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Quantification of bioactive compounds in *Coffea arabica* L. and optimization of polyphenol extraction

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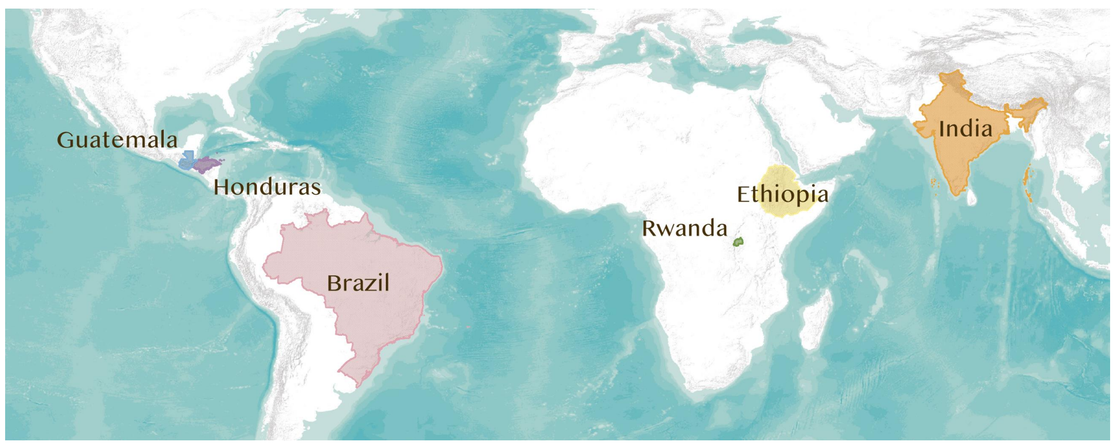
SPOKE 8, WP 1, TASK 8.1.1

INTRODUCTION

Objectives:
- Determine the **metabolic profiles** of **green coffee beans** *(Coffea arabica* L.) from different geographic locations.
- Select the most appropriate **NaDES protocol** (a novel, non-toxic, **eco-friendly solvent**) and optimize different compositions and phenol extraction parameters.
- Test different **extraction techniques**.

MATERIALS AND METHODS



Methods: Green coffee samples from **Brazil**, **Guatemala**, **Honduras**, **Ethiopia**, **Rwanda**, and **India** supplied by *illycaffè* S.p.A. (Trieste).

HPLC-FLD:
- Free Form **Amino acids** *(Fig.1A)*
- **Biogenic amines** *(Fig.1B)*: Putrescine, Spermidine, Spermine, and Tryptamine [1].

HPLC-DAD:
- **Caffeine** and **chlorogenic acids** *(Fig.1C)* are neochlorogenic, chlorogenic, and cryptochlorogenic acid [1].

FOLIN- CIOCALTEU ASSAY- spectrophotometric method :
- **Total Phenols** *(Fig. 3)*:

Four extraction methods [2] were tested:
- Ethanol 70%,
- Methanol 95%
- Hot water (100°C)
- NaDES (betaine and glycerol 1:2)

RESULTS

High concentrations of **acidic amino acids** (Fig.1A) and **chlorogenic acid** (*Fig. 1C*) were consistently observed across the samples, aligning with the expectation for arabica coffee.

The data shows **high** concentrations of **Putrescine** (Fig.1B) followed by Spermidine, Spermine, and Tryptamine.

