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Effect of boiling and simulated digestion on the total phenol, total flavonoid and antioxidant activity of commonly consumed legumes in Sri Lanka

A. Deen¹, R. Visvanathan¹, I. Rathanayaka¹, B. C. Jayawardana² and R. Liyanage^{1*}

¹Laboratory of Nutritional Biochemistry, National Institute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka.

²Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka.

*ruvini.li@nifs.ac.lk

Legumes are considered as a rich source of proteins, complex carbohydrates (dietary fibers), minerals and vitamins. Owing to the fact, above legumes hold a special place in vegetarian diet. In addition, legumes are gaining attention due to their extraordinary health benefits. These health benefits are attributed to the presence of numerous bioactive compounds in legumes. Antioxidants are one such important bioactive compound present in legumes. However, processing and gastrointestinal digestion may alter the bioavailability of antioxidants in legumes. Hence, this study focuses on the effect of boiling and simulated digestion on the antioxidant capacity, phenolic and flavonoid content of chickpea, mung (MI6), cowpea (Waruni), cowpea (Dawala) and horse gram (Kollu). The raw and boiled legume samples were digested by using synthetic gastrointestinal enzymes (pepsin, pancreatin, bile extract). The total phenol (TP) content and total flavonoid (TF) content in experimental legume samples were assessed using Folin-ciocalteu method and Aluminium chloride colorimetric method, respectively. The antioxidant activity in experimental legume samples were determined using DPPH (2,2-diphenyl -1 -picrylhydrazyl), ABTS (3-ethylbenzothiazoline-6-sulphonic acid) and FRAP (Ferric reducing power) methods. All the experiments were carried out in triplicate and three factor factorial model was used to analyze the data and the level of $p \leq 0.05$ was considered significant. According to the results it shows that boiling and simulated digestion modulate the bioavailability of antioxidants and their activity. Among the raw samples, Horse gram (Kollu) showed the highest ($p \leq 0.05$) amount of phenolics (20.66 ± 1.58 mg GAE/g), highest ($p \leq 0.05$) Fe^{3+} reducing activity, ABTS and DPPH radical scavenging activity while cowpea (Dawala) showed the lowest amount of phenolics (13.59 ± 0.1 mg GAE/g) and lowest ($p \leq 0.05$) antioxidant activity. However, upon boiling, studied legumes showed ($p < 0.05$) a reduced bioavailability of TP, TF content and reduced antioxidant activity. When considering the simulated digested samples, boiled legumes showed a significant increase ($p \leq 0.05$) in TF, TP content and antioxidant activity compared to raw samples. *In-vitro* digested, boiled Mung and horse gram had the highest Fe^{3+} reducing activity (233.90 ± 13.10 mM/ Fe^{2+} g⁻¹ / 233.68 ± 37.82 mM/ Fe^{2+} g⁻¹) and ABTS radical scavenging activity (621.83 ± 16.77 μ molTE/g / 363.34 ± 10.34 μ molTE/g). Hence, the overall results reveal that the processing and simulated digestion modulate the bioavailability of TF, TP and the antioxidant activity of above five selected legumes. Bioavailability of phenols and flavonoids were high ($p \leq 0.05$) in horse gram and mung bean compared to other legumes.

Keywords: Antioxidant Activity, Bioavailability, Flavonoids, Simulated digestion, Phenol

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