Proceedings of the Nutrition Society

Abstracts of Communications

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All abstracts are prepared as camera-ready material by the authors.

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The influence of information and extended sensory exposure on acceptance of reduced-fat products. By KARIN STUBENITSKY, JACKIE I. AARON, SUSAN L. CATT and DAVID J. MELA. *Institute of Food Research, Consumer Sciences Department, Earley Gate, Reading RG6 6BZ.*

There is established evidence from human and animal research that hedonic responses to sensory characteristics of foods may be modified by extended sensory exposure. So-called 'mere exposure' effects suggest that dietary modifications initially having poor acceptance become more acceptable with repeated experience. However, it also possible that differences in post-ingestive effects may lead to a decrease in acceptance. There are few controlled studies which have focused on changes in acceptance of reduced-fat (RF) foods or diets over extended periods of time, and these changes are often found to be related to individual's attitudes and beliefs. In the present study, we have examined influences on the liking and acceptance of RF foods in a realistic, extended home-use situation.

Volunteers who were not habitual consumers of RF products, were given full-fat (FF) or reduced-fat (RF) pork sausages and milk chocolate snack bars at home over a period of 12 weeks, according to the following treatment groups: (a) FF blind (n 34); (b) RF blind (n 35); (c) RF informed (product labelled 'reduced-fat'; n 37); and (d) Control (received no products; n 37). Subjects in the experimental groups were given quantities of products sufficient for a target consumption of 1-2 times per week for sausages, and 3 times per week for chocolate snack bars; and were instructed to use the same cooking method (e.g. grilling) for the sausages throughout the study. The subjects rated products for selected measures of acceptability on 100mm visual analog scales at home each week and, in addition, all subjects took part in blind sensory evaluation sessions every month. In the initial blind tests, both the RF and the FF versions of the two products received high scores for acceptability. The RF and FF sausages were assigned similar scores, but the RF chocolate snack bars were rated slightly lower than the FF version. Subjects also completed questionnaires on eating behaviour and attitudes, and scores on these did not differ between groups.

Overall results indicated no consistent shifts in the hedonic ratings of the RF products compared with the FF products over the 12-week trial. However, subjects indicated a significant rise in 'boredom' in their in-home ratings. Although the rise in boredom appeared steeper for sausages than for chocolate, this was unrelated to product version or frequency of consumption. This suggests that boredom was not specifically related to the sensory or nutritional attributes of the products; nevertheless, the determinants of this effect may have important implications for long-term food choice. The 'reduced-fat' information had a small, negative effect on acceptance ratings for the chocolate snack bars, but not for the sausages. These results are consistent with other studies, and indicate generally high and sustained consumer acceptance of these RF products in normal home use over extended periods. Additional analyses need to focus on the relationships amongst attitudes and product information, to identify the most appropriate methods for promoting purchase and use of such products.

Weight status, taste preferences and dietary choice. By DAVID N. COX, LYNNE PERRY, PETER B. MOORE, LLOYD VALLIS and DAVID J. MELA. *Consumer Sciences Department, Institute of Food Research, Reading RG6 6BZ, UK*

Some investigators have suggested that obesity is marked by a particular liking for sweet, high-fat foods: however, the major sources of dietary fat tend to be savoury (salty) rather than sweet, and perception and liking of saltiness in relation to diet and body weight status have not been explored. In the present study lean (LE, BMI 20-25 kg/m²) and obese (OB, BMI ≥30 kg/m²) adult consumers, not on weight-loss diets or actively losing weight, kept 4 d weighed dietary intakes and simultaneously rated foods for liking (9-point hedonic scale); and for predominant taste (sweet, sour, bitter, salty) qualities.

	Lean (n 41) †		Obese (n 35) †	
	Mean	SE	Mean	SE
BMI (kg/m²)	22.6	0.2	35.2***	0.8
Estimated % body fat‡	23.6	1.1	38.0***	0.8
Emotional eating score	2.4	0.1	2.8	0.2
External eating score	3.1	0.1	2.9	0.1
Restrained eating score	2.7	0.1	2.7	0.1
Food energy density (kJ/g)§	5.9	0.1	6.4 *	0.2
Overall liking score	7.7	0.2	7.8	0.2
'Salty' food liking score	7.6	0.2	7.7	0.2
'Bitter' food liking score	7.5	0.2	7.5	0.2
'Sour' food liking score	7.5	0.2	7.5	0.2
'Sweet' food liking score	7.9	0.2	7.8	0.2

Mean values were significantly different from those for lean: *P < 0.05, *** P < 0.001.
† Only subjects with recorded energy intakes / estimated BMR >1.06 (Goldberg *et al*. 1991).
‡ Estimated by bioelectrical impedance, sexes combined.
§ Mean of 4 d intakes, excluding non-alcoholic beverages and water (but including milks).

The Table shows that measures of restrained, emotional and external eating behaviours, scored on 5-point scales (van Strien *et al*. 1986), did not differ between groups. OB subjects reported mean dietary intakes with a significantly higher food energy density, but there were no significant group differences in percentage energy from specific macronutrients (results not shown).   There were no significant differences in overall liking scores or for liking of foods characterized by any specific taste quality. Only for OB subjects were there significant correlations found: percentage 'sweet' foods positively correlated with percentage food energy carbohydrate; whilst percentage 'sweet' foods negatively correlated with fat (r 0.37 and -0.34 respectively, both P <0.05), and percentage 'salty' foods positively correlated with food energy density (r 0.44, P <0.01).

While these data do not show any greater preference by OB compared with LE subjects for any particular taste quality, there was a significantly higher mean energy density of food intake by the OB subjects, which was associated with intakes of savoury (salty) foods. Further analyses of these data will focus on other diet-sensory relationships and their associations with weight status.

Goldberg, G. R., Black, A. E., Jebb, S.A., Cole, T. J., Murgatroyd, P. R., Coward, W. A. & Prentice, A. M. (1991). *European Journal of Clinical Nutrition* **45**, 569-581.
van Strien, T., Frijters, J. E. R., Bergers, G.P.A. & Defares, P.B. (1986). *International Journal of Eating Disorders* **5**, 295-315.

Lack of preference-reinforcing effects of different sugars. By A. AHERNE, P. POLET, E.A. ATKINSON, S. STEPHENS, J.E.L. DAY and P.J. ROGERS, *Consumer Sciences Department, Institute of Food Research, Reading RG6 6BZ*

One factor influencing preferences for sugar-containing foods and drinks is an inborn liking for sweet taste. Others may include their metabolic and mood effects (Mela & Rogers, 1998). For example, association of a flavour with the 'metabolically satisfying' after-effects of intragastrically delivered carbohydrate can lead to a long-lasting increase in the rats' preference for that flavour (Sclafani & Ackroff, 1994). The aim of the present experiment was to investigate the preference-reinforcing effects of different sugars in man, namely 50 g sucrose, 50 g glucose, 50 g fructose, or 25 g glucose + 25 g fructose, in 250 ml water. These were compared with the effects of a non-nutritive sweet drink (75 mg aspartame + 75 mg acesulfame-K; same level of sweetness as the glucose drink), and an equal volume of plain water. Participants (thirty-four males and fourty-two females, aged between 18 and 32 years) consumed the sugar or other drinks (*n* 12 or 13 per group) followed 5 minutes later by 50 ml of a novel, non-sweet drink (cold mango and ginger flavoured, non-caffeine-containing, 'herb tea'). They received these drinks for four consecutive days starting at 16.00 hours each day. For 2 h before and 2.25 h after 16.00 hours they were not permitted to consume any other food or drink. On the fifth day the participants were presented with 1 litre of the mango and ginger tea and 1 litre of water and invited to drink as much or as little as they wanted of these during the next 2 h (*ad libitum* intake test'). A greater increase in preference for the novel-flavoured drink (measured by pleasantness ratings of the drink and *ad libitum* intake) in the groups consuming the sugars would provide evidence of nutrient or other carbohydrate-related reinforcing effects. A greater increase in preference for the novel drink when it was paired with the intense sweeteners than when it was paired with water would indicate a reinforcing effect of sweetness (though the experiment sought to minimize this latter effect by imposing the 5 min delay between consumption of the sweet drink and the novel flavour; see Sclafani & Ackroff, 1994).

