



ARE YOU WHAT YOU EAT?
IAS TECHNICAL REPORT NO. 99/04

INSTITUTE OF APPLIED SCIENCES
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By

Prof. Bill Aalbersberg

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ARE YOU WHAT YOU EAT?

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The aim of the ongoing research process reported here is to determine how well what people eat over a long period of time can be determined from stable isotope ratios of hair, ear-wax, breath and saliva samples. The proportion of heavy isotopes in food depends on where the food came from and its position in the food chain. For instance, marine seafood has a relatively high proportion of ^{15}N compared with other protein sources. With plants the proportion of ^{13}C depends on the biochemistry of photosynthesis. Plants such as cane sugar and maize have more ^{13}C whilst most other plants have relatively less. Carbohydrate has more ^{13}C than fat.

Polynesian New Zealanders have a high predisposition to obesity which may reflect an evolutionary development of more efficient fat deposition. In a previous study (Rush et al, 1999) it was hypothesised that NZ Polynesian women would oxidise relatively more carbohydrate than their European counterparts both at rest and during exercise. Study subjects were 39 Polynesian and 40 European healthy female volunteers aged between 18 and 27 y with a wide range of fatness. Metabolic fuel mix was assessed from the respiratory exchange ratio (RER) and the proportion of ^{13}C in expired breath ($^{13}\text{CO}_2/^{12}\text{CO}_2$) at rest and during three levels of exercise. Seven-day diet diaries were used to assess dietary intake of carbohydrate, fat and ^{13}C enriched sugars. Resting $^{13}\text{CO}_2/^{12}\text{CO}_2$ was significantly correlated with the proportion of enriched sugar in the dietary carbohydrate ($r=0.34$, $p=0.003$). Resting $^{13}\text{CO}_2/^{12}\text{CO}_2$ adjusted for enriched sugar intake was significantly correlated with RER ($R=0.45$, $p=0.001$). Ethnicity was not a significant predictor of adjusted $^{13}\text{CO}_2/^{12}\text{CO}_2$, at rest or during exercise, whereas degree of central adiposity, measured as the subscapular-to-

triceps skinfold ratio, and percentage body fat were significant. Differences in metabolic fuel mix were accounted for by differences in the diet, body fat and distribution of the body fat.

We hypothesised that if people were eating a simple diet, rich in marine fish and with a measurable intake of enriched sugars, the isotope ratios of nitrogen and carbon in the food consumed would be related to the ratios in hair, ear-wax, breath and saliva samples. In consultation with the Secretariat of the Pacific Community, the University of the South Pacific, the Fiji Ministry of Health and others a relatively isolated village Ucunivanua in the district of Verata, 45 km north east of Suva, Fiji was chosen as the study site. The villagers eat a relatively large amount of fish and seafood that they catch and rely on food that is grown locally. The methodology of a pilot study of 20 individuals in the village was designed to measure the quantities and frequency of foods consumed; to sample and measure the isotopic ratios of carbon and nitrogen in foods commonly consumed; to sample hair, ear wax, breath and saliva and to measure the isotopic ratios of carbon and nitrogen in these; to train students and village people in research techniques and to form the basis of future research on nutrition and health

Preparation for the project began in 1997 and the samples were collected in March, 1999. It is hoped that analysis will be completed by December 1999. The analysis of the samples and data collected will add to the body of knowledge that is used in the formulation of strategies for the improvement of health by good nutrition. Collaborative researchers and students were drawn from the University of the South Pacific, the National Food and Nutrition Committee, Auckland Institute of Technology and Oxford University with funding from the Secretariat of the Pacific Community.

Rush EC, Plank LD & Coward WA. Expired $^{13}\text{CO}_2$ and Metabolic Fuel Mix in Young New Zealand Polynesian and Caucasian Women. *Journal of Human Ecology* 10; 1-5.