

Towards a generalization of the dosage of hydroalcoholic tinctures of medicinal plants

Horacio Ramírez-Saldaña¹, Moisés S. Castañeda-Ramírez¹,
José F. Rivas-Vilchis^{1*}.

¹Specialty in Acupuncture and Phytotherapy, Universidad Autónoma Metropolitana at Iztapalapa, México City, México

Corresponding Author: Email: jfrv@xanum.uam.mx

ABSTRACT

Tincture is a liquid pharmaceutical form used for the extraction and preservation of active ingredients present in plants. Hydroalcoholic tinctures are widely used in phytotherapy and homeopathy for the treatment and prevention of various health disorders. The appropriate dosage of tinctures is one of the main issues in their therapeutic use. This study aims to analyze the dosage ranges of tinctures of plants commonly used in phytotherapy and to describe their general dosage patterns using polynomial linear interpolation or spline. The doses of mother tincture of 60 medicinal plants usually used in México were analyzed. The grams of dry drug per day were calculated from the concentration of the tincture w/v (1:5 or 1:10) and the recommended daily dose. The minimum, average, and maximum recommended doses for each plant were calculated in g/day. The frequency of the minimum, average, and maximum doses were analyzed by polynomial linear interpolation or spline. This analysis showed that most tinctures have a dosage range within narrow limits. Besides, the low doses can be grouped into two ranges, while the medium and higher doses into three ranges. Furthermore, the analysis of the dosage range of the sample of tinctures confirmed 2 - 3 dosage subgroups. These dosage ranges are possibly related to the parts of the plants used for making the tinctures and providing different yields. These analyses would allow us to propose a general dosage rule.

Keywords: Medicinal plants, hydroalcoholic tincture, polynomial spline.

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I. INTRODUCTION

Tinctures employ ethanol as a solvent, utilizing its dual solubility in water and lipids to extract a wide range of phytochemicals. First, herbs undergo maceration, facilitating the dissolution of both water-soluble and alcohol-soluble compounds. Ethanol acts as a preservative, extending shelf life by mitigating microbial contamination. The extraction process concentrates bioactive compounds, enhancing the overall potency of the tincture. Not all phytochemicals are equally soluble in ethanol, influencing the spectrum of extracted compounds. The use of pharmaceutical-grade ethanol prevents impurities from impacting the final product. The maceration and ethanol concentration duration must be optimized for maximal compound extraction. [1, 2] Despite many years of systematic study, tinctures and their use still pose many problems for therapeutics. [3, 4] Anyone coming from the outside world and approaching herbal medicine for the first time might wonder why we prepare such a wide variety of herbal medicines in such an essential and similar way. Various factors influence the therapeutic quality when tinctures are used in a pharmaceutical form. Many of the tinctures come mainly from flowering plants or angiosperms.

The use of alcoholic tinctures has persisted for centuries; however, several dilemmas remain:

1. Pharmaceutical: This includes the therapeutic quality of medicinal plant tinctures, their shelf life, and the qualities of different batches.
2. Therapeutical: Individual organic responses are not proportional to an active ingredient, which is initially unknown. Thus, in phytotherapy, the principle between dosage characteristics and plasma concentrations of some plant components is not operative. [5]

Many practitioners of phytotherapy maintain that extracts from whole plants, including tinctures, and not individual components constitute the truly effective remedy, stating that the whole is more effective than the parts.

Some authors maintain no clinical or experimental evidence to support this hypothesis. [6] A tincture cannot be tested for each patient and determined the appropriate dose. Chromatography is often used to compare the product profile with an authentic standard and the product control to check the content of a single component. [7, 8] The different points of view on the therapeutic use of medicinal plants highlight the need for a standardized dosage framework to improve treatments and patient care. A broad reference framework will include diverse traditional and modern methodologies to utilize of the experience accumulated in the different therapeutic approaches.

This study aims to describe the general dosage patterns of alcoholic tinctures of medicinal plants using polynomial linear interpolation or spline.

II. MATERIALS AND METHODS

1. Tincture doses. The doses recommended by international organizations for hydroalcoholic tinctures of 60 medicinal plants commonly used in Mexico were analyzed. The grams of dry drug per day were calculated from the concentration of the tincture w/v (1:5 or 1:10) and the recommended daily dose. Doses lower, average, and higher recommended for each plant were calculated in g/day. The frequency of the lower, medium, and higher doses were analyzed by polynomial linear interpolation or spline.

2. Polynomial linear interpolation or spline analysis. For the spline analysis, the distributions of the low, medium, and high doses of the studied plants were taken, and the polynomial analysis was applied to them, see Figures 1 – 3.

III. RESULTS AND DISCUSSION

The averages and standard deviation of the lowest, medium and highest doses of the plants analyzed are shown in Table 1.

Table 1. Range of dose of 60 medicinal plantas in grams per day

Range of dose	Mean \pm standard deviation
Lower	0.87 ± 0.49
Medium	1.71 ± 1.02
Higher	1.29 ± 0.75

In mathematics, a polynomial interpolated curve or spline is a function defined in partial form by polynomials. The spline is achieved by using polynomial theory. Interpolated curves are used in biomedicine and other disciplines that require design. Spline curves are simple and accurate in construction and allow curve fitting related to pharmacokinetics. We proposed that the levels and phases of herbal doses of hydroalcoholic tinctures can be analyzed by interpolated curves, creating a generalized pattern of tincture dosing. This analysis showed that most tinctures have a dose range within narrow limits. Furthermore, the mean doses can be grouped into three ranges for the medium and higher doses while two ranges for lower doses.