The results, however, showed no significant effects of group on either change in pleasantness (group x day interaction, $F_{(15,69)}$ 0.85) or *ad libitum* relative intake (main effect of group, $F_{(5,207)}$ 0.99) of the novel flavoured drink (see Table). An unexpected finding was a small increase in pleasantness rating of the novel flavoured drink for the fructose group which was significantly different from the water control.

	Sucrose		Glucose		Fructose		Glucose+ fructose		Aspartame+ acesulfame-K		Water	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Pleasantness (mm)†	5.1	2.5	4.2	4.1	1.3*	4.8	8.0	6.0	9.5	4.4	6.7	3.8
Ad libitum intake‡	0.27	0.07	0.32	0.04	0.29	0.06	0.24	0.04	0.23	0.04	0.31	0.05

Mean value was significantly different from water control, $P<0.05$ (*post hoc* least significant difference test).
† Change in pleasantness from day 1 to day 4, measured using a 100mm Visual Analogue Scale.
‡ Relative intakes calculated as: tea intake/(tea+water intakes).

In conclusion, the experiment found no evidence of significant preference-reinforcing effects of various sugars. This is despite the fact that the method used is known to be sensitive to the reinforcing effects of caffeine (Mela & Rogers, 1998). The finding that fructose tended to prevent the increase in preference with exposure that was observed for all of the other drinks is consistent with reports of mild adverse reactions (related to fructose malabsorption, slower gastric emptying, etc.) that occur following consumption of large pure fructose loads (Riby et al. 1993).

Mela, D. J. & Rogers, P. J. (1998). *Food, Eating and Obesity: The Psychobiological Basis of Appetite and Weight Control.* London: Chapman and Hall.
Riby, J. E., Fujisawa, T. & Kretchmer, N. (1993) *American Journal of Clinical Nutrition* **58**, 748S-753S.
Sclafani, A. & Ackroff, K. (1994). *Physiology and Behavior* **56**, 399-405.

Are flavoured vegetables acceptable to adolescents? By W.L.WRIEDEN and I. BURGER, *School of Management and Consumer Studies, University of Dundee, DD1 4HT*

It is well-established that the average intake of vegetables and fruit by British adolescents is poor and that there has been little improvement in this situation in recent years (Adamson *et al.* 1992; Wrieden & Moore, 1998). This is a topic for concern as there is now considerable evidence to show that diets rich in vegetables and fruit reduce the risk of cancer (World Cancer Research Fund, 1997). The National Heart Forum (1997) have summarized a range of interventions and strategies to increase vegetable and fruit consumption by all ages. One proposal is to promote imaginative serving ideas and a food retailer has recently produced a range of flavoured frozen vegetables aimed to help children increase their vegetable consumption. The flavouring ingredients used in these vegetable products inherently alter the overall nutrient profile of the vegetables. Thus, all products contain considerably more non-milk extrinsic sugars than their plain counterparts and a portion of flavoured cauliflower or peas provides nearly half the reference nutrient intake for Na for a child aged 7-10 years. Should these products be successful they may further reinforce the consumption of sweetened and salted products that ideally should be reduced in the diet.

The acceptability of these novel vegetable products was tested by first-year secondary pupils (fifteen boys, eighteen girls, aged 12-13 years) at a Scottish school. Four flavoured products and their standard counterparts were prepared according to the cooking instructions and immediately presented to the pupils in a class situation. Each vegetable was scored for appearance, smell, flavour and texture on a six-point scale.

		Median score			
		Appearance	Flavour	Texture	Odour
Carrots	plain	4.0	4.0	4.0	4.0
	chocolate flavour	3.0*	2.0	4.0	4.0
Cauliflower	plain	4.0	4.0	3.0	3.0
	cheese and onion flavour	4.0	3.0	4.0	4.0**
Peas	plain	4.0	4.0	4.0	3.5
	baked-bean flavour	3.0***	3.5	2.5	3.0
Sweetcorn	plain	5.0	6.0	5.5	5.0
	pizza flavour	4.0**	5.0*	5.0	5.0

Significantly different from score for plain vegetable groups using the Wilcoxon matched-pairs signed rank test, *$P<0.05$, **$P<0.01$, ***$P<0.001$.

Chocolate carrots, baked-bean-flavoured peas and pizza-flavoured sweetcorn scored significantly lower on appearance (and flavour for pizza-flavoured sweetcorn) than their plain counterparts. The odour of the cheese-and-onion-flavoured cauliflower scored better than the plain cauliflower but there were no significant differences in any other attribute. However when comparisons were made within sex groups girls gave a median flavour score of 1.0 to chocolate carrots compared with 4.0 for the plain counterparts ($P=0.056$). Thus for adolescents of this age group we may conclude that this range of flavoured vegetables is unlikely to be any more acceptable than plain boiled vegetables. Further work should be carried out to confirm this for adolescents and also younger children.

Adamson,A.J., Rugg-Gunn,A.J., Appleton,D.R., Butler,T.J. & Hackett,A.F. (1992). *Journal of Human Nutrition and Dietetics* **5**, 371-385.
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Wrieden, W.L. & Moore, E.J.H. (1998). *International Journal of Health Education* (In the Press).

Correlation between taste and toxicity of cassava (*Manihot esculenta* Crantz) roots. By LINLEY CHIWONA-KARLTUN[1], JONATHAN MKUMBIRA[2], JOHN SAKA[3], LEON BRIMER[4], NZOLA M MAHUNGU[5], MPOKO BOKANGA[6] AND HANS ROSLING[1], [1]*Division for International Health Care Research, Department of Public Health, Karolinska Institutet, Stockholm, Sweden;* [2]*Bvumbwe Agricultural Research Station, Limbe, Malawi;* [3]*Department of Chemistry, Chancellor College, University of Malawi, Zomba, Malawi;* [4]*Department of Pharmacology, The Royal Veterinary and Agricultural University, Copenhagen, Denmark;* [5]*International Institute for Tropical Agriculture, Southern African Root Crops Research Network, Dar-es-Salaam, Tanzania;* [6]*International Institute for Tropical Agriculture, Ibadan, Nigeria*

Cassava roots are an important tropical staple crop. Bitter roots containing cyanogenic glucosides must be rendered safe by processing. It is questioned whether farmers can predict toxicity by tasting fresh roots.

We studied 492 fresh cassava (*Manihot esculenta* Crantz) roots from a farming community in Malawi. Farmers graded bitterness into five categories by tasting the roots upon harvesting. In the laboratory, the roots were split longitudinally and the cyanogenic potential was determined in one half of each root and in the other half the degree of bitterness was graded by a twelve person taste panel.

The mean of cyanogenic glucosides in the 132 roots from the three 'cool' (or sweet) cultivars was 29 (95% CI 4; range 1 - 123) mg HCN equivalents/ kg fresh weight. The value for the 360 roots from bitter cultivars was 153 (95% CI 10; range 22 - 661) mg/kg. The mean glucoside content differed significantly between the group of roots classified into each category of bitterness by farmers. The mean taste scores obtained by the taste panel for each root correlated with the glucoside levels (r = 0.77) and the degree of correlation was even stronger using a logarithmic transformation of the glucoside levels (r = 0.87). The mean taste results of all the roots from each of the ten cultivars correlated more with the cyanogenic potential (r = 0.98).

It is plausible that the bitter taste is due to the presence of cyanogenic glucosides. The results confirm the farmers' perceptions that toxicity can be predicted by tasting fresh cassava roots.

Validation of the Ramsey formula for estimation of energy requirements in children and adolescents with cystic fibrosis. By JOHN J. REILLY[1], JUDITH M. RALSTON[1], T. JOHN EVANS[2], JANE WILKINSON[2], JAMES Y. PATON[3], *University Departments of [1]Human Nutrition and [3]Child Health, and [2]CF Unit, Yorkhill Hospitals, Glasgow G3 8SJ*

Growth retardation and undernutrition remain common complications of cystic fibrosis (CF). Effective prevention and management of undernutrition requires provision of energy in appropriate amounts. Energy requirements are believed to be abnormal in CF (Reilly et al. 1997), but can be estimated using a formula recommended by Ramsey et al. (1992) which attempts to individualize the estimate for lung disease, activity level, and degree of malabsorption. This formula is rarely used in the UK, and an alternative approach based on estimation of energy requirements as 120% of the estimated average requirement (EAR) is more common. The aim of the present study was to test the adequacy of these two approaches for estimation of total daily energy expenditure (TDEE) in fifteen children with CF (six girls, nine boys, mean age 10.0 (SD 2.4) years) characterized by a range of severity of lung disease. Children were studied when well and living as outpatients.

