Abstract

Thesis Title: *Nutrient Composition and Digestibility of Chloroplast Rich Fractions from Green Leaf Materials*

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Green leaf material is recognized as a good source of many valuable nutrients including vitamins, fatty acids and minerals. Chloroplast-rich-fractions (CRFs) were prepared from green plant species and their nutrient composition compared with the whole leaf materials (WLMs). Digestibility of CRFs from spinach was also compared with the WLM using simulated *in vitro* oral, stomach and small intestinal conditions. The impact of pancreatic lipase-related protein 2 from guinea pig (gPLRP2) on the hydrolysis of galactolipids compared to neutral lipid, Tributyrin was subsequently determined *in vitro*. Porcine pancreatic lipase was also used against the same substrates compared to gPLRP2. Furthermore, spinach CRFs and WLMs were fed to zebrafish and the impact of CRFs and WLMs on growth performance and transition of certain compounds into zebrafish body was evaluated.

Results indicated that compared with the WLM, the CRFs were enriched in more lipids and fatty acids, and more proteins and amino acids. Spinach CRFs possessed the highest α-tocopherol (62 mg 100 g^{-1} , dry weight (DW)), β-carotene (336 mg 100 g^{-1} DW) and lutein

(341 mg 100 g^{-1} DW) contents, whilst grass CRFs had the highest alpha-linolenic acid (ALA) concentration (69.5 mg g^{-1}). Of the minerals, iron was most notably concentrated in CRF.

The digestive conditions caused changes in the structure and composition of the material providing some indication of its digestibility and bioaccessibility.

Whilst PLRP2 was more active on galactolipids, with moderate reaction against the neutral lipid, pancreatin indicated higher activity on Tributyrin with almost no activity against MGDG.

Diets with 10% zebrafish meal reduction improved growth rate with significant reduction in feed conversion ratio (FCR) compared to the control. CRFs diets showed greater ALA content and distinct pigmentation of zebrafish egg and flesh due to the CRF carotenoids.

Overall, the results indicated that CRF is a potential digestible source of vital nutrients.