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Hepatic lipid composition in dietary models of high iron NAFLD investigated with Synchrotron Infrared and X-Ray Fluorescence microscopy

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Hepatocytes are essential for maintaining homeostasis of mammalian iron and lipid metabolism. Serious health consequences have been linked to dysregulation of both areas. One such consequence is non-alcoholic fatty liver disease (NAFLD). Approximately 30% of individuals with NAFLD demonstrate a moderate increase in hepatic iron; however, the mechanism and metabolic consequences remain under-investigated. We assessed the metabolic consequences using mice fed either a control or high fat (HF) diet, with or without high iron. Attenuated Total Reflection Infrared Microscopy (Macro-ATR) at the Australian Synchrotron was used to investigate lipid composition and distribution, and X-Ray Fluorescence Microscopy (XRF) at the Diamond Light Source (UK) was used to determine subcellular iron concentration and distribution. Peri-portal hepatocytes of HF fed animals exhibited elevated lipid parameters, including ester and free fatty acid concentrations ~7x that of controls (P<0.005). The increase was seen within lipid droplets, which were primarily composed of cholesteryl esters and triglycerides. When HF livers were iron loaded, reductions in all lipid parameters were observed, with ~2.6x lower relative ester concentration (P<0.05) compared to HF only. Iron loaded HF peri-portal hepatocytes exhibited shorter chain lengths (P<0.005) and a shift in the olefinic peak (3011 cm-1) compared to HF (3007 cm-1) (P<0.05), suggesting the shorter chains were more polyunsaturated. Iron accumulated within mitochondria of peri-portal hepatocytes of animals fed high iron diets. Poly-unsaturated lipids are strong activators of hepatic lipid breakdown and this study suggests a role for iron in reducing the lipid burden by remodelling hepatic lipids in NAFLD.

Level of Expertise

Student

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

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