Measurements of TDEE were made over 13-14d, by doubly-labelled water, in each child. Coefficient of fat absorption (CFA: fat absorption/fat intake) was calculated for each child based on a 3d household measures record for estimation of fat intake, and a 3d quantitative stool collection for estimation of fat output. Resting energy expenditure was measured on two or three occasions in each child and the mean used in calculations. Standard lung function tests were carried out in all patients. Estimation of TDEE using the Ramsey formula employed three steps: prediction of BMR (World Health Organization, 1985); multiplication of predicted BMR by activity level 1.7 and incorporation of correction for degree of lung disease; correction of TDEE for fat malabsorption where CFA <0.93, this applied to only two of the fifteen patients. Estimates of TDEE were also made as 120% of the EAR. Agreement between measured and predicted TDEE was tested using bias and limits of agreement (Bland & Altman, 1986).

Predicted TDEE from the Ramsey formula tended to underestimate measured values, but this difference was not statistically significant (95% CI -1.10 to 0.10 MJ/d). Limits of agreement were +1.68 to -2.72 MJ/d. Predicted TDEE from the formula 120% of EAR tended to overestimate measured values. While this difference did not reach statistical significance (95% CI -0.21 to 1.74 MJ/d), bias relative to measured TDEE was greater, and limits of agreement considerably wider, than for the Ramsey formula (+4.29 to -2.82MJ/d).

In conclusion, the Ramsey formula provides an accurate and convenient method for estimation of TDEE in children with CF. Estimation was more accurate at the individual level than the alternative, more widely used, approach based on 120% of EAR. We conclude that the Ramsey formula could and should be used more widely in clinical management of CF.

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Pattern and timing of excess weight gain in Scottish children treated for acute lymphoblastic leukaemia. By J. VENTHAM[1], J.J. REILLY[1], M. DONALDSON[2] and B.E.S. GIBSON[3], *Departments of* [1]*Human Nutrition,* [2]*Child Health and* [3]*Haematology, Yorkhill Hospitals, Glasgow G3 8SJ*

Children with acute lymphoblastic leukaemia (ALL) gain weight excessively during and after 2 years of chemotherapy treatment (Odame *et al.* 1994) and a high proportion of adolescent and young adult survivors are obese (Didi *et al.* 1995). Early studies speculated that weight gain was caused by cranial irradiation, however excess weight gain occurs even when ALL patients have not been treated with cranial radiotherapy (Van Dongen-Melman *et al.* 1995; Reilly *et al.* 1996). Furthermore, we have recently shown that excess weight in children treated for ALL without cranial irradiation is caused by reduced total energy expenditure secondary to reduced habitual physical activity (Ventham *et al.* 1997). The aim of the present study was, therefore, to describe the pattern of excess weight gain in a large cohort of Scottish patients treated on the UK Medical Research Council Protocol XI (1990–1997).

The medical records of all 126 Scottish patients who remained in continuous remission on UK ALL XI were examined retrospectively. Complete data to 3 years post diagnosis was available in only fifty-nine patients (twenty-eight boys, thirty-one girls). Measurements of height and weight were used to calculate BMI at 6 monthly intervals from diagnosis to 3 years and were expressed as standard deviation (SD) scores relative to UK reference data (Cole *et al.* 1995). Annual changes in BMI SD score from diagnosis to 3 years for these fifty-nine patients are shown in the Table.

	Mean change in BMI SD score (95% CI) from diagnosis		
	Combined (n 59)	Boys (n 28)	Girls (n 31)
1 year	0.66* (0.41 to 0.91)	0.96* (0.60 to 1.33)	0.39* (0.10 to 0.72)
2 year	0.87* (0.64 to 1.10)	0.94* (0.60 to 1.28)	0.81* (0.47 to 1.15)
3 year	0.91* (0.69 to 1.14)	0.97* (0.58 to 1.35)	0.86* (0.60 to 1.13)

*Statistically significant *P*<0.05 (paired *t* test)

For the fifty-nine patients mean BMI SD score at diagnosis was -0.19 (SD 1.02) and mean age at diagnosis was 5.4 years (SD 3.2). The changes in BMI SD score presented were statistically significant (paired *t* test, *P*<0.05). Rates of excess weight gain shown here are slightly lower than those previously described (Odame *et al.* 1994), and rates were highest during treatment. This study confirms that excess weight gain remains a feature of current chemotherapy regimens which do not routinely use cranial radiotherapy and suggests that is most marked in the first year of treatment.

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Didi, M., Didcock, E., Davies, H.A., Ogilvy-Stuart, A.L., Wales, J.K.H. & Shalet, S.M. (1995). *Journal of Pediatrics* **127**, 63–67.
Odame, I., Reilly, J.J., Gibson, B.E.S. & Donaldson, M. (1994). *Archives of Disease in Childhood* **71**, 147–149.
Reilly, J.J., Blacklock, C.J., Dale, E., Donaldson, M. & Gibson, B.E.S. (1996). *International Journal of Obesity* **20**, 1130–1132.
Van Dongen-Melman, J.E.W.M., Hokken-Koelega, A.C.S., Hahlen, K., de Groot, A., Tromp, C.G. & Egeler, R.M. (1995) *Pediatric Research* **38**, 86–90.
Ventham, J.C., Reilly, J.J., Ralston, J.R., Donaldson, M. & Gibson, B.E.S. (1997). *Proceedings of the Nutrition Society* **56**, 316A.

A 10-year follow-up of dietary change in Scotland. By C. BOLTON-SMITH[1], and S. OGSTON[2], [1]*Nutrition Research Group, CVEU and* [2]*Department of Epidemiology and Public Health, University of Dundee, Ninewells Hospital and Medical School, Dundee DD1 9SY*

Diet was assessed in Scotland in 1985 and 1995 by means of a standard food-frequency questionnaire (FFQ) (Bolton-Smith *et al.* 1991). The Scottish Heart Health study of 1984–7 surveyed 11 629 men and women aged 40–59 years who were drawn randomly (with 5 year age and sex stratification) from general practitioner registers across the thirteen Health Boards. The 10-year resurvey achieved 3230 fully complete FFQ from half of the remaining eligible participants (*n* 9009). Nutrient analysis was performed using multivariate ANOVA (SPSS-NT version, 1997) unique sum of squares model, entering smoking (current, ex- and never), leisure activity (<1/week, 1/week, ≥2/week), Health Board (*n* 13) and survey year (1985 and 1995), with age as a continuous variable.

The results showed that year of survey was a significant independent determinant (*P*≤0.01) of the percentage energy from total, saturated and polyunsaturated fat, carbohydrate, sugar and protein, and of fibre and vitamin C intake for both sexes. Age was an independent determinant of the percentage energy from total and saturated fat and alcohol, plus vitamin A. Smoking was a strong determinant (*P*<0.001) of the variation in the assessed micronutrients (vitamins C and E and Fe) for men and women and of the percentage energy from total fat for men and the percentage energy from sugar for women. The measure of physical activity during leisure time was a more frequent determinant of nutrient variation for women (MJ, percentage energy from sugar, vitamin C and fibre) than for men (percentage energy from protein). Health Board was also a strong independent determinant of nutrient variation for men and women, with the exception of carbohydrate and sugar for men. The greatest proportion of variation in nutrient intake explained by the model was for the percentage energy from saturated and total fat (15–16 % for men, 24–26 % for women), followed by vitamin C (mg/d) (12 % for men, 14 % for women). The significance of year of survey for total and saturated fat and vitamin C was supported by a shift from full-fat to low-fat milks and spreads and a halving of the proportion not reporting fresh fruit consumption (referring to apples, pears, bananas and citrus fruits) for men (17 % to 8.5 %) and women (8.8 % to 3.6 %) between 1985 and 1995.

It seems that at least some aspects of the national diet-health messages (e.g. Scottish Office, 1992; Department of Health, 1994) are getting through to at least some people.

