

Quantification of Antioxidant Capacity of Herbal Materials and Commercial Essential Oils

Nicholas Cleffi, Anthony Perillo, Elias Zakko, Dr. Yan Xu

School of Theoretical and Applied Science, Ramapo College of New Jersey, Mahwah, NJ,

Introduction

Herbal materials and essential oils are prevalent in both chemical and physical therapies. These therapies offer benefits through topical application as well as aromatherapy. Despite their widespread use, the lack of FDA approval raises concerns about the safety and efficacy of these products. Manufacturers bear the responsibility of ensuring product quality and validity, yet contamination and adulteration are common challenges.

In response to these concerns, an experimental project was conducted to evaluate the quality of commercial herbal products, with a recognition that there might be an ambiguity surrounding product purity and concentration. The experimental trials focused on assessing the antioxidant capacity of dry herbs and essential oils available on the commercial market, which can be used as an important measure of their quality. Specifically, this project examined three herbal samples (ginseng root powder, lemon balm leaf, and lavender flower) and 18 essential oils commonly utilized in various therapeutic applications sourced from the Amazon website.

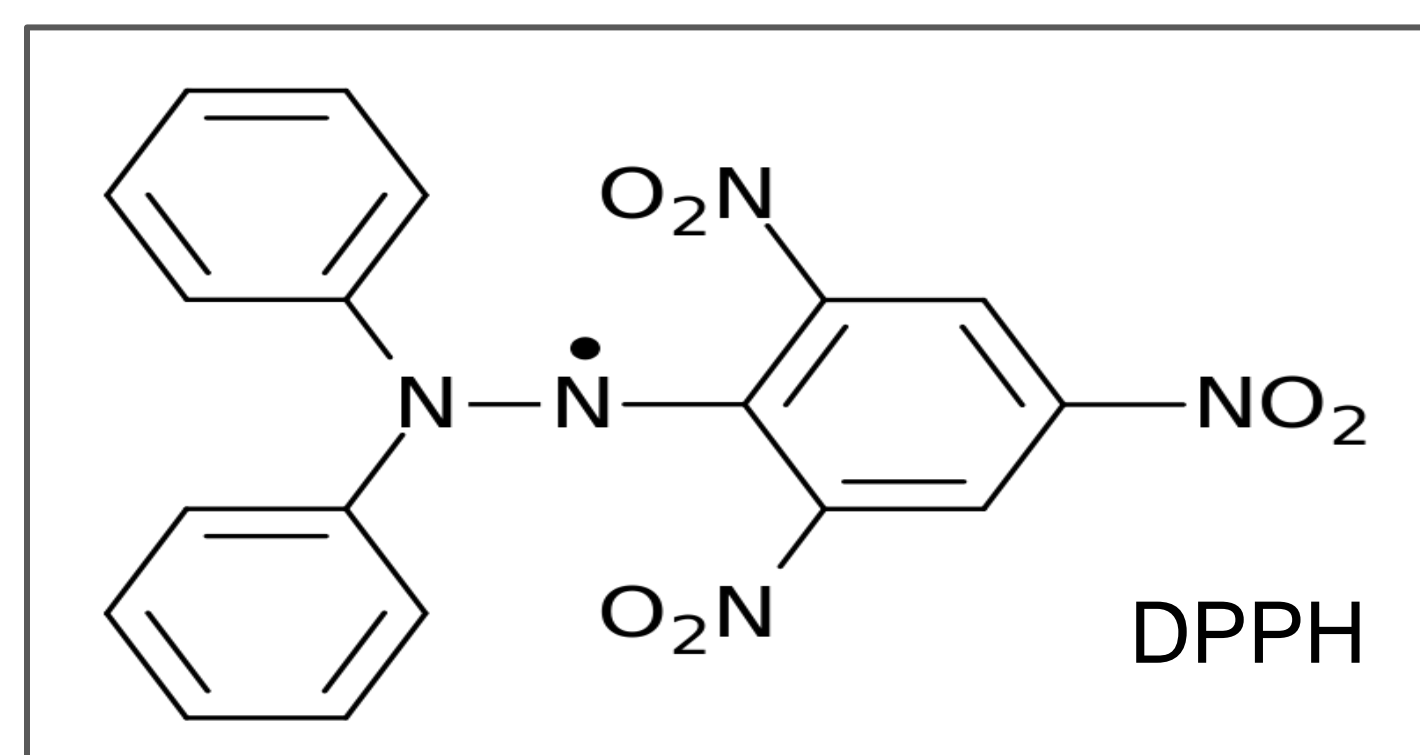
These experimental tests would allow us to determine how much active ingredients were contained in each commercial product, given unknown extraction, purification and dilution processes were involved in their production. Moreover, the results will also provide a quantitative marker for estimating their efficacy in traditional as well as modern medicinal practices.