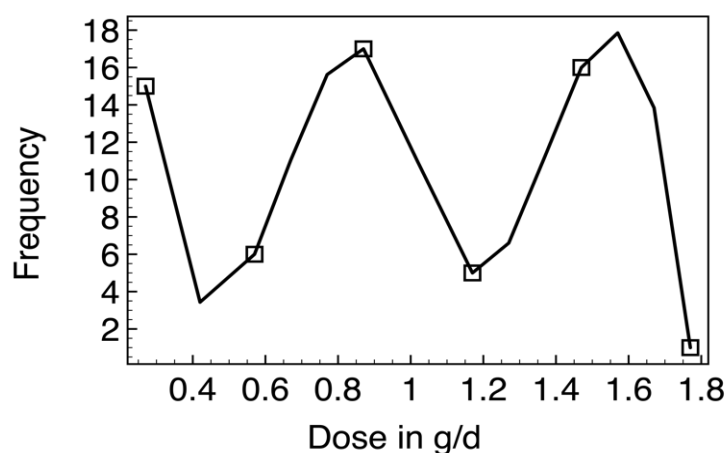


Figure 1. Polynomial linear interpolation or spline of the lower dose range of tinctures of medicinal plants: 0.12 – 1.92 g/d.

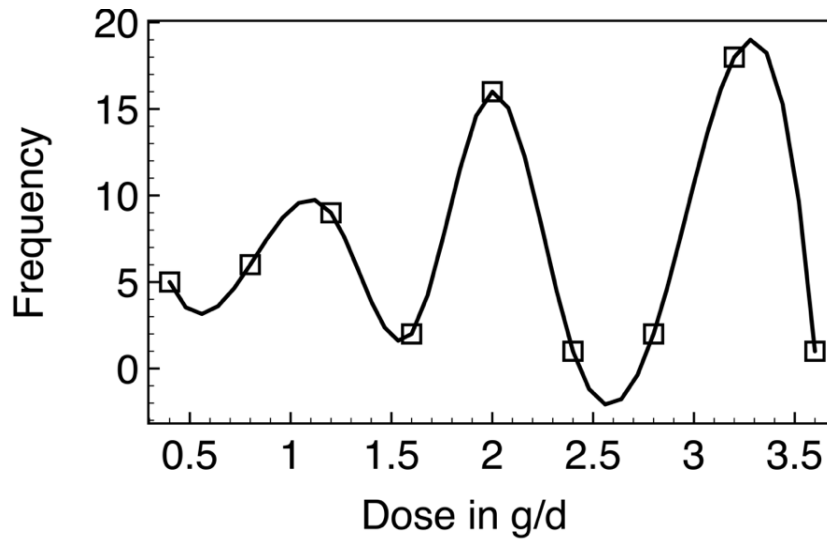


Figure 2. Polynomial linear interpolation or spline of the medium dose range of tinctures of medicinal plants: 0.1 – 2.5 g/d.

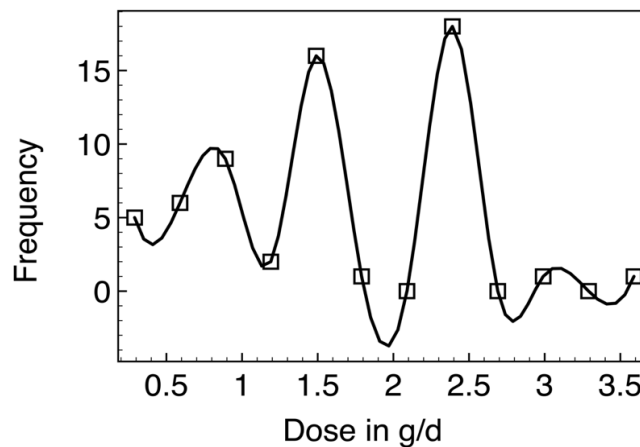


Figure 3. Polynomial linear interpolation or spline of the higher dose range of tinctures of medicinal plants: 0.14 – 3.74 g/d.

Figure 4 shows the adjusted frequency range for the low, medium and high levels of the tinctures analyzed. Two dosage ranges predominate for the low doses, while there are three dosage levels for the medium and high dosage levels.

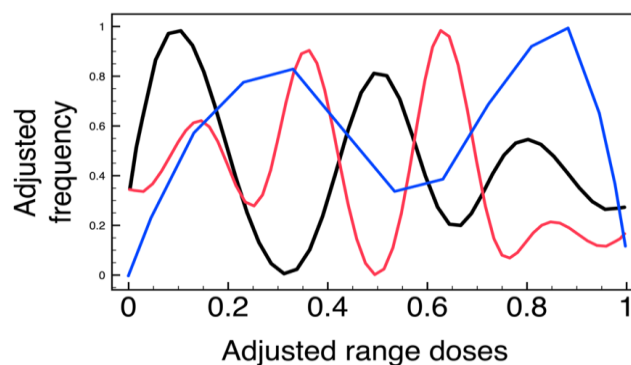


Figure 4. Range of adjusted frequencies for low doses (blue line), average doses (black line), and high doses (red line).

IV. CONCLUSION

Hydroalcoholic tinctures, known as mother tinctures, mostly have a dosage range within narrow limits. Furthermore, the spline model analysis of the dosage range of the sample of tinctures studied showed that there are three dosage subgroups. These dosage ranges are possibly related to the parts of the plants used to make the tinctures and that provide different yields. These polynomial linear interpolation spline analysis model would allow us to study of the general patterns of dosing for hydroalcoholic tinctures and propose a general dosage rule.

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