Bolton-Smith, C., Smith, W.C.S., Woodward, M. & Tunstall-Pedoe, H. (1991) *British Journal of Nutrition* **65**, 321–335.
Department of Health (1994) *Nutritional Aspects of Cardiovascular disease. Report on Health and Social Subjects* no. 46. London: H. M. Stationery Office.
The Scottish Office. (1992). *Scotland's Health A challenge to Us All.* Edinburgh: H. M. Stationery Office.

Dietary management in a work-site setting. BY CATHERINE R. HANKEY[1], DEAN O'DONOHUGUE[2] and MICHAEL E.J. LEAN[1], *University of Glasgow Department of Human Nutrition, Queen Elizabeth Building, Glasgow Royal Infirmary, Glasgow G31 2ER and Department of Occupational Health British Petroleum, Grangemouth FK3 9TA*

Healthy volunteers were sought for a weight management study. The study was located in the Occupational Health Department of a large petrochemical work-site employing close to 1200 people in the central belt of Scotland. The work force were 90% male with 43% shift workers. A message advertising the study and detailing selection criteria was sent to all employees of BP Oil using electronic mail. The message requested healthy volunteers for the opportunity to find out the composition of their present diet and to receive specialized advice about how to adjust their diet in line with current dietary targets. Physical measurements of body composition and plasma lipid concentrations were also offered. In all, 190 requests for further information were received, together with individuals' anthropometric information. Principal selection criteria included a BMI between 22.5 and 28 kg/m^{2}, being in good health, and a desire to lose body weight. Of the fifty-one volunteers who fulfilled the inclusion criteria, thirty-four completed the study, BMI range 22.5-27.8 kg/m^{2}, and data from these are reported here.

Individualized dietary advice to reduce body weight by 0.5 kg/week (i.e. estimated resting metabolic rate x 1.3 - 2510 kJ) was given together with specific guidance towards the achievement of the current dietary targets for fruit (three portions daily), vegetables (two portions daily, defined using the plate model) and fish consumption (two portions weekly). A 7 d weighed food inventory was completed at baseline, before dietary intervention, and after intervention (weeks -1 and 11). A mean weight loss of 3.4 SD 3.4 kg or 4.3% of body weight was achieved with the final BMI range 21.6-27.3 kg/m^{2}. The percentage of subjects achieving dietary targets before and after intervention are shown in the Table.

Dietary targets	Baseline		Subjects achieving dietary targets Post-intervention	
	n	%	*n*	%
Fruit (3 portions daily)	1	3	16	47
Vegetables (2 portions daily)	16	47	14	41
Fish (2 portions weekly)	19	56	24	71
All targets	0	0	4	12

Fasting plasma total, LDL and HDL cholesterol and triglyceride concentrations were measured, at baseline and week 12. The baseline measures were 5.5 SD 0.9, 4.2 SD 0.9, 1.4 SD 0.8 and 1.4 SD 0.8 mmol/l. Post-intervention all these plasma measurements remained unchanged (P>0.05).

This study showed the use of electronic mail as an economical method of engaging employees who need to implement dietary change. The findings were promising for the fruit and fish dietary targets. These short-term improvements are encouraging in a new population not usually accessible to health surveys. Longer term reinforcement, with possible benefits for both employees and employer, is required.

Iron intake and iron status in young children in Edinburgh. By ABDULAZIZ M. AL-OTHMAN[1], NEVILLE R. BELTON[1] and TERRY R. KIRK[2], [1]*Department of Child Life and Health, University of Edinburgh, EH9 1UW, and* [2]*Centre for Nutrition and Food Research, Department of Dietetics and Nutrition, Queen Margaret College, Edinburgh EH12 8TS*

Fe-deficiency anaemia is recognized as a common problem in young children in the UK (Department of Health, 1994). The present study has sought to measure Fe intake in young children (9-36 months old), to identify nutritional factors that may affect Fe intake and Fe status and to ascertain whether a food-frequency questionnaire can identify those at risk due to their diet.

Sixty-one healthy children aged between 9 and 36 months were studied. They were those whose parents agreed to participate from a larger number chosen randomly from children registered at three health centres in Edinburgh using the Lothian Health Board list. A 4 d weighed food inventory, a semi-quantitative food-frequency and social questionnaire (FFQ) and anthropometric measurements were completed for all children. Haemoglobin (Hb), mean corpuscular volume (MCV), serum ferritin (SF), mean corpuscular Hb (MCH), mean corpuscular Hb concentration (MCHC) and packed cell volume were estimated in blood samples taken from thirty-seven of the children at the end of their food intake studies. Compeat-5 (Carlson Bengston Consultants Ltd, London) was used to calculate nutrient intakes and SPSS and Excel were used for data analysis.

Fe intake showed a mean of 5.14 mg/d with a range from 1.56 to 11.6 mg/d. The mean for Hb was 123 g/l (range 103-148 g/l) and the median value for SF was 16.0 µg/l (range 2.0-53.0 µg/l). SF correlated positively with intakes of Fe (r 0.40, P < 0.05). Although the mean Fe intake represented 73% of the reference nutrient intake (RNI) (Department of Health, 1991), only twelve children (19.7 %) achieved the RNI. In contrast, sixteen children (26.2 %) did not reach the lower reference nutrient intake (LRNI) for Fe.

Haem iron intake averaged 0.31 mg/d for all the children in this study or 0.02 mg/kg body weight per day in those children not taking any infant formula. These values are comparable to those found in the UK study by Gregory (1995) who found an average haem iron intake of 0.2 mg/d by children aged between 1½ -3½ years or 0.02 mg/kg body weight per day. However Mira et al. (1996) in a study of children aged between 12-36 months in Sydney, Australia, found a mean haem iron intake of 0.42 mg/d in iron replete children and 0.28 mg/d in iron depleted children.

Breakfast cereals were good sources of Fe for most of the children. On the FFQ, sugar-coated cereals correlated with Hb (r 0.51, P <0.001) whereas corn flakes were inversely correlated with Hb (r – 0.37, P = 0.011) and with MCV (r – 0.36, P = 0.015). Similarly on the FFQ, Hb was correlated with pork (r 0.37, P = 0.013), bacon (r 0.28, P = 0.044) and sausages (r 0.29, P = 0.04) whereas beef was correlated with MCV (r 0.43, P = 0.004).

We have shown that Fe intakes less than both the RNI and LRNI are common in children between the ages of 9 months and 3 years. Our conclusion is that breakfast cereals and meat are important dietary factors which positively influence Fe intake and Fe status in this age group who are vulnerable to Fe-deficiency anaemia. We consider that these foods should be strongly recommended to parents for inclusion in the post-weaning diet of children of this age.

Department of Health (1991). *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report on Health and Social Subjects*, no. 41. London: HMSO.

Department of Health (1994). *Weaning and The Weaning Diet. Report on Health and Social Subjects no. 45.* London: HMSO.

Gregory, J.R., Collins, D.L., Davies, P.S.W., Hughes, J.M., Clarke, P.C. (1995). *National Diet and Nutritional Survey: children aged 1½ –4 ½ years.* London: HMSO.

Mira, M., Alperstein, G., Karr, M., Ranmuthugala, G., Causer, J., Niec, A. & Lilburne, A. (1996). *British Medical Journal* **312**, 881-883.

The fat content of yoghurts determines the release of flavour volatiles during eating. by M. S. BRAUSS[1], I. CAYEUX[2], B. HARVEY[2], R. S. T. LINFORTH[1] and A. J. TAYLOR[1], [1]Samworth Flavour Laboratory, Food Sciences, University of Nottingham, Sutton Bonington Campus, Loughborough LE12 5RD, UK: [2]Firmenich SA, 1 Route des Jeunes, CH-1211, Geneva 8, Switzerland.

Changing the fat content of a food may change its flavour and texture (Drake & Swanson, 1995), and hence will affect consumer acceptability of that product. While many government and private groups have recommended reduced intakes of total fat, saturated fat and cholesterol, if consumer acceptability of fat-reduced foods is low, then higher fat foods will be preferentially purchased (Guinard, 1995).