Methods/Materials

2,2-diphenyl-1-picrylhydrazyl (DPPH) was used as a free-radical provider to interact with compounds carrying antioxidant properties. It was diluted in 100% methanol and then mixed up with dry herb or essential oil samples (diluted in 100% methanol) individually.

The reaction was incubated in the dark for 30 min. The color change (represented as a lower absorbance at 517 nm recorded by a spectrophotometer) of the DPPH solution indicated the scavenging of free radicals by the antioxidants contained in each sample. Pure methanol mixed with DPPH solution was used as the blank.

Percent (%) of inhibition of free radicals is expressed as $(\text{absorbance of blank} - \text{absorbance of sample}) / \text{absorbance of blank} * 100\%$



Results

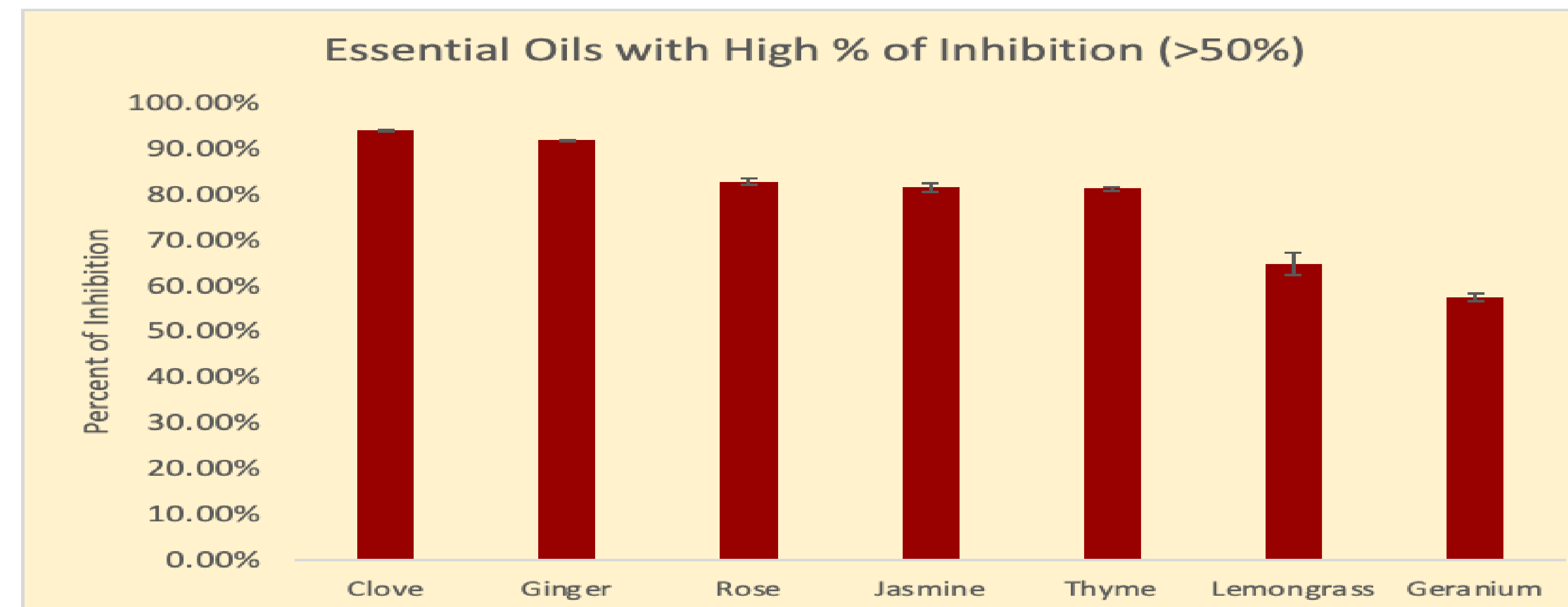


Figure 1. Percent of inhibition of free radicals in DPPH tests in various essential oils (higher than 50%)

