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COMPREHENSIVE ANALYSIS OF FODMAP CONTENT IN PORTUGUESE FOOD PRODUCTS WITH PRELIMINARY STUDIES ON FRUITS AND VEGETABLES

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INTRODUCTION & AIM

Fermentable Oligosaccharides, Disaccharides, Monosaccharides, and Polyols, commonly referred to as **FODMAP**, can aggravate symptoms of various gastrointestinal (GI) conditions, such as **irritable bowel syndrome** (IBS)(1). Patients with these conditions often need to follow a **low-FODMAP diet**, requiring knowledge of FODMAP composition. FODMAP are found in both natural sources, such as fruits and vegetables (1); and industrial sources (ingredients and additives) (2). This study aimed to analyze the FODMAP composition of Portuguese fruits and vegetables to support dietary recommendations for individuals with GI impairment.

METHOD

This experimental study was carried out between October 2022 and August 2023. We carefully selected a diverse range of vegetables and fruits of Portuguese origin to be included in our sampling (N=76). The vegetable selection comprised 17 varieties and the 4 fruit varieties samples are shown in Figure 1.

The sampling protocol included only national varieties, excluding regional ones.

Fresh samples were collected from greengrocers and supermarkets.

FODMAP content was determined for all raw samples, as well as for those typically consumed cooked in Portugal according to traditional cooking practices.

The sample preparation and analytical method is illustrated in Figure 2.

Figure 1. Selection of vegetables and fruits included in this study.

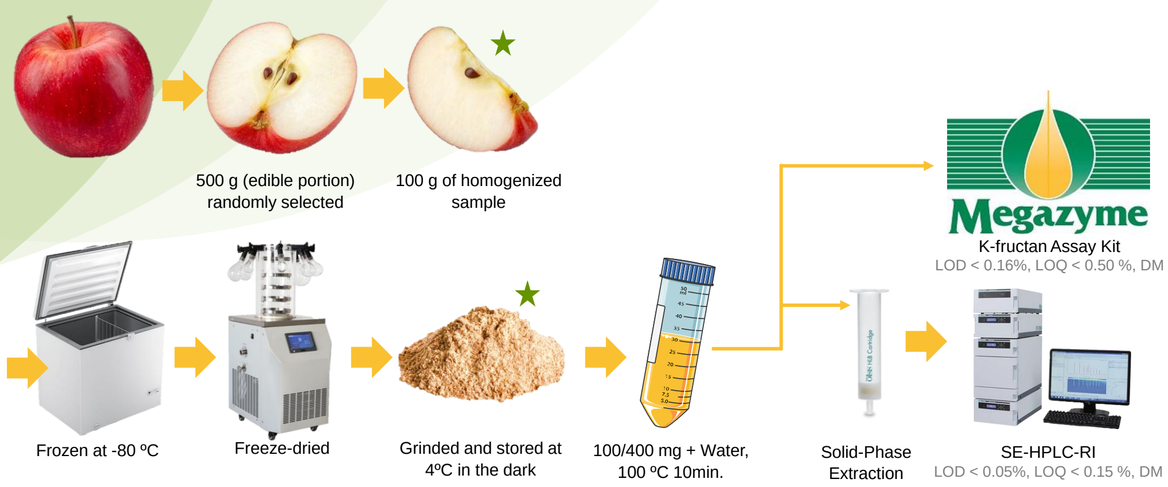

Figure 2. Sample preparation, extraction and analytical protocols used in this study.

★ Relative moisture content (%) determination points at 105 ºC.

The results were expressed as g per 100g of fresh weight (FW) and represented as average values ± standard deviation. Previously published cutoff FODMAP values were used for discussion (3). Descriptive statistics and analysis of variance (ANOVA) were performed at 95% confidence interval ($p \leq 0.05$), using IBM SPSS Statistics (Version 29.0).

RESULTS & DISCUSSION

Regarding fructan content, high amounts were found in **red onion** (1.47±1.18 g/100g), **white onion** (0.52±0.00 g/100g), and **Royal Gala apple** (1.77±0.07 g/100g), all expressed in FW (Figure 3).

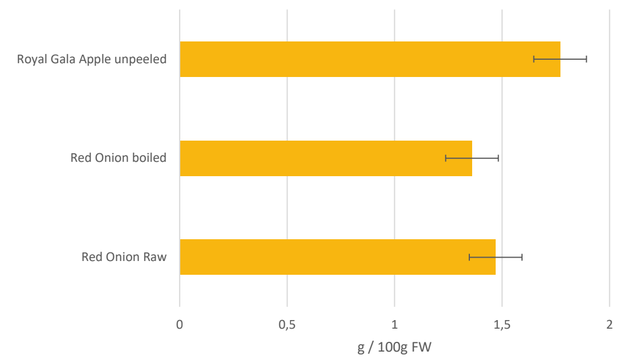

Figure 3. Average fructan content in the samples above the cutoff of 1g/100g of FW.

The results of our study regarding the fructan content of onions are coherent with the literature, but we observed differences in apples (4).

Broccoli, **red capsicum**, **zucchini**, **"Rocha" pear**, and **"Royal Gala" apple** showed **high fructose** concentrations compared to all the other samples (Figure 4A). Significant amounts of sorbitol were found in **pear** and **apple** (2.19±0.12 and 0.31±0.11 g/100g, respectively) (Figure 4B).

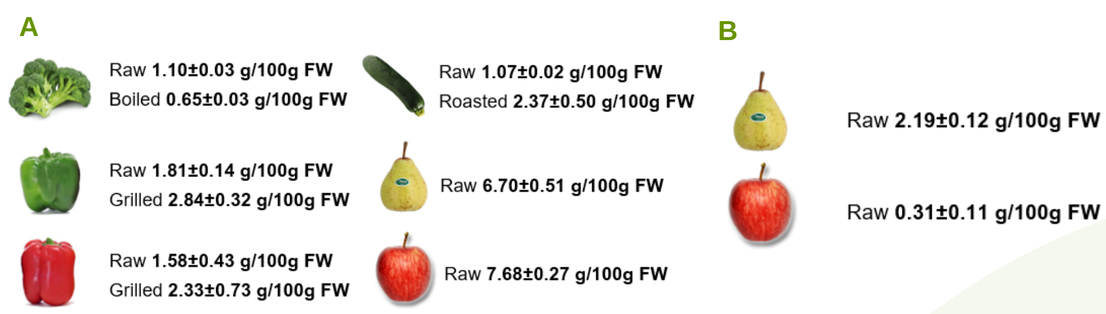

Figure 4. Average levels of Fructose (A) and Sorbitol (B) in samples with high concentrations.

These findings corroborate data from other studies already published (4). Additionally, there were significant variations in FODMAP content between the fruit clusters, namely fructose, excess fructose, sorbitol, mannitol, raffinose, nystose and kestose ($p<0.05$). Significant differences were also found between raw and cooked samples in vegetables ($p<0.05$).

CONCLUSION

The results were consistent with global data and provide a solid basis for developing a database on the FODMAP content of Portuguese foods and the best cooking techniques to minimize FODMAP content.

However, they also highlight the significant variability in natural products, particularly due to differences in maturation, underscoring the need for a wider range of samples to obtain consistent results.

ACKNOWLEDGMENTS

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