How changes in fat content affect flavour release in foods is not well understood. In these experiments, yoghurts of differing fat content were eaten by one individual (five reps.) while expired air from the nose was sampled into an atmospheric pressure ionization – mass spectrometer (API-MS) fitted with an air-sampling interface (Linforth & Taylor, 1996). The release of three flavour compounds and ethanol was followed on the breath. The release of compounds was found to be significantly affected by the fat percentage of the yoghurt, in terms of maximum intensity (I_{max}), time to I_{max} and persistence. The presence of fat resulted in reduced intensity and enhanced persistence of flavour volatiles with low polarity, as measured by the API-MS.

These results may explain some of the problems associated with flavours of low-fat foods, which are often described as unbalanced. This could be due to changes in ratios between key flavour components.

Drake, M. A. & Swanson, B. G. (1995). *Trends in Food Science and Technology* **6**, 366-369.

Guinard, J-X. (1995). *Food Quality and Preference* **7**, 21-28.

Linforth, R.S.T. & Taylor, A.J. (1996). *Improvement Relating to Volatile Compound Detection*. UK Patent Application No. 9615304.4.

Errors in self-reported height and weight. By MARK WOODWARD[1], CAROLINE BOLTON-SMITH[2] and CAROLINE MORRISON[3], [1]Department of Applied Statistics, University of Reading, Reading RG6 6FN, [2]Nutrition Research Group, CVEU, Ninewells Hospital and Medical School, Dundee DD1 9SY and [3]MONICA Project, Royal Infirmary, Glasgow G31 2ER

As part of the fourth MONICA survey in north Glasgow in 1995, a random sample of 865 men and 971 women aged 25 - 64 years were asked to report their height and weight on a postal questionnaire. Subjects were invited to a clinic where height and weight were measured, in light clothing without shoes, by trained observers using calibrated scales (Seca, Germany) and a stadiometer (Holtain, UK). Self-reported and 'true' (measured) values were compared.

There was a tendency to underestimate both height and weight (see figs.): only 19% of men and 14% of women overestimated their height and 42% of men and 31% of women overestimated their weight. On average, men underestimated their height by 13 mm and their weight by 0.63 kg. For women, the corresponding values were 17 mm and 0.95 kg. For each sex, 75% of self-reported heights were within 30 mm of the true values. For men, 75% of self-reported weights were within 3.2 kg of the true values; for women, 75% were within 2.4 kg.
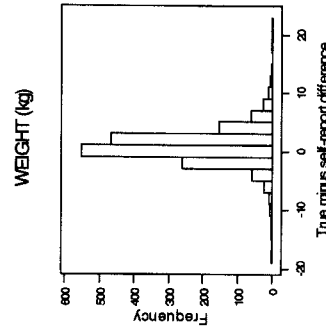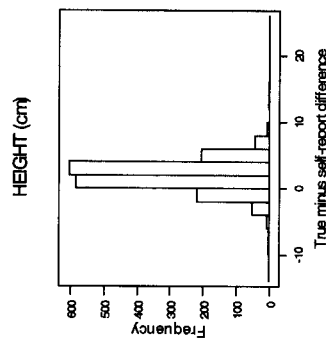
HEIGHT (cm)

WEIGHT (kg)

Although height and weight were generally reported fairly accurately, the difference between true and self-reported values was found to vary systematically in each case when multiple regression models were fitted. The difference in height decreased with increasing BMI (P = 0.02) and age (P < 0.0001) and was smaller in men than women (P = 0.002). The difference in weight increased with increasing BMI (P < 0.0001) and was smaller in men than women (P = 0.0002); the rate of increase with BMI was also smaller in men than women (P = 0.0007). These relationships with BMI are broadly in agreement with previous findings, although the tendency to under-report height has not been seen in other populations (Ziebland et al. 1996).

Ziebland, S., Thorogood, M., Fuller, A. & Muir, J. (1996). *Journal of Epidemiology and Community Health* **50**, 105-106.

Effect of advice to simultaneously reduce both dietary fat and sugar, or advice to reduce dietary fat alone on body-weight status: results from a 6-month intervention study. By SANDRA DRUMMOND and TERRY R. KIRK, *Centre for Nutrition and Food Research, Queen Margaret College, Clerwood Terrace, Edinburgh EH12 8TS*

Obesity is a major public health problem in the UK and levels are steadily increasing. To help combat this growing problem the Scottish Office Department of Health (1996) made dietary recommendations to reduce the percentage energy from both fat and non-milk extrinsic sugars (NMES). It is important to ascertain whether these recommendations are sustainable in the free-living population and, if so, whether they have the desired effect on body-weight status. The present study aimed to look at the effect of two types of dietary advice on body weight-status in a group of normal to moderately overweight men over a 6-month period.

Seventy-four men, (mean BMI 27.7 kg/m²), were randomly allocated to one of three groups; group 0 received no nutritional advice; group 1 received advice to reduce both fat and NMES; group 2 received advice to reduce dietary fat only, allowing *ad-libitum* NMES. Food intake was recorded (un-weighed diet diary) at baseline (7 d) and after 2, 4 and 6 weeks (not reported here) and 6 months (4 d). No advice was given to reduce total energy intake. After 6 months, group 1 significantly decreased percentage energy from fat by 5.4% but failed to decrease percentage energy from either total sugar or NMES. Group 2 significantly decreased percentage energy from fat by 8.0% with no significant change in percentage energy from total sugar or NMES. Groups 1 and 2 significantly increased percentage energy from carbohydrate by 3.6% and 5.7% respectively. Group 1 appeared to decrease energy intake by 1.31 MJ/d whereas group 2 showed a smaller non-significant decrease in energy intake. No weight change was observed in group 1 whereas group 2 lost 1.2 kg after 6 months.

	Baseline Mean	SD	6 Months Mean	SD
Energy intake (MJ/d)				
Group 0 (n 25)	10.44	1.67	10.14	2.02
Group 1 (n 24)	10.74	2.24	9.43*	2.51
Group 2 (n 25)	11.04	1.67	10.27	2.78
% Energy from total sugar				
Group 0 (n 25)	16.9	4.9	15.7	5.7
Group 1 (n 24)	17.0	5.4	16.5	4.7
Group 2 (n 25)	16.5	5.5	19.6	7.1
% Energy from carbohydrate				
Group 0 (n 25)	46.2	5.1	44.9	5.9
Group 1 (n 24)	44.5	4.8	48.1*	5.7
Group 2 (n 25)	43.7	5.0	49.4***	8.4
Body weight (kg)				
Group 0 (n 25)	88.9	10.8	88.9	10.6
Group 1 (n 24)	89.7	8.7	89.2	9.0
Group 2 (n 25)	90.7	13.7	89.5*	13.5
% Energy from fat				
Group 0 (n 25)	36.8	4.8	38.2	5.6
Group 1 (n 24)	38.8	4.9	33.4****	5.8
Group 2 (n 25)	40.2	4.0	32.2***	7.5
% Energy from NMES				
Group 0 (n 25)	9.8	3.6	8.8	4.2
Group 1 (n 24)	9.9	4.7	8.1	3.3
Group 2 (n 25)	9.3	4.5	10.1	4.6
% Energy from protein				
Group 0 (n 25)	16.8	2.7	16.7	2.0
Group 1 (n 24)	16.6	2.8	18.4*	3.5
Group 2 (n 25)	16.0	2.8	18.2*	4.5

Mean values were significantly different from baseline: *$P < 0.05$, ***$P < 0.001$ (2 -tail *t*-test)

Both groups 1 and 2 were successful in reducing the percentage energy from fat, but group 1 could not achieve a significant reduction in sugar intake despite advice to do so. Paradoxically, group 1 did not reduce body weight despite a reduction in recorded energy intakes, indicating under-reporting or non-compliance between the recording periods. However group 2 significantly reduced mean body weight, perhaps as a result of a small but consistent reduction in energy intake over the 6-month period. Our results indicate that advice to reduce dietary fat alone with *ad-libitum* NMES, may help to promote a reduction in body weight, perhaps by increasing long-term compliance to the dietary advice.

Scottish Office Department of Health (1996). *Eating for Health: A Diet Action Plan for Scotland.* Edinburgh: HMSO.