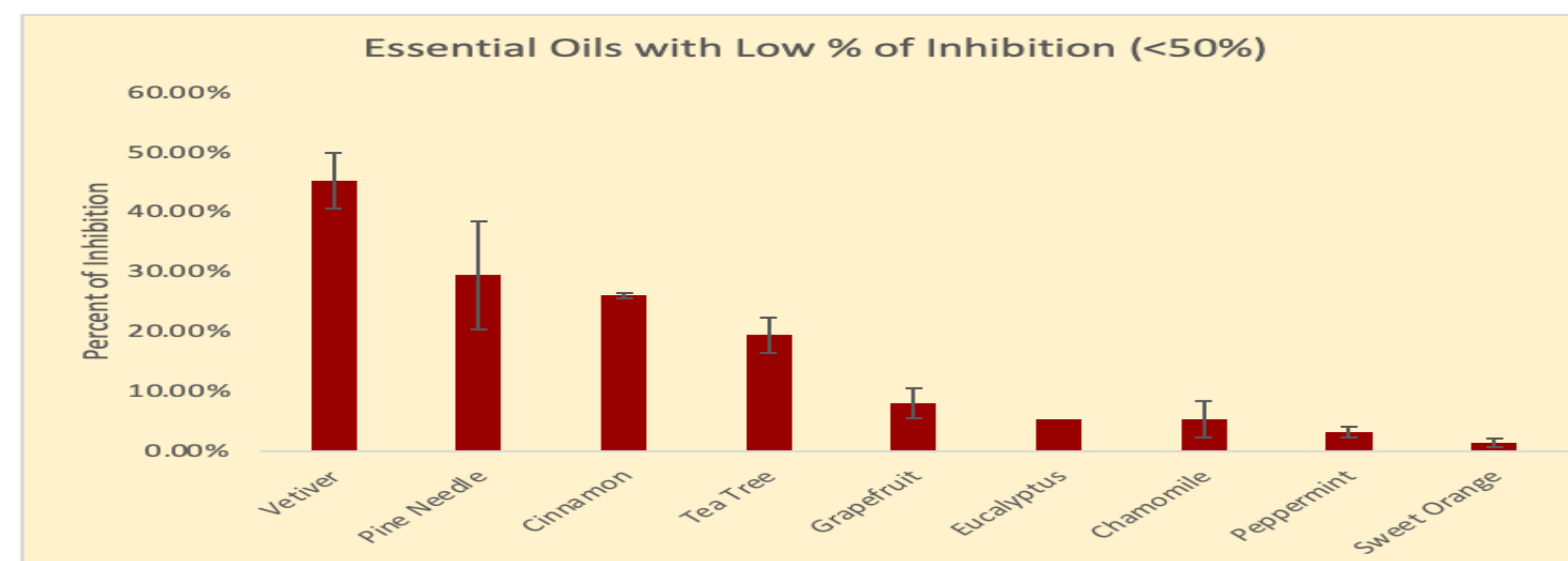


Figure 2. Percent of inhibition of free radicals in DPPH tests in various essential oils (lower than 50%)

