



Metabolomics

The delivery of our science strategy depends on the use of a Systems Biology approach. Here we will focus on maintenance and development of a state-of-the-art capability in transcriptomics, proteomics and metabolomics and the promotion of best practice across the range of our activities.

Human studies with the IFR metabolomics platform

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G Le Gall^{1-5*}, E.K. Kemsley^{a 1,3,5}, L.J. Harvey^{a 1}, J.R. Dainty^{a 1,3}, A.C.S. Polley^{a 2}, L.C. Oliveira^{a 2}, I.T. Johnson^{a 2}, J.M.H. Bennett^{a 4}, M. Rhodes^{a 4}, E.K. Lund^{a 4}, B. Teucher^{a 3}, J.E. Arsenault^{c 5}, K.H. Brown^{c 5}, D.L. de Romana^{d 5}, M.E. Penny^{d 5}, S.J. Fairweather-Tait^{a 1,3,5} and I.J. Colquhoun^{a 1-5}

^aInstitute of Food Research, Norwich, NR4 7UA, UK

^bBUPA Hospital Norwich, Colney, Norwich NR4 7TD

^cUniversity of California Davis, One Shields Avenue, Davis, CA, 95616, USA

^dInstituto de investigación nutricional, La Molina, Lima, Perú
Superscript numbers correspond to the study number in this poster

Introduction

- Determining the role of diet in metabolic regulation is a key scientific objective of nutrition.
- The IFR has a long experience with diet interventions on human volunteers. As many as twelve studies can take place simultaneously during a given year. We also have international collaborations.
- We have undertaken ¹H NMR and LC/MS based metabolomics on samples from a number of studies from both IFR and elsewhere. They are briefly surveyed in the present poster.

1: CuGenes study (IFR H2)

- Aim: Could an increase in dietary copper intake could be detected?
- Six healthy male volunteers were given a daily copper supplement of 6mg/d for 6 weeks. 24 hour urines were collected
- ¹H NMR was performed and genetic algorithm applied to search for subsets of useful spectral features.

Results:

1. INTERINDIVIDUAL VARIANCE

Urine profiles from all volunteers could be separated using only a few variables (N-acetyl from proteins, trimethylamine, glycine, alanine and citric acid).

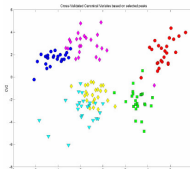


Figure 1. Separation of the 24 urines from six volunteers (CVA on 5 variates)

2. COPPER EFFECT

- No model could be found to distinguish pre- and post-intervention samples when all the volunteers were included.
- Models on each individual highlighted that taurine levels changed for four volunteers and that they were correlated slightly with changes in levels of bile acids. Levels increased for two volunteers and decreased for the other two. The discussion is in progress.

2: BORICC study (IFR G1)

- Aim: Assess a potential correlation between profiles of patients having consulted for a bowel disorder (but subsequently cleared) and their reported fruit and vegetable intake.
- Results: Urinary analysis was performed by ¹H NMR. Preliminary results indicate that a significant (p 0.05) decrease of creatinine is observed for the group with the highest fruit and vegetable intake. Also hippuric acid levels tend to increase for this group.

Future work

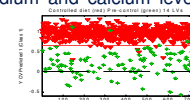
- Effects of pre and probiotics on post menopausal volunteers (INDUSTRY)
- Flavonoids intake from lactose tolerant and intolerant volunteers (IFR H1)
- Isoflavones and selenium intake to reduce the risk of breast cancer (UEA)
- Effects of high dose of zinc on healthy adults (UCDavis)
- Effects of fish intake on the fecal waters of healthy volunteers and volunteers with gastrointestinal tract conditions (EU Framework 6+ FSA)

3: OSTEODIET study (IFR H2)

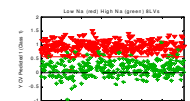
- Aim: Follow the ¹H NMR urinary metabolite profile of 17 post menopausal volunteers consuming controlled diets (4 way crossover design) to study the effects of altered sodium and calcium levels. 722 urines were analysed.

Results:

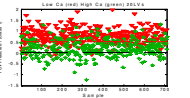
1. Urine profiles separating all volunteers were successfully modelled using only a few variables (same as for the Cugenes study)
2. Free choice diet could be distinguished from controlled diet (Figure 2)
3. GA and PLS-DA differentiated high and low sodium intake (Figure 3)
4. The modelling of the differentiation between the high and low calcium intake was not successful (Figure 4)
5. The data analysis is in progress. Plasma samples also available and LC/MS experiments under consideration.



Key: Free Controlled
Figure 2. PLS-DA model for free vs controlled diet



Key: High Na Low Na
Figure 3. PLS-DA model for sodium intake



Key: High Ca Low Ca
Figure 4. PLS-DA model for calcium intake

4. Laparoscopic Adjustable Gastric Banding study (IFR G1/ BUPA)

- Aim: following the plasma profile of 7 morbidly obese patients during weight loss after Laparoscopic Adjustable Gastric Banding (LAGB) .

5: Zinc supplementation of Peruvian infants (IFR H2, Univ California Davis & Lima, Peru)

- Aim: Could dietary zinc intake be detected in plasma and urine ¹H NMR spectra?