Evaluation of the Scottish Health Survey Eating Habits Questionnaire to monitor Scottish Diet food targets. By MICHAEL E. J. LEAN[1], SUSAN ELEY[1], ANNIE S. ANDERSON[2], CAROLINE MORRISON[3] and CAROLINE BOLTON-SMITH[4] [1]*Department of Human Nutrition, University of Glasgow, Glasgow Royal Infirmary, G31 2ER,* [2]*Centre for Applied Nutrition Research, Matthew Building, University of Dundee, DD1 4HT,* [3]*MONICA Project, Glasgow Royal Infirmary, G31 2ER* [4]*Nutrition Research Group, CVEU, Ninewells Hospital, Dundee DD1 9SY*

The two page Scottish Health Survey Eating Habits Questionnaire (EHQ) was developed to assess specific food and eating habits relevant to attaining the dietary targets. In the 1995 wave of the Glasgow-MONICA Survey, 1085 adults aged 25-64 years living in North Glasgow completed the EHQ 2 weeks after they had completed the Scottish Heart Health Survey/Glasgow MONICA food frequency questionnaire (FFQ), a lengthier more complete dietary assessment tool (Bolton-Smith *et al.* 1991). Using these data, the ability of the EHQ diet questions to indicate the key Scottish dietary targets was assessed in relation to the consumption of fruits and vegetables, starchy foods and fish.

Frequency of consumption per week (unquantified serving)	FFQ Median	FFQ Inter quartile range	EHQ Median	EHQ Inter quartile range	Percentage difference from FFQ median
Fruits, vegetables, beans and pulses	20.3	13.5, 28.9	15.5	10, 22	-23.6
Fruits	6.8	3.5, 11.5	3.0	1, 7	-55.5
Vegetables, beans and pulses	13.0	8.3, 18	11.0	7.9, 16	-15.4
Starchy foods	31.3	22.7, 42	27.5	21.5, 41.5	-12.0
Bread	21.0	13.6, 31	17.5	17.5, 31.5	-16.7
Breakfast cereals	3.3	0.5, 7	3.0	0.7	-7.7
Potatoes, pasta and rice	6.3	5.8	3.0	3.7	-52.0
Fish	2.0	1.3	1.5	1, 3.3	-25.0
White Fish	1.0	0.3, 2	1.0	0.5, 1	0
Other fish	0.5	0.3, 1.3	0.5	0.3, 1	0

The Table shows the comparisons between the median frequencies of consumption by both assessment tools. Comparing the two questionnaires, there was consistent bias between the methods for fruits and vegetables, (from the analysis using the Bland & Altman (1986) method, FFQ:EHQ was 1.33, 95% CI: 1.29, 1.38) and bias was very small for 'starchy foods' (FFQ:EHQ 1.08, 95% CI:1.05, 1.12) but these data suggest that the combination of foods like "potatoes, pasta and rice" as a single food group in the EHQ, led to systematic underreporting, especially by the male subjects (percentage difference from FFQ median for men −9.9, for women −5.2). For fish consumption, there were wide but non-systematic discrepancies between the two methods, with essentially no bias between them (FFQ:EHQ 0.99, 95% CI: 0.94,1.03). One shortcoming of the EHQ is its inability to monitor the consumption of oily fish as no clear distinction was made between different types of fish. Overall, there was a low frequency of fish consumption.

The EHQ provides a short, easily administered dietary assessment tool which may be able to monitor dietary change towards the adult Scottish Diet food targets. Further validation studies are required to examine the constant factors used to take account of the biases.

Bland, J.M. & Altman, D.G. (1986). *Lancet* I, 307-310.
Bolton-Smith, C., Smith, W.C., Woodward, M. & Tunstall-Pedoe, H. (1991). *British Journal of Nutrition* 65, 321-335.
Scottish Office (1996). *Eating for Health: A Diet Action Plan for Scotland.* Edinburgh: HMSO.

Using electronic mail for monitoring compliance to Scottish dietary targets. By SUSAN ELEY and MICHAEL E J LEAN, *Department of Human Nutrition, University of Glasgow, Glasgow Royal Infirmary, G31 2ER.*

Electronic mail (e-mail), one tool of the Internet is immediate and cheap to use. Its use in applied nutrition is in its infancy. In the present study, the eating habits of a group of university student volunteers were assessed using an electronic self-administered version of the eating habits questionnaire (EHQ) developed for the Scottish Health Survey relevant to the Scottish dietary targets (Scottish Office, 1996). Reproducibility of the EHQ was assessed by administration on two occasions (T1 and T2), 1 week apart. A systematic sample of 260 university students were contacted with a recruitment e-mail letter. Form 161 volunteers, 116 successfully returned the second EHQ to complete the repeatability study. The table shows that the present EHQ is highly dependable with regard to assessing compliance with Scottish dietary targets.

	Baseline food frequency per day (n 116)				Cases same at T2 (%)	Correlation between T1 and T2	
	3+	2-3	1	<1		r	P value
Fresh fruit	14	23	3	76	93	0.98	<0.001
Cooked green vegetables	13	43	2	58	100	1.00	<0.001
Cooked root vegetables	23	40	2	51	100	1.00	<0.001
Raw vegetables	22	43	3	48	98	0.99	<0.001
Beans or pulses	31	0	49	36	100	1.00	<0.001
Potatoes, pasta and rice	0	1	33	82	100	1.00	<0.001

With the reporting of fresh fruit, it has been noted that responses are reliable due to the discrete nature of fresh fruit pieces to count (Cox *et al.* 1997). Therefore it is suggested that the difference may reflect dietary changes between the two administrations 1 week apart. Care is needed in interpretation. It is possible that some students just saved their first questionnaire and re-sent it in response to the second call for information, since two thirds of the volunteers returned identical responses to all questions. This is improbable statistically, although each questionnaire had an identification code. Alternatively, the broad nature of the categories of the EHQ could mean that subtle variation in reported frequency of food consumption does not automatically lead to a different response. The EHQ may be particularly suited to repeated measures. Further work is needed to ascertain the validity of data collection using e-mail and the Internet.

The Internet and e-mail system offers new exciting and highly cost-effective prospects for nutrition research, although it suffers from the methodological issues applicable to surveys in general, particularly sampling bias.

Cox D.N.. Anderson A.S.. Reynolds, J.. McKellar, S., Mela, D.J. & Lean, M.E.J. (1997) European Journal of Clinical Nutrition 51: 177-180.

Scottish Office (1996). Eating for Health: A Diet Action Plan for Scotland. Edinburgh: HMSO.

Some micronutrient intakes of Scottish schoolchildren aged 5½ to 8½ years compared with intakes at age 1½ to 4½ years. By P. J. LONGBOTTOM[1], W.L. WRIEDEN[1], C.M. PINE[2] and J.A. DAVIES[2], [1]*School of Management and Consumer Studies, University of Dundee, DD1 4HT[1] and* [2]*Dental Health Services Research Unit, Dental School, University of Dundee, DD1 4HR*

Recent reports have raised concern over certain aspects of children's diets in Scotland today (Scottish Office, 1993). Gregory *et al.* (1995) showed that the average daily Fe and Zn intakes of pre-school children in Scotland, as in the rest of the UK, were below the reference nutrient intake (RNI). Although both Ca and vitamin C intakes were above the RNI, Scottish children had the lowest intakes in the UK.

As part of a study to track the diet of pre-school children into the primary years, intakes of selected nutrients (expressed as nutrient densities in weight per 4.18 MJ) of a group of Scottish children at age 1½ to 4½ years were compared with their intakes 4 years later. The study followed up those consenting from the Scottish sample of children (n 41) originally surveyed in the 1992-3 National Diet and Nutrition Survey of children aged 1½ to 4½ years (Gregory *et al.* 1995) and was carried out in the period October 1996 to April 1997. As in the first survey average daily intakes were calculated from 4 d weighed dietary records appropriately weighted to make them equivalent to a 7 d record.

	Median of intake /4.18 MJ		Actual median daily intake	
	1992-3	1996-7	1992-3	1996-7
Ca (mg)	493	453*		692
Zn (mg)	3.62	3.57		5.79
Fe (mg)	4.79	5.13*		8.59
Vitamin C (mg)	40.6	30.8		50.8
Fruit (g)	61.3	27.7*		55.7
Vegetables (g)	15.8	20.8		42.9
Potatoes (g)	29.3	34.8		71.4
Meats (g)	47.0	30.3*		60.7
Breakfast cereal (g)	21.5	18.9		42.4
Milk and milk products (g)	215	124***		255

Significantly different from median for 1992-3 using the Wilcoxon matched-pairs signed rank test, *$P<0.05$, **$P<0.01$, ***$P<0.001$.