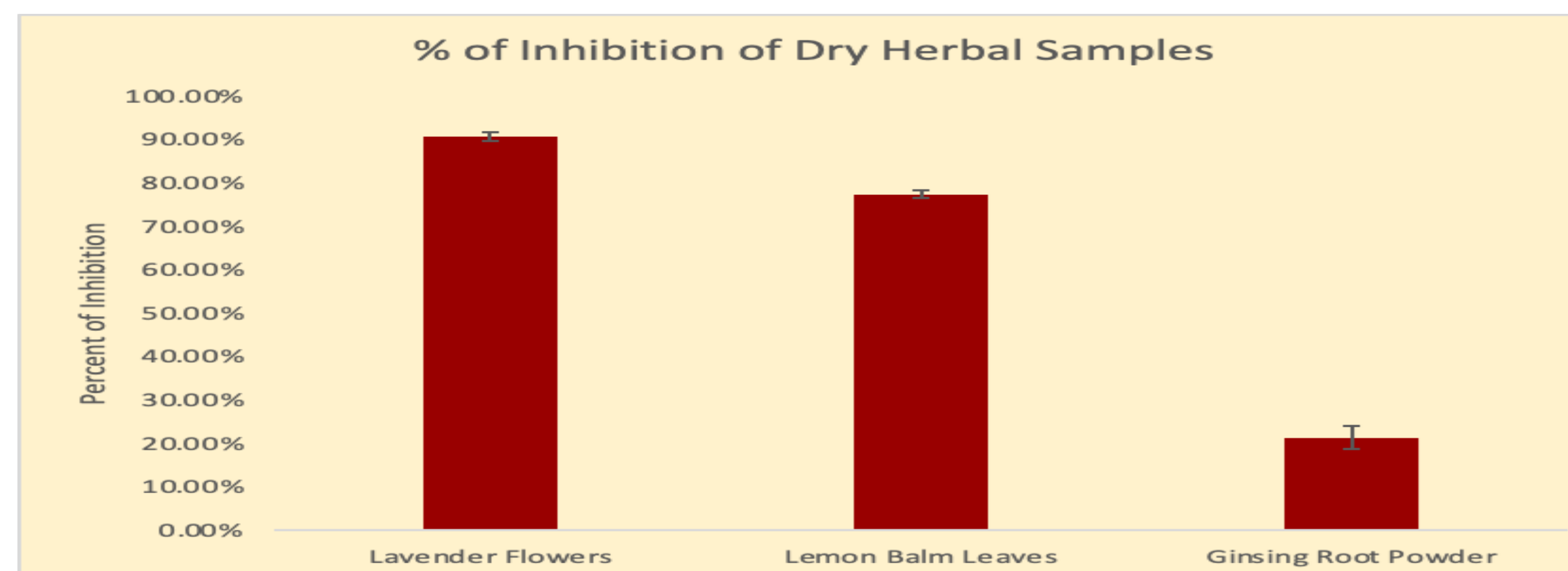


Figure 3. Percent of inhibition of free radicals in DPPH tests in dry herbal samples



Figure 4. Visual color change observed in samples with high percent of inhibition

Discussion

Higher Scale >50%

- Clove and ginger essential oils exhibited remarkably high antioxidant activity showing percent inhibitions of 93.87% and 91.80% respectively.
- Rose and jasmine oils demonstrated significant inhibition of free radicals, with percentages of 82.73% and 81.43%
- Thyme and lemongrass displayed moderate antioxidant capacity, with percent inhibitions of 81.16% and 64.77%
- Geranium oil excited a lower but still notable antioxidant activity, with a percent inhibition of 57.43%

Lower Scale <50%

- Vetiver and pine needle showed comparatively lower antioxidant activity with percent inhibitions of 45.25% and 29.43%
- Cinnamon and tea tree oils displayed moderate antioxidant activity, with percent inhibitions of 26.01% and 19.43%
- Oils with minimal antioxidant capacity included grapefruit, eucalyptus, chamomile, peppermint, and sweet orange, with percent inhibitions ranging from 8.07% to 1.39%

Further Thoughts

- Understand which dried herbal samples and essential oils contain the most potent antioxidant properties and work toward creating innovative treatments relating to health conditions associated with oxidative stress.
- Explore natural alternative strategies from the information collected and identify herbal supplements that can combat free radicals and offer high antioxidant protection, with an aim to reduce reliance on synthetic compounds.



- Incorporation of holistic wellness practices including traditional medicine approaches such as Ayurveda and Traditional Chinese Medicine.
- With these findings practitioners can enhance the efficacy of existing treatments to promote well-being as a whole.

Acknowledgements

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