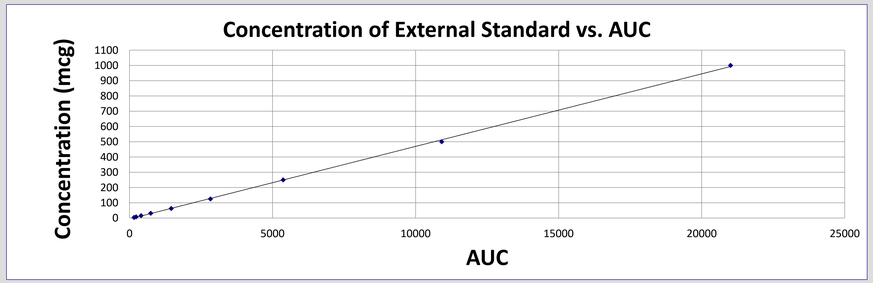
METHODS

- VK is extremely hydrophobic (logP 9.3) and is therefore extractable with lipophilic solvents.
- A kale and water emulsion was created using a consumer-grade emulsifying blender. Laboratory instruments were substituted with kitchen appliances wherever possible.
- The emulsion was rinsed and filtered using muslin to remove excess liquid while retaining the plant material and VK for further processing.
- Evaporation of the organic solvent reduced the size of our sample and allowed quantification of VK in our sample through High-Performance Liquid Chromatography (HPLC).
- We compared the HPLC data to the external standard to determine the quantity of VK present in our sample.

RESULTS

- Preliminary results suggested that the protocol can extract 15.5 mcg/g of VK from kale. This coincides with the limited literature on extraction of VK from edible sources conducted via laboratory techniques.
- Recovery rates of the internal standard have consistently been 80-85%, suggesting that the process is retaining high levels of VK
- HPLC data suggests that the primary extract component found in samples is VK, with very few impurities.





DISCUSSION

- Assuming 15.5 mcg/g is a reproducible extraction amount, a patient would require the extract of 3.2 kg of kale daily to achieve a dose of 50 mg. This amount could potentially be decreased if using oils with high baseline VK content, such as canola oil.
- Further study is needed to determine whether similar efficiency is obtainable by replacing hexanes with edible oils.
- An at-home protocol would be complicated by reproducability, reliability, and burden of obtaining and blending large amounts of kale daily. Consumption of large amounts of oils may also have unintended dietary ramifications.

CONCLUSION

- VK can be extracted and concentrated from kale with kitchen appliances and laboratory solvents, though further validation is needed to determine the reproducibility of this method.
- It is unlikely that an at-home vitamin K extraction protocol will ever be practical for the treatment of LAAR toxicity.
- This collaboration between department of pharmacy practice and the department of pharmaceutical sciences resulted in student project, scholarship opportunities, and exploration of a novel patient care option.

CITATIONS

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