Mean daily energy intakes were 4.88 MJ (1161 kcal) for the pre-school children and 6.91 MJ (1641 kcal) for the same children 4 years later. Median nutrient densities for Ca were lower in the children's more recent diets and this reflected the decrease in intakes of milk and milk products. Intakes of Fe, but not Zn, had improved despite a reduction in the intake of meats per 4.18 MJ. Actual median intakes were below the RNI (for children aged 4-6 years) for Zn and 17% of the children had intakes below the lower reference nutrient intake. Median intakes of the other nutrients were above or similar to the RNI. Intakes of fruit per 4.18 MJ had decreased, but the decrease in vitamin C intake per 4.18 MJ was not statistically significant. Further work is in progress to establish continuities and changes in food selection and nutrient intake in this group of children.

Gregory, J.R., Collins, D.L. Davies, P.S.W., Hughes, J. & Clarke, P.C.(1995). *National Diet and Nutrition Survey: Children Aged 1 1/2 to 4 1/2. Vol. 1: Report of the Diet and Nutrition Survey.* London: HMSO.
Scottish Office (1993). *Scotland's Health – A Challenge To Us All. The Scottish Diet.* Edinburgh:HMSO.

Use and knowledge of food labels of shoppers in Glasgow. By SOPHIE TESSIER, CHRISTINE A. EDWARDS and SUSAN ELEY, *Department of Human Nutrition, University of Glasgow, Yorkhill Hospitals, Glasgow G3 8SJ*

Diet composition is the most significant contributor to premature deaths and chronic diseases amongst adults in Western countries (Anderson *et al.* 1995). Nutritional information provided on food labelling could contribute to the achievement of progressive and sustained dietary changes in strategies such as the Scottish Dietary Action Plan (Scottish Office, 1996). However, information currently provided on food may not be appropriate to help consumers to make informed choices (Black & Rayner, 1992). The purpose of the present study was to assess Glasgow consumers' use and understanding of food labels, and to identify the nutrition information that they would prefer on labels. Glasgow is a city with one of the highest incidence of coronary heart disease which has been linked to poor diet (Scottish Office, 1993).

Shoppers in supermarket were approached randomly. The sample was close to the distribution of neighbourhood types in Glasgow (unpublished). The men sampled in this survey were not typical of the Glasgow male population but may represent the characteristic of male shoppers. The 132 interviews (81% women, 19% men) revealed that 78% read information provided on food labels at least occasionally, but only 18.9% were reading them frequently. Men who frequently or always read labelling on food were more likely to be between 45 and 54 years old (25%), whereas among women, the 18-24 and 35-44 years age groups, and over 65 years old predominated (p=0.035). The deprivation score, education level and education level did not affect significantly the frequency of reading food labels.

Among those who read food labels, use-by-date was the most reported information looked at on dairy products (60.8%), ready-made meals (45.1%) and sweets/biscuits/crisps/soft drinks (43.1%). Additive content was rated as the most important information looked at on canned/dried foods by 32.4% of consumers. "Calories" (energy content) and ingredient list were also aspects of the nutrition information that aroused interest. On dairy product labels 41.4% of women consulted "calories" and 55% of the men the ingredients list. To test the nutritional knowledge of the group, respondents were asked to give a verbal description (high, medium or low) of the content of five nutrients on a standard food label provided.

Food label category	Subjects answering food label question correctly (%)		
	Males (*n* 25)	Females (*n* 107)	All (*n* 132)
Sugar	44	27	30
Fat	24	20	21
Saturated fat	84	56	61
Salt	32	13	17
Fibre	76	71	72

The difficulties experienced by 90.9% of consumers, in evaluating the numerical amount of the main nutrients, indicate the need for improvement of the current food labels format. When questioned about how the label could be improved, many shoppers wanted details of cholesterol (43.2%), total sugar (30.3%), additives (29.5%), and fat (23.5%) on the label; fewer reported the need for details of protein (12.1%), energy (10.6%) and starch (9.8%). A high proportion of participants (50%) claimed to have no problem with the current food format. However, those that had problems wanted food labels that were "bigger", "highlighted" or written in "plain English" with words (e.g. high, medium or low) rather than a numerical description.

These results suggest that before improved food labels can have an impact on consumer food choice, strategies will be needed to encourage shoppers to read them.

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Scottish Office (1993). *The Scottish Diet*. Edinburgh: HMSO.
Scottish Office (1996). *Eating for Health*. Edinburgh: HMSO.
Black, A. & Rayner, M. The Coronary Prevention Group (1992). *Just Read the Label*. London: HMSO.

Nutritional status and growth in children with human immunodeficiency virus-1 infection in Romania. By P.M. MATHIAS[1], E. BALL[1], D. DUICULESCU[2] and P. CALISTRU[2], [1]*Department of Biological Sciences, Dublin Institute of Technology, Kevin Street, Dublin, Ireland,* [2]*"Dr. Victor Babes", Hospital for Infectious and Tropical Diseases, Bucharest, Romania*

Human immunodeficiency virus-1 (HIV-1) infection in children is associated with growth dysregulation and decreased lean body mass (Hirschfeld, 1996). Optimal growth and normalization of body composition may reduce the rate of infectivity and improve prognosis (Beisel, 1996). The present study describes nutritional status and growth in children treated at the Casa Doru paediatric AIDS unit at "Dr. Victor Babes" Hospital for Infectious and Tropical Diseases in Bucharest.

Twenty-six HIV-1-infected children, fifteen male and eleven female, mean age 7.4 (SD 0.86) years, were studied. These were long-stay, relatively healthy children with non-progressive disease and minor opportunistic infections which were treated symptomatically. None was on anti-retroviral therapy. Children were fed on a mixed diet which provided a daily energy intake of between 7.6 and 8.4 MJ, plus a 1.05 MJ supplement of Nutrifil (Nutrifil Ltd., Ireland), a nutritionally complete food shown to be effective in the treatment of malnutrition and HIV infection (Mathias & Byrne, 1995; Bakeine *et al.* 1997). Variables evaluated were weight, height, mid-arm muscle circumference (MAMC) and triceps skinfold thickness (TSF), at baseline and after 6 and 12 months.

	Assessment intervals						
	Baseline (*n* 26)		6 months (*n* 26)		12 months (*n* 26)	
	Mean	SE	Mean	SE	Mean	SE
Body weight (kg)	19.5 (10th)+	0.78	20.6 (10th)	0.83	21.2* (3rd -10th)	0.95
Height (m)	1.11 (<3rd)	0.19	1.12 (<3rd)	0.21	1.15* (<3rd)	0.20
TSF (mm)	5.9 (5th - 10th)	0.4	5.9 (5th - 10th)	0.3	6.5 (5th - 10th)	0.6
MAMC (mm)	134 (5th -10th)	3.0	136 (5th -10th)	2.7	139 (5th)	3.3

*Significantly different from baseline, same group: *P* < 0.05, (paired tests).
+Numbers in brackets indicate the mean percentile for that variable using standard percentile charts for weight and height (Tanner & Whitehouse, 1976), and TSF and MAMC (Frisancho, 1981). The 50th percentile is regarded as normal.

The results in the Table show that in relation to standard percentile charts mean values for all variables were lower than normal during the study. At baseline stunting was more prevalent than wasting. Twenty (77%) children were less than 90% height for age, compared with nineteen (73%) who had normal weight for height (Waterlow, 1972). The low values for TSF and MAMC throughout the study suggest that body composition remained abnormal with respect to both fat and lean tissue. There were significant increases in the mean weight and height over 12 months, although not commensurate with normal growth (Tanner & Whitehouse, 1976). These data indicate that current clinical and nutritional regimens are successful in supporting low growth velocity in HIV-1-infected children but not for normalization of body composition. Anti-retroviral therapy and more aggressive nutritional management may correct this (Miller, 1996). These treatments are currently in progress.

