# A 7 Day Low v High Glycaemic Index Diet Reduces Liver Fat Content

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**Background:** Glycaemic index (GI) is a way of ranking carbohydrates according to the postprandial effect on blood glucose levels and has received increasing interest in recent years [1, 2]. Low glycaemic index diets have been considered potentially beneficial in diabetes, coronary heart disease and obesity [3] and cohort studies have shown correlations between dietary glycaemic index and non-alcoholic fatty liver disease (NAFLD) [4]. $^{1}$H MRS provides a powerful, well validated method of measuring liver fat fractions non-invasively with numerous benefits over biopsies [5]. In this study, the effects of 7 day low (LGI) v high (HGI) glycaemic index diet on hepatic lipid stores were investigated using $^{1}$H MRS.

**Study design:** After obtaining ethical approval, 8 healthy males were recruited following informed consent (sedentary, non-smokers, no metabolic disorders, Age=20.1±0.4 yr, BMI=23.0±0.9 kg m$^{-2}$). Subjects were investigated using a two way randomized cross over study design with a 7 day HGI v LGI dietary intervention and >4 week washout (isocaloric, Fat =28%, Protein=12%, CHO = 61%, [6]) (Fig 1). Subjects were provided with all foods for the diet week and underwent pre and post diet study test days.

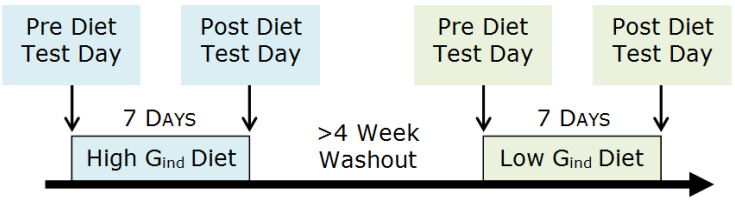


Figure 1. Study Design Overview.

**Test Day:** During the test day subjects arrived at the test centre between 7:30 and 8:30am and were fasting from 10pm the previous evening. $^{1}$H MRS were acquired for fasted liver lipid measurements, after which subjects consumed either a HGI or LGI test breakfast . Blood samples were taken regularly for the following 300 minutes to confirm glycaemic response and a final $^{1}$H MRS scan was taken at the end of the test day at t = 360 minutes.

**MR Protocol:** All measurements were performed on a Philips Achieva 3T scanner and $^{1}$H MRS acquired using a Philips XL torso coil. Scout images were obtained and used for voxel placement (30x30x30mm). $^{1}$H MRS were obtained using a respiratory triggered, water suppressed, PRESS sequence with varying TE (BW=2 kHz, samples=1024, TR=5000ms, NSA=40, TE=40ms, 50ms, 60ms, 80ms, total scan ~10 mins). A water unsuppressed spectrum was acquired with half the averages as an internal reference peak to determine lipid fat fractions. Spectra were phase corrected and the area of the main $CH_2$ peak (~1.3 ppm) and water peak were quantified using a peak fitting algorithm. Fat fractions were calculated using standard formula described previously [7] and corrected for $T_2$ relaxation using the spectra acquire at varying TE

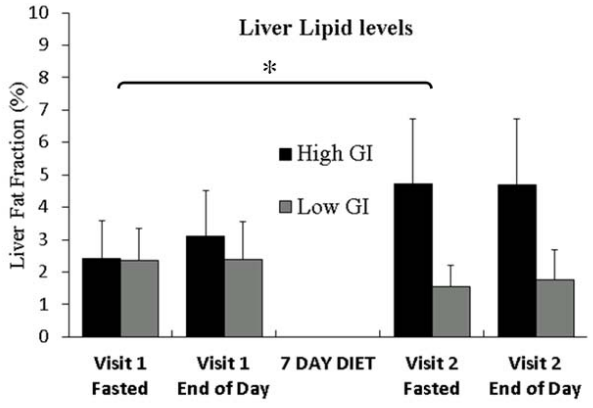


Figure 2. Changes in Liver Lipid levels *P<0.05

**Result:** Blood samples confirmed a high and low glycaemic response for respective test meals. On the pre diet test day, fasted liver fat fractions were consistent for both HGI and LGI arms (HGI = 2.4 ± 1.2 %; LGI = 2.4 ± 1.0 %; P = 0.82) and end of day lipid levels were within error of fasted levels (FIG 2). Following the 7 day diet, fasted liver fat fractions increased for HGI (4.7 ± 2.0 %) compared with LGI (1.6 ± 0.7 %) reaching statistical significance (two way F-test, P < 0.05) and this effect was consistent across the test day.

**Conclusions:** This study used a simple MRS protocol to show the beneficial impact on liver lipid levels of a LGI compared with HGI diet after only 7 days. This is consistent with other cohort studies [4] and has important applications in the prevention and control of metabolic disease. Further studies should explore longer term interventions and patient groups.

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**1**.Jenkins D.J.A. *et al.*, Am J Clin Nutr (1981) 34, 362-366; **2**.Foster-Powell K. *et al.*, Am J Clin Nutr (2002) 76, 5-56; **3**.Jenkins D.J.A. *et al.*, Am J Clin Nutr (2002) 76, 266s-273s; **4**.Valtuena S. *et al.*, Am J Clin Nutr (2006) 84, 136-142; **5**.Hamilton G. *et al.*, Nmr in Biomedicine (2011) 24, 784-790; **6**.Morgan L.M. *et al.*, Brit J Nutr (2012) 108, 1286-1291; **7**.Stephenson M.C. *et al.*, NMR in Biomedicine (2013) 26, 1518 - 1526;