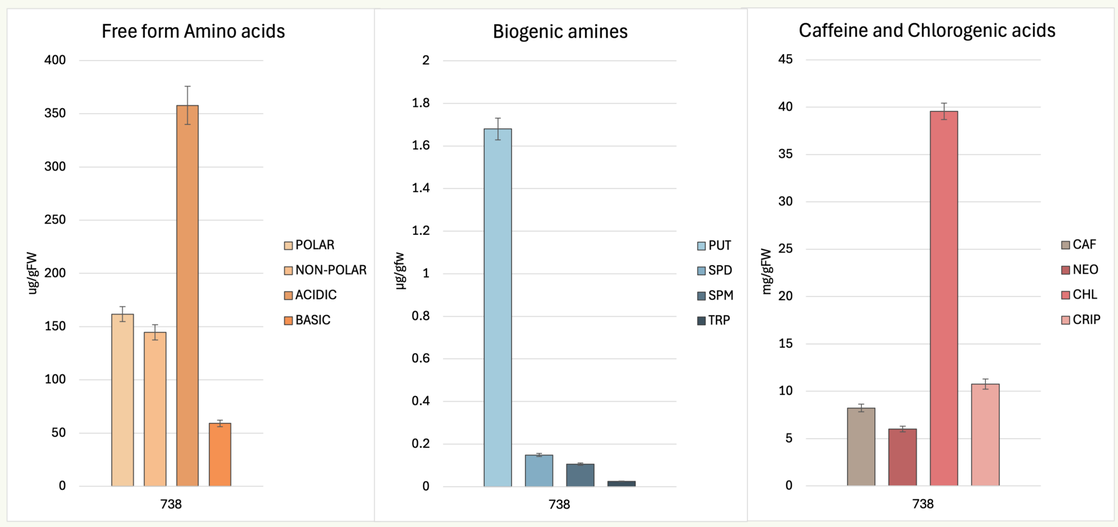


Fig. 1. Example of characterization of one of the Brazilian samples (738) **:[A]** Amino acids grouped as follows: POLAR (ser, thr, tyr), NON-POLAR (gly, ala, pro, val, met, ile, leu, phe), ACIDIC (asp, glu), BASIC (hys, arg, lys); **[B]** Biogenic amines: Putrescine (PUT), Spermidine (SPD), Spermine (SPM) and Tryptamine (TRP), **[C]**Caffeine (CAF), Neochlorogenic acid (NEO), Chlorogenic acid (CHL) and Cryptochlorogenic acid (CRIP) in green coffee samples.

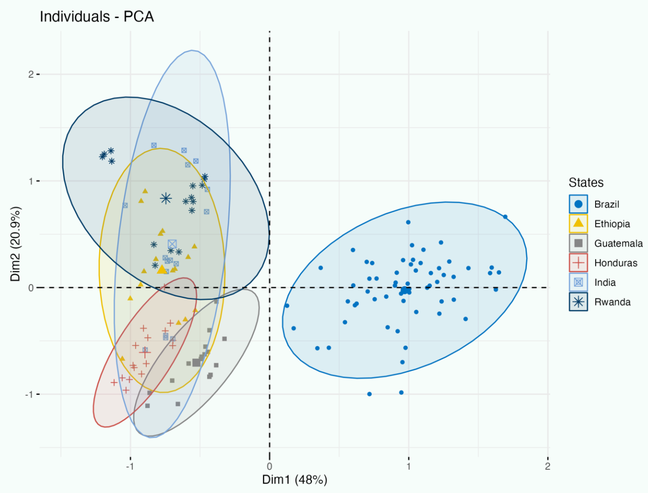


Fig. 2. Discrimination of coffee samples with different geographical origins using Principal Component Analysis.

The data obtained showed **variations** in **biochemical composition** among the samples.

Principal Components Analysis revealed a distinct **clustering** of the samples from **Brazil** and a separation of **Rwanda** from **Honduras and Guatemala**, which exhibited similar chemical patterns.

Hot water consistently exhibited **higher performance** for total phenol recovery, followed by **NaDES** (betaine-glycerol).

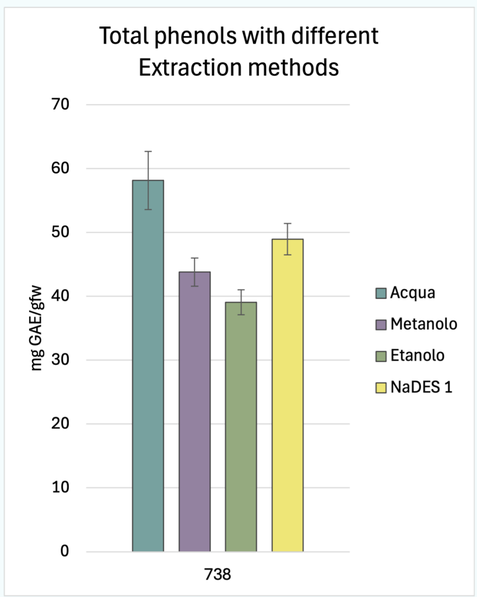


Fig 3. Total Phenols in one sample (738) extract obtained from hot water, ethanol 70%, methanol 95%, and NaDES 1. The data represents the average of replicates ± the sd. GA: gallic acid.

REFERENCES

[1] M. Ferri *et al.*, "Recovery of polyphenols from red grape pomace and assessment of their antioxidant and anti-cholesterol activities," *N Biotechnol*, vol. 33, no. 3, pp. 338–344, May 2016, doi: 10.1016/j.nbt.2015.12.004.
[2] S. Monari, M. Ferri, B. Montecchi, M. Salinitro, and A. Tassoni, "Phytochemical characterization of raw and cooked traditionally consumed alimurgic plants," *PLoS One*, vol. 16, no. 8 August, Aug. 2021, doi: 10.1371/journal.pone.0256703.

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