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Beisel, W.R. (1996). *Journal of Nutrition* **126**, 2611S - 2615S.
Frisancho, A.R. (1981). *American Journal of Clinical Nutrition* **34**, 2540-2546.
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Natural derivatives of phloridzin show potent antioxidant activity in human low density lipoproteins. By JAMES O'REILLY[1] , TIM RIDGWAY[2] , GREG TUCKER[2] , and HELEN WISEMAN,[1] [1]Nutrition, Food and Health Research Centre, King's College London Campden Hill Road, Kensington, London W8 7AH and [2]Division of Nutritional Biochemistry, School of Biological Sciences, University of Nottingham, Sutton Bonington Campus, Leicestershire LE12 5RD

Epidemiological studies suggest that dietary intake of foods rich in flavonoids is associated with a lower risk of cardiovascular disease (Hertog et al. 1993). One mechanism by which flavonoids may afford this protection is by functioning as antioxidants since the oxidation of LDL is widely believed to be a key event in atherosclerosis (Witzum, 1994). Developing tissues of apple trees (Malus sp.) are particularly abundant with phloridzin (aglycone = phloretin). Hydroxylated derivatives of this flavonoid have recently been prepared enzymically by Ridgway & Tucker (1997) using polyphenol oxidase. We report that in vitro, 3-hydroxyphloretin and 3-hydroxyphloridzin are potent inhibitors of LDL oxidation. LDL was prepared and oxidation induced at 37 °C using cupric ions (5 μM) as previously reported (O'Reilly et al. 1997). The antioxidant activity of each compound was determined by two measures of LDL oxidation. Firstly, the minimum concentration required to inhibit TBARS formation by 50% (IC_{50}) after 2h incubation and secondly the length of the lag phase before diene formation (Esterbauer et al. 1989) with each compound added at a final concentration of 1.25 μM.

Compound	LDL[*] lag phase (min) (n 4)		IC_{50} (μM) LDL[†] TBARS (n 4)	
	Mean	SD	Mean	SD
Control	55	5.0	–	–
Phloridzin	59	5.2	11	1.2
3-Hydroxyphloridzin	112**	7.4	1.0	0.1
Phloretin	80**	6.8	3.9	0.4
3-Hydroxyphloretin	125**	10.3	0.8	0.2
Butylated hydroxytoluene	205**	23	0.6	0.1

**Significantly different from the control (containing 10 ml ethanol/l): $P < 0.01$.
[†]LDL protein concentration was 0.1mg/ml.

The Table shows that the hydroxylated phloridzin and phloretin derivatives extended the lag phase of LDL oxidation by more than 2-fold above that of the control. This was markedly greater than the precursors particularly phloridzin which showed no significant antioxidant activity at 1.25 μM. TBARS formation was inhibited at IC_{50} concentrations that were some 4 and 11-fold lower for 3-hydroxyphloretin and 3-hydroxyphloridzin respectively compared with the corresponding precursors. Although the specifically designed lipid antioxidant butylated hydroxytoluene was the most potent compound tested in this study, apple-derived phloridzin might be a source of potent antioxidants for use in the food industry. However, more information is required concerning the safety profile of these substances.

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Fasting levels of plasma bile acids in Asian vegetarians, Caucasian vegetarians and Caucasian omnivores. By VASSILIKI COSTARELLI, T.A.B. SANDERS and SHEELA REDDY, *Nutrition, Food and Health Research Centre, King's College London, Campden Hill Road, W8 7AH*

Plasma bile acids may influence risk of breast cancer by promoting the growth of mammary tumours (Baker et al. 1992). Lower faecal bile acid concentrations have been reported in subjects consuming vegetarian diets (Reddy et al. 1993). The purpose of the current study was to investigate whether differences in faecal bile acid concentration are reflected in plasma following omnivorous and vegetarian diets. Plasma bile acid concentrations were determined on samples of stored frozen plasma from fasting blood samples by GC in three groups of premenopausal women whose faecal bile acid concentrations had previously been determined (Reddy et al. 1993): Asian vegetarians (n 17), Caucasian vegetarians (n 16) and Caucasian Omnivores (n 19). The data were analysed by ANOVA and the results are summarized in the Table.

	Total faecal bile acids (mg/g dry wt)		Total plasma bile acids (μmol/l)	
	Mean	SE	Mean	SE
Asian vegetarians	5.48[ab]	0.55	2.1	0.18
Caucasian vegetarians	3.81[bc]	0.58	2.0	0.20
Caucasian omnivores	6.78[a]	0.98	2.0	0.20

Mean values within a column not sharing a common superscript letter were significantly different, $P < 0.05$; Bonferonni's Multiple Comparison Test.

Although faecal bile acid concentrations were lower in the Caucasian vegetarians than in the omnivores ($P < 0.05$), the fasting levels of plasma bile acid concentration were similar between the three groups. Bayerdorffer et al.(1993) reported that serum concentration of primary and secondary bile acids were lower in women than men. The present results indicate that fasting levels of plasma bile acids in premenopausal women are low regardless of the different diets consumed and do not necessarily reflect faecal bile acid concentrations. We have previously reported that plasma bile acids increase substantially following the consumption of a meal. In order to test whether there is an association between plasma bile acid concentrations and risk of breast cancer, we suggest that the measurements be made in the postprandial state rather than the fasting state.

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Calf serum immunoglobulin estimations requiring minimal laboratory facilities and skills. By K.T.
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Unnecessarily high disease and death rates in young calves may frequently be associated with failure to
consume adequate colostrum from the cow within 24 h (and preferably within 6 h) of birth. In the savannah
regions of Africa poor cow nutrition and body condition resulting in the birth of weak calves and the secretion
of limited colostrum coupled with inadequate management practices (tethering of the calf whilst the cow
grazes all day) contribute towards a major problem. A simple, cheap method to determine calf serum
immunoglobulin (Ig) status would be invaluable for diagnostic purposes. Ig concentrations have been
determined by three methods: (a) by direct reading refractometer (McBeath *et al.* 1971) using a few drops of
serum; (b) by measurement of the time required for 0.1 ml serum to coagulate with 0.05 ml 100 ml/l
glutaraldehyde solution at 20° (Tennant *et al.* 1979); (c) by assessment of the turbidity developed at 20° after
20 min (ZST units) when 0.1 ml serum is added to 6.0 ml standardized $ZnSO_4$ solution (McEwan *et al.* 1970).
Serum globulin was also determined by a standard method utilizing a Technicon Axon Autoanalyser as the
difference between total serum protein and serum albumin.

Hereford x Friesian beef cows (*n* 23) in good body condition and with sound udders calved in individual
pens. Wherever possible this was supervised. The calves were put to the cows as soon as practicable after
birth and encouraged to suckle the maximum amount of colostrum then and at frequent intervals during the
day. Blood samples were obtained immediately after birth but before suckling, and again after 2 d (*n* 11).
Samples were obtained from a further six calves at 2 d only. For the remaining six calves several (two to four)
samples were obtained at intervals from a few hours after initial suckling to 2 d after birth. Ig concentration
wase estimated in all forty-six samples by each of the methods. The overall range of individual values
(autoanalyser) was 8-62 g Ig/l.

Regression analyses showed that the following relationships were all highly significant ($P < 0.001$).

$Ig = 1.07$ x total protein - 27.0 (r 0.98) $Ig = 0.92$ x refractometer protein - 19.5 (r 0.93)
$Ig = 42.1 - 0.44$ x coag time (min) (r -0.87) $Ig = 1.07$ x ZST units + 14.0 (r 0.79)

The mean Ig concentration (autoanalyser) for the sera of eleven calves pre-suckling was 14.9 (SE 0.62) g/l
and that for twenty-three sera after 2 d was 42.4 (SE 1.80) g/l. The mean respective ZST values were 4.3 (SE
1.12) and 24.3 (SE 0.96) units. Coagulation times with glutaraldehyde were < 10 min for thirty of thirty-one
sera and all had Ig concentrations > 30 g/l. In contrast, twelve of thirteen sera which had not coagulated after
> 60 min had individual Ig concentrations < 18 g/l. Total serum protein concentrations assessed by
refractometer were 40.3 (SE 0.65) g/l pre-suckling and 66.4 (SE 3.37) g/l after 2 d. Assessment of Ig status is
perhaps most rapidly made in the field by using a suitably calibrated refractometer (Model 20-63 Bellingham &
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Misleading results may be obtained for moribund calves due to haemoconcentration.

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