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Influence of Coffee Silverskin, Caffeine and 5-Caffeoylquinic Acid on Sugar Uptake Using Caco-2 Cells: A Preliminary Study †

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Abstract: A single paragraph of about 100 words to give a brief introduction to your work.

Keywords: keyword 1; keyword 2; keyword 3 (List three to ten pertinent keywords specific to the article yet reasonably common within the subject discipline.)

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Coffee silverskin (CS) is the major by-product of coffee roasting and a source of caffeine and chlorogenic acids (CGA), recognized modulators of sugar metabolism [1,2].

In this work, the effect of a CS extract on glucose and fructose uptake by human intestinal epithelial (Caco-2) cells was ascertained. Freeze-dried aqueous extracts were prepared using an ultrasound probe. The obtained powder was characterized regarding its caffeine content and CGA profile by RP-HPLC-DAD [2]. Caco-2 cells were incubated (37 °C, 24 h) with 1 mg/mL of extract and then glucose and fructose uptake were measured by incubating the cells (37 °C, 6 min) with 10 nM ^{3}H-deoxy-D-glucose (^{3}H-DG) or 100 nM ^{14}C-fructose (^{14}C-FRU), respectively [3]. The effects of the major compounds identified were similarly assessed using standards, individually and combined. Furthermore, the mRNA levels of intestinal transporters of these sugars (SGLT1, GLUT2, and GLUT5) were quantified by RT-qPCR after cell treatment (24 h) with CS extract [4].

Caffeine was the main component of the extract and 5-caffeoylquinic acid (5-CQA) the major CGA, followed by 5-feruloylquinic acid (5-FQA). Other isomers were found in minor amounts (3-CQA, 4-CQA, and 4-FQA). CS was able to reduce significantly ^{3}H-DG and ^{14}C-FRU uptake (~17% and ~19%, respectively). These effects were not related to cytotoxicity, as confirmed by the lactate dehydrogenase assay. When testing individual compounds at the concentrations present in the extract, neither caffeine nor 5-CQA influenced ^{3}H-DG and ^{14}C-FRU uptake, but significant inhibitions were found when combined (~16% and ~18%, respectively). This synergistic activity suggests their major role on CS effects. The extract also decreased the expression levels of GLUT2 transporter in ~71%, without influence on SGLT1 and GLUT5 transporters, thus evidencing the importance of GLUT2 on sugars uptake results. Overall, these findings highlight the beneficial effects that CS might have on type 2 diabetes and other metabolic disorders.

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References

1. Alves, R.C.; Casal, S.; Oliveira, B. Benefícios do café na saúde: Mito ou realidade? *Química Nova* **2009**, *32*, 2169–2180, doi:10.1590/s0100-40422009000800031.
2. Puga, H.; Alves, R.C.; Costa, A.S.; Vinha, A.F.; Oliveira, M.B.P.P. Multi-frequency multimode modulated technology as a clean, fast, and sustainable process to recover antioxidants from a coffee by-product. *J. Clean. Prod.* **2017**, *168*, 14–21, doi:10.1016/j.jclepro.2017.08.231.
3. Andrade, N.; Silva, C.; Martel, F. The effect of oxidative stress upon intestinal sugar transport: An in vitro study using human intestinal epithelial (Caco-2) cells. *Toxicol. Res.* **2018**, *7*, 1236–1246, doi:10.1039/c8tx00183a.
4. Andrade, N.; Araújo, J.R.; Correia-Branco, A.; Carletti, J.V.; Martel, F. Effect of dietary polyphenols on fructose uptake by human intestinal epithelial (Caco-2) cells. *J. Funct. Foods* **2017**, *36*, 429–439, doi:10.1016/j.jff.